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# Human Health and Ecological Risk Assessment
# Off-Site Portion of Koppers Inc. Facility
# Superior, Wisconsin

Prepared for :

Beazer East, Inc.
Pittsburgh, Pennsylvania

Prepared by:

AMEC Earth & Environmental
Boston, Massachusetts

15 January 2009

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# TABLE OF CONTENTS

## LIST OF FIGURES

## LIST OF TABLES

# LIST OF APPENDICES

## EXECUTIVE SUMMARY

On behalf of Beazer East, Inc. (Beazer), AMEC has prepared this Off-Property Human Health and Ecological Risk Assessment (HHERA) for the Koppers Inc. (KI) Facility in Superior, Wisconsin (Site). The HHERA contains both a human health risk assessment (HHRA) and an ecological risk assessment (ERA) for the off-property portion of the Site.

The HHERA is consistent with the technical memoranda submitted to the Wisconsin Department of Natural Resources (WDNR) on March 31, 2006 and September 24, 2007 regarding the proposed approaches for developing the ecological and human health risk assessments for the off-property portion of the Site. The HHERA considers WDNR responses dated October 30, 2006, April 24, 2007, May 12, 2008, May 28, 2008, and July 23, 2008 (WDNR 2006, WDNR 2007, WDNR 2008a, WDNR 2008b, WDNR 2008c).

The HHERA evaluates potential risks for three off-property exposure areas: the portion of the tributary to Crawford Creek[1] within the floodplain immediately upgradient of the confluence with Crawford Creek (referred to in the HHERA as Area 1), Crawford Creek from the confluence with the tributary to Crawford Creek downstream to the railroad embankment (Area 2), and Crawford Creek downstream of the railroad embankment to the confluence with the Nemadji River (Area 3). Potential risks associated with the remaining portions of the tributary to Crawford Creek, upstream of the Crawford Creek floodplain, are not assessed in this HHERA because remediation activities are anticipated for this portion of the tributary such that any potential human health and ecological risks that may exist under current conditions will be mitigated to acceptable levels by future remediation activities. A Corrective Measure Study (CMS) will be prepared to identify, evaluate and select potential remedies that are protective of both ecological and human receptors.

The HHRA evaluates potential risks to human receptors from potential exposure to constituents of potential concern (COPCs) in soil, surface water, and sediment. Exposure point concentrations (EPCs) are estimated for constituents detected in a given medium. In floodplain soils, the COPCs include polycyclic aromatic hydrocarbons (PAHs), pentachlorophenol, and dioxins and furans (expressed as dioxin toxic equivalents or TCDD-TEQ). In sediment, the

[1] The tributary to Crawford Creek was formerly referred to as the "Outfall 001 drainage ditch."

COPCs include PAHs and dioxins and furans. In surface water, the COPCs include PAHs and pentachlorophenol. Potential receptors included recreational visitors and hunters. At the request of WDNR, potential exposures to trappers potentially contacting surface soil, sediments, and surface water were also evaluated.

Two sets of potential exposures and risks are estimated in the HHRA. One set follows the approaches presented in the March 2006 and September 2007 technical memoranda (BBL 2006, BBL 2007), including the use of COPC-specific dermal absorption adjustment factors (AAFs) developed by AMEC and exposure assumptions AMEC believes are representative of reasonable maximum exposures, as recommended by USEPA guidance. These are referred to as the "AMEC exposure scenarios" in the HHRA. The other set incorporates WDNR responses to the technical memoranda, including the use of default AAFs recommended by WDNR as well as WDNR-recommended exposure frequencies and durations that are greater than used in the AMEC exposure scenarios and likely lead to unrealistic overestimates of potential exposure and risk. These latter scenarios are referred to as the "WDNR exposure scenarios" in the HHRA.

For both sets of exposure scenarios, hazard indices associated with potential human exposure to off-property media are less than 1.0, indicating that no adverse noncarcinogenic health effects are expected to occur assuming a reasonable or highly conservative maximum exposure.

Similarly, the HHRA also indicates that potential excess lifetime cancer risks fall within or are less than USEPA's acceptable risk range of 10-4 to 10-6 and are below Wisconsin's target risk of 10-5 defined in NR 720.11 for both sets of exposure scenarios. Thus, the risk assessment demonstrates that for the expected uses, the off-property areas addressed in this HHRA do not pose an unacceptable cancer risk to potential human receptors.

A quantitative ERA was conducted for the three off-property exposure areas. The majority of the vegetation in the Crawford Creek floodplain is classified as "emergent wetland", dominated by plants that can sustain long periods of inundation: grasses, sedges and occasional willows and dogwoods (BBL 2000). The floodplain is bordered by a forested habitat containing mainly hardwood tree species with variable amounts of understory vegetation (BBL 2000). Potential ecological receptors were selected to be consistent with the habitat types observed in the off-property area. In addition to fish and benthic macroinvertebrates that inhabit the creek itself, this ERA evaluates potential upper trophic level receptors that represent the dominant feeding guilds that may potentially be exposed to COPCs present in Crawford Creek and its floodplain. All receptors are conservatively expected to incidentally ingest surface water from the creek. The species evaluated in the ecological risk assessment include the meadow vole (Microtus pennsylvanicus), the little brown bat (Myotis lucifugus), the tree swallow (Tachycineta bicolor), the American robin (Turdus migratorius), the mink (Mustela vison), and the belted kingfisher (Cerlye alcyon).

EPCs are estimated for constituents of potential ecological concern (COPECs) detected in a given medium. Consistent with the September 24, 2007 technical memoranda, the COPCs in floodplain soils, sediment, and forage fish include PAHs, pentachlorophenol, and dioxins and furans. In surface water, the COPCs include PAHs and pentachlorophenol. In flying insects, COPCs include PAHs and dioxins and furans.

The evaluation of potential effects to benthic invertebrates concludes that the Site-specific macroinvertebrate community data reveal the presence of a relatively diverse macroinvertebrate community at all locations, though BBL and WDNR differ in their interpretation of the health of the community and the cause of any impacts. The existing data preclude a firm conclusion about the presence or absence of an effect of COPECs on the macroinvertebrate community.

The evaluation of potential effects to the fish community in Crawford Creek suggests no adverse effects to the fish community are expected from the evaluated COPECs. However, the absence of available criteria for several COPECs combined with the changes observed in the downstream fish community in Crawford Creek preclude a firm conclusion about the presence or absence of an effect of COPECs on the Crawford Creek fish community.

The evaluation of potential risks to higher trophic level receptors potentially exposed to COPCs through the food chain found potential risk to the kingfisher, the mink, the robin, the swallow, and the vole in the portion of the tributary to Crawford Creek immediately upgradient of the confluence with Crawford Creek (Area 1). The ERA also indicates potential risk to the kingfisher, the mink, and the vole in Crawford Creek from the confluence with the tributary to Crawford Creek downstream to the railroad embankment (Area 2) and potential risks to the swallow in the portion of Crawford Creek downstream of the railroad embankment to the confluence with the Nemadji River (Area 3). Given that the assessment of potential risks is based on predominantly conservative assumptions (including using no observed effect levels to derive toxicity reference values rather than lowest observed effect levels), adverse effects are unlikely when hazard quotients are less than 10. Consequently, COPEC concentrations in off-property sediments and surface waters are not expected to pose an unacceptable risk to higher trophic level receptors.

The evaluation of potential food chain risks associated with COPECs in the off-property portion of the Site found that a potential risk to populations of upper trophic receptors were unlikely in any of the three exposure Areas because all LOAEL-based Toxicity Quotients (TQs) were less than 1.0 and most NOAEL-based TQs were either less than 1.0, or slightly greater than 1.0 (TQs between 1.0 and 5.0). Given that potential exposures of some receptors to some COPECs exceed NOAEL-based Toxicity Reference Values (TRVs) in Areas 1 and 2, but not in Area 3, a potential risk to individual upper trophic level receptors may exist in Areas 1 and 2. The potential for risk is driven primarily by potential exposures to COPECs in Crawford Creek sediments via the food chain (i.e., from consumption of fish, benthic macroinvertebrates or emergent insects by receptors such as the kingfisher, mink or swallow). However, actual adverse effects in Areas 1 and 2 seem unlikely given that: 1.) uncertainty factors are used in the derivation of TRVs and, thus, estimated exposures do not exceed actual effect levels (i.e., do not exceed the NOAEL or LOAEL); 2.) upper trophic level receptors are unlikely to forage in only a single Exposure Area; and, 3.) that all LOAEL-based TRVs are less than one. Other than a NOAEL-based TQ of 1.5 for the robin in Area 1 associated with potential exposure to TCDD-TEQ, COPECs in floodplain soils do not appear to pose a potential ecological risk.

Given the uncertainties presented in this HHERA and observations of periodic sheens within Crawford Creek, corrective actions will be evaluated as part of a Corrective Measures Study for the tributary to Crawford Creek sediments within Area 1, floodplain soils within Area 1, and Crawford Creek sediments within Area 2, in addition to sediments and adjacent bank soils along the upstream portion of the tributary to Crawford Creek (which are not evaluated in this HHERA).

## 1.0 INTRODUCTION

This report presents a Human Health and Ecological Risk Assessment (HHERA) for the off-property portion of the Koppers Inc. (KI) Facility in Superior, Wisconsin (Site). The HHERA is consistent with the technical memoranda submitted to the Wisconsin Department of Natural Resources (WDNR) on March 31, 2006 and September 24, 2007 regarding the proposed approaches for developing the ecological and human health risk assessments for the off-property portion of the Site. The HHERA also considers WDNR responses dated October 30, 2006, April 24, 2007, May 12, 2008, May 28, 2008, and July 23, 2008.

Following this Introduction (Section 1.0), Section 2.0 presents the Site-specific human health risk assessment (HHRA). The ecological risk assessment (ERA) is presented in Section 3.0. The results are summarized in Section 4.0. Calculations of potential risks are presented in Appendix F (Human Health) and Appendix I (Ecological).

The Site is located in a rural, sparsely-populated setting in Douglas County, Wisconsin, approximately five miles southeast of the City of Superior. The facility property comprises approximately 112 acres and is zoned for industrial use. The eastern property boundary parallels County Road A, and the northern property boundary parallels Hammond Avenue (Figure 2-1). The area surrounding the Site has remained relatively unchanged for the past 60 years and is predominantly undeveloped.

The facility was constructed by the National Lumber and Creosoting Company and has been in operation since 1928. The property changed hands through a series of property transactions between 1938 and 1988, when Beazer, which then owned the property, sold it to Koppers. The facility is currently owned by Koppers, although Beazer retains certain environmental responsibilities for historical conditions. The facility historically produced pressure-treated railroad ties, bridge timbers, switch ties and crossing panels. The primary preservative used at the facility was creosote with a Number 6 fuel oil carrier. From 1955 to 1979, pentachlorophenol (penta) with a petroleum oil carrier was also used. Wood-treating operations were discontinued and the facility was decommissioned in 2006. Koppers presently uses the facility for storage and distribution of untreated wood.

The majority of the surface water runoff at the Koppers wood-treating facility drains to the north-northwest and is discharged to Outfall 001, which is located in the northwest corner of the Koppers property (Figures 2-1 and 2-2). Discharge to Outfall 001 is variable and dependent on precipitation events, with the flow received by the Outfall 001 drainage ditch (which is referred to as the "tributary to Crawford Creek" beyond the property boundary) primarily resulting from snowmelt and stormwater runoff at intermittent intervals. The tributary to Crawford Creek discharges into Crawford Creek approximately 0.5 mile west of the facility. Crawford Creek is a meandering stream that flows at intermittent intervals and discharges to the Nemadji River approximately 1 mile downstream of its confluence with the Outfall 001 drainage ditch.

The United States Environmental Protection Agency (USEPA) issued the Hazardous and Solid Waste Amendments (HSWA) portion of the Resource Conservation and Recovery Act (RCRA) permit (No. WID 006 179 493) to the Site on September 30, 1988. The HSWA portion of the permit required the assessment of the release of hazardous waste constituents from solid waste management units at the facility. On April 24, 1992, the WDNR was authorized to administer the HSWA program. On September 20, 1995, the WDNR adopted provisions for state-authorized corrective action (Site-wide) under the state's HSWA authority.

Numerous investigations have been conducted at the Site since 1981 to characterize the nature and extent of environmental impacts resulting from historical wood-treating operations. This includes investigations on the KI property itself, as well as the tributary to Crawford Creek, Crawford Creek, and the associated floodplain areas hydraulically downstream from the facility. Consistent with the approach discussed with and approved by the WDNR during a November 21, 2003 meeting with Beazer, the "off-property" portion of the Site is being addressed separately from the "on-property" portion of the Site. The off-property portion of the Site includes portions of the tributary to Crawford Creek, Crawford Creek, and the floodplain areas downstream from the property boundary, as depicted in Figure 2-1. Potential risks associated with the remaining portions of the tributary to Crawford Creek, upstream of the Crawford Creek floodplain, are not quantitatively assessed in this HHERA because remediation activities are anticipated for this portion of the tributary such that potential human health and ecological risks that may exist under current conditions will be mitigated by future remediation activities. This approach was discussed with and agreed to by the WDNR during a January 2, 2007 conference call with AMEC. A Corrective Measure Study (CMS) will be prepared to identify, evaluate and select potential remedies for the upstream portion of the tributary to Crawford Creek that are protective of both ecological and human receptors.

The purpose of the human health risk assessment (HHRA) is to estimate potential risks to human health, if any, that may be associated with the off-property portion of the Site, assuming existing (i.e., baseline) conditions. The approach adopted by the HHRA is consistent with the approach recommended by the National Research Council (NRC) and follows human health risk assessment guidance provided in the USEPA's Risk Assessment Guidance for Superfund (RAGS), Volume I Part A - Human Health Evaluation Manual (USEPA 1989) and other USEPA risk assessment guidance, as well as WDNR guidance. The approach adopted in this risk assessment follows the four-step process of hazard identification, toxicity assessment, exposure assessment, and risk characterization defined by the National Academy of Sciences (NAS 1983) and USEPA (USEPA 2000). A qualitative uncertainty analysis is also included. Each of these steps is described in the following subsections.

### 1.1 Hazard Identification

In the Hazard Identification step, analytical data are evaluated and constituents of potential concern (COPC) are selected for quantitative risk assessment. As summarized in the Off-Property Investigation Data Summary Report (BBL 2006), off-property data have been collected during several phases of investigation since 1996. As proposed in the Off-Property Ecological and Human Health Assessment Approach Memoranda dated September 24, 2007 (BBL 2007), the sediment, soil, and fish samples collected during 2005 off-property investigation activities were reviewed to determine adequacy for completing the off-property HHERA. Surface water data collected in June 1996 and August 1999 are used to evaluate exposure to this medium.

Refer to Tables 2-1 through 2-3 for a summary of sediment, soil, and surface water analytical data considered in this HHERA. Field observations and data collection methods were previously submitted to the WDNR in the 2006 Off-Property Investigation Data Summary Report and the Supplemental Surface Water and Streambed Sediment Investigation Report (BBL

2000). Summary Statistics for each medium are presented in Tables 2-6 through 2-8. The summary statistics for constituents detected in at least one sample in an area include the frequency of detection, the minimum, average, and maximum detected concentrations. Values equal to one-half the limit of detection (as reported by the laboratory) were used as a surrogate concentration when calculating the average for those constituents that were not detected in a particular sample.

For purposes of this ERA, the off-property portion of the Site was subdivided into three exposure areas. These areas are described below and shown in Figure 2-2.

- Area 1: The portion of the tributary to Crawford Creek and the surrounding floodplain that is upstream/upgradient of the confluence with Crawford Creek.

- Area 2: Crawford Creek and the surrounding floodplain from the confluence with the tributary to Crawford Creek downstream to the railroad embankment.

- Area 3: Crawford Creek and the surrounding floodplain downstream of the railroad embankment to the confluence with the Nemadji River.

Samples assumed to be representative of each of these exposure areas are presented in Tables 2-11, 2-12, and 2-13. A summary of the off-property data considered in this HHERA, separated by exposure area, is also attached to this document as Appendix A.

### 1.1.1 Selection of Constituents of Potential Concern (COPCs)

COPCs are defined as the detected analytes that are potentially associated with the Site and that occur in high enough concentrations to warrant more detailed evaluation in the HHRA. Constituents detected in a given medium (for the datasets specified above) have been included for evaluation as COPCs for that medium. In accordance with the Off-Property Human Health Risk Assessment Memoranda dated September 24, 2007, COPCs in floodplain soils include polycyclic aromatic hydrocarbons (PAHs), pentachlorophenol, and dioxins and furans (as TCDD-TEQ) (BBL 2007). In sediment, the COPCs include PAHs and dioxins and furans. In surface water, the COPCs include PAHs and pentachlorophenol.

## 1.2 Toxicity Assessment

The purpose of the Toxicity Assessment is to identify both the types of adverse health effects a COPC may potentially cause, as well as the relationship between the amount of COPC to which receptors may be exposed (i.e., the dose) and the likelihood of an adverse health effect (i.e., response). Adverse health effects are characterized by USEPA as carcinogenic or noncarcinogenic. Dose-response relationships are defined by USEPA for oral and inhalation routes of exposure. The results of the toxicity assessment, when combined with the results of the exposure assessment (Section 2.3), provide an estimate of potential risk.

This section provides dose-response information for COPCs evaluated in this risk assessment. Section 2.2.1 describes the USEPA approach for developing noncarcinogenic dose-response values. The carcinogenic dose-response relationships developed by USEPA are discussed in Section 2.2.2. Noncarcinogenic and carcinogenic dose-response values used in this risk assessment are presented in Table 2-14. Dose-response information used in this risk assessment was obtained from the following sources, in order of priority in accordance with USEPA guidance (USEPA 2003):

- USEPA's Integrated Risk Information System (IRIS) (USEPA 2008);
- USEPA' Provisional Peer Reviewed Toxicity Values (PPRTVs); and
- Other sources, such as California USEPA, ATSDR, and USEPA's Health Effects Assessment Summary Tables (HEAST) (USEPA 1997a).

### 1.2.1 Non-Carcinogenic Dose-Response

Constituents with known or potential noncarcinogenic effects are assumed to have a dose below which no adverse effect occurs, or conversely, above which an effect may be seen. This dose is called the threshold dose. In laboratory experiments, this dose is known as the No Observed Adverse Effect Level (NOAEL). The lowest dose at which an adverse effect is seen is called the Lowest Observed Adverse Effect Level (LOAEL). By applying uncertainty factors to the NOAEL or the LOAEL, the USEPA has developed Reference Doses (RfDs) for chronic exposures to constituents with potential noncarcinogenic effects (USEPA 2008).

The uncertainty factors account for uncertainties associated with the dose-response value, such as the effect of using an animal study to derive a human dose-response value, extrapolating from the high doses used in the laboratory experiment to the low doses typically encountered in environmental settings, and evaluating sensitive subpopulations. For constituents with potential noncarcinogenic effects, the RfD provides reasonable certainty that if the specified exposure dose is below the RfD, then no potential noncarcinogenic health effects are expected to occur even if daily exposure were to occur for a lifetime. RfDs are expressed in terms of milligrams of constituent per kilogram of body weight per day (mg/kg-day).

Oral and dermal routes of exposure were evaluated in this risk assessment. Because dermal toxicity values are not generally available, oral dose-response information is used to estimate the potential risk associated with both oral and dermal exposures. For constituents for which no inhalation RfD has been developed by USEPA, surrogate RfDs were identified from structurally similar constituents. To include constituents in the risk assessment that do not have dose-response values listed in these sources, surrogate toxicity values were assigned based on structural and toxicological similarities. All RfDs are presented in Table 2-14 and discussed in Appendix B. The RfDs are consistent with values presented in the September 24, 2007 technical memoranda.

### 1.2.2 Carcinogenic Dose-Response

Carcinogens are conservatively assumed to have some probability of causing an adverse health response (cancer) at any dose. That is, the threshold dose for any carcinogen is assumed to be zero. The cancer-causing potency of known or potential carcinogens is estimated based on laboratory animal toxicological data and human epidemiological data. There is uncertainty in extrapolating observed responses from high doses in laboratory experiments or occupational settings, to the expected responses from low doses typically encountered in environmental settings. USEPA therefore conservatively assumes that the dose-response curve for carcinogens is linear at all doses, i.e., every unit increase of constituent dose corresponds to the same unit increase in the lifetime probability of cancer. The numerical estimate of the cancer-causing potency of a carcinogen is referred to by the USEPA as the Cancer Slope Factor (CSF), and its unit of measurement is $(mg/kg\text{-}day)^{-1}$. CSFs are presented in Table 2-14 and discussed in Appendix B. The CSFs are consistent with values presented in the September 24, 2007 technical memoranda.

In addition to benzo(a)pyrene (BaP), six PAH are considered by USEPA to be potentially carcinogenic. However, USEPA has developed carcinogenic toxicity factors only for BaP. BaP is generally assumed to be one of the most potent members of the PAH class of constituents. BaP comparative potency factors (CPFs) are quantitative indicators of the comparative potency of a PAH constituent compared to the potency of BaP. This risk assessment uses CPFs recommended by USEPA (1993a). These CPFs are presented in Table 2-15. The CPFs are used to convert the exposure point concentration for each potentially carcinogenic PAH to an equivalent concentration of BaP (see Section 2.3.3).

In order to assess the potential risk of harm from exposure to PCDD and PCDF congeners present in soil, toxicity equivalence factors (TEFs) are used. The TEFs relate the toxicity of each congener to that of 2,3,7,8-TCDD, which is the most toxic congener (USEPA, 1986). The TEFs used in this risk assessment are those recommended by the World Health Organization (Van den Berg et al. 2006) (see Table 2-16). For each exposure point and medium, the TEFs are used to derive 2,3,7,8-TCDD toxic equivalent (TCDD-TEQ) concentrations (see Section 2.3.3 Exposure Point Concentrations).

### 1.2.3 Absorption Adjustment Factors

Absorption adjustment factors (AAFs) were used in the risk calculations for dermal and oral exposures. AAFs are necessary because the efficiency of constituent absorption via a particular route of exposure and from a particular environmental matrix may differ from the absorption efficiency for the exposure route and matrix used in the experimental study that provides the basis of the CSF or RfD. AAFs are used to adjust a receptor's average daily dose (ADD) based on these two absorption efficiencies, resulting in an ADD that is comparable to the toxicity value. The AAF is defined as the ratio of the absorption efficiency from the route of exposure and matrix of interest to the absorption efficiency from the route of exposure and matrix used in the study from which the toxicity value was derived.

AMEC has derived a scientifically defensible AAF (hereafter referred to as AMEC AAFs) for each relevant chemical/route/medium situation as recommended by USEPA (1989). AMEC's AAFs for dermal exposures are presented in Table 2-17. Dermal AAFs for PAHs and pentachlorophenol were based on a review and analysis of peer-reviewed literature, attached as Appendices C and D, respectively. The dermal AAF of 0.04 for TCDD-TEQ was based on the dermal absorption factor of 3% reported by USEPA (2004), adjusted by the reported dietary absorption factor of 70%. However, as described in AMEC's response letter to WDNR's comments on the HHRA approach (AMEC 2007a), only the AMEC dermal AAFs are used in the AMEC assumption scenarios presented in this HHRA. In accordance with agreements with WDNR, oral AAFs are set as USEPA default values of 1.0. WDNR agreed that Site-specific values could be used if Beazer executed an animal study with Site soils. However, in the absence of such a study, the default of 1.0 must be used.

An alternate risk scenario is presented in this HHRA which considers AAFs based upon default values recommended by USEPA (USEPA 2004) as requested by WDNR (WDNR exposure scenarios). The values are considered "default" because they do not consider "chemical-specific absorption efficiencies" but are based upon a review of limited scientific literature for compound classes (USEPA 2000; 2001). USEPA default AAFs are presented in Table 2-18.

### 1.2.4 Permeability Constants

The dermal permeability constants (Kp) for PAHs used to evaluate potential surface water exposures in the tributary to Crawford Creek and Crawford Creek were derived from scientific literature. The Kp for BaP of 0.02 cm/hr was used as a surrogate for all potentially carcinogenic PAHs and the Kp for pyrene of 0.04 cm/hr was used as surrogate noncarcinogenic PAHs. The derived Kp values are presented in Table 2-19 and the derivation of these values is provided in Appendix E.

The Kp for BaP used in this HHRA is lower than the USEPA default Kp for BaP of 0.7 cm/hr because the USEPA default Kp is derived using methods and assumptions not appropriate for PAHs. That is, USEPA has not based its Kp for benzo(a)pyrene on experimental data on PAHs. Instead, the Kp is an estimated value derived from a regression equation that resulted from fitting a curve to a large data set of data of constituents of different classes. The parameters in the regression equation are molecular weight and octanol-water partition coefficient. Experimental studies have showed that dermal absorption of PAHs is inversely proportional to octanol-water partition coefficient not directly proportional as assumed by the Kp equations (Roy et al. 1997). Thus, the regression equation selected by USEPA to derive Kp values is not appropriate for PAHs.

## 1.3 Exposure Assessment

The risk assessment process requires the identification of exposure scenarios to assess the potential for current and potential future adverse health effects from COPCs at or near the Site. While these scenarios represent hypothetical people and activities, they reflect the physical description of the Site and the surrounding recreation and residential areas, as well as the activities that may potentially occur in these areas. In addition to the potential exposure scenarios described in the Off-Property Ecological and Human Health Risk Assessment Approach Memoranda, dated September 24, 2007 (BBL 2007), this HHRA also includes an evaluation of WDNR potential exposure scenarios as requested in the WDNR May 12, 2008 and July 23, 2008 letters (WDNR 2008a, WDNR 2008b).

This section is divided into three subsections. Section 2.3.1 describes the potential receptors and exposure scenarios selected for evaluation in the HHRA. Section 2.3.2 presents the potential exposure pathways evaluated for the off-property portions of the Site and describes the methods used to estimate potential exposure doses. Section 2.3.3 describes the methods used to estimate exposure point concentrations.

### 1.3.1 Potential Exposure Scenarios

As described in Section 2.1, this HHRA addresses a portion of the tributary to Crawford Creek, Crawford Creek, and the adjacent bank/floodplain areas downstream of the KI property boundary (Figure 2-1). The tributary to Crawford Creek discharges to Crawford Creek approximately 0.5 miles west of the KI facility. Crawford Creek is a meandering stream that flows at intermittent intervals north to the Nemadji River. The creek is 6.2 miles in total length and drains an area of approximately 8.45 square miles. Crawford Creek discharges to the Nemadji River approximately 1 mile downstream of its confluence with the tributary to Crawford

Creek. The Nemadji River discharges to Lake Superior approximately 3 miles downstream (to the northeast) of its confluence with Crawford Creek. There is no known commercial or potable use of Crawford Creek. Crawford Creek is bordered by a relatively broad floodplain between Hammond Avenue and the confluence with the Nemadji River. As shown in the site cover type map (previously provided to WDNR as Figure 6-1 of the Supplemental Surface Water and Streambed Sediment Investigation Report (BBL 2000)), several different habitat classifications were identified within the floodplain of Crawford Creek and the adjacent areas during the habitat evaluation conducted by BBL biologists on July 12 and 13, 1999. These habitat classifications include emergent wetland, bottomland hardwood forest, upland hardwood forest, upland mixed forest, and ruderal (i.e., human-impacted) cover types.

As summarized in the Off-Property Investigation Data Summary Report (BBL 2006), the tributary to Crawford Creek is a highly incised channel with steep banks that flatten out as the ditch enters the Crawford Creek floodplain area. This HHRA does not quantitatively evaluate potential risks associated with portions of the tributary to Crawford Creek which are upstream of the Crawford Creek floodplain area. Remediation activities are anticipated for this portion of the tributary such that potential human health risks that may exist under current conditions will be mitigated to acceptable levels by future remedial action.

Residences are located along Hammond Avenue, northwest of the KI facility and south of the tributary to Crawford Creek. The nearest residence is located approximately 200 feet south of the tributary to Crawford Creek and greater than 400 feet southeast of the floodplain associated with the tributary to Crawford Creek. A railroad embankment intersects Crawford Creek approximately one-half mile downstream of the confluence with the tributary to Crawford Creek. The "off-property" portion of the Site, as defined in Figure 2-1, is zoned as a Resource Conservation District by the Board of Supervisors of the County of Douglas.
Two sets of potential exposure scenarios are presented in this HHRA. One set follows the approaches presented in the March 2006 and September 2007 technical memoranda, including the use of constituent-specific dermal absorption adjustment factors (AAFs) developed by AMEC (herein referred to as AMEC exposure scenarios). The other set incorporates WDNR responses to the technical memoranda, including the use of default AAFs and exposure

parameters recommended by WDNR (herein referred to as WDNR exposure scenarios). Both sets of potential exposure scenarios are described further below.

AMEC exposure scenarios

Potential receptors consistent with the current and reasonable future use scenarios in the off-property portion of the Site include local residents who may occasionally visit Crawford Creek and the surrounding area for recreational purposes and hunters who may visit the off-property portion of the Site during the hunting season.

Exposure parameters were compiled for these receptors and are presented in Table 2-20. The parameters presented in Table 2-20 are consistent with the values presented in the September 24, 2007 technical memoranda. For both types of receptors, two age groups (i.e., a teenager (12-18 year old) and an adult) were selected for evaluation. The exposure duration for the teenager receptor was assumed to be 6 years, while the adult receptor was evaluated for 24 years. Exposure parameters were developed based on information in the USEPA Exposure Factors Handbook (USEPA 1997b). Whenever available, Site-specific exposure information (for example, the number of days per year receptors may be present in the off-property area) was utilized. Both recreational visitors and hunters were assumed to be exposed via incidental ingestion of, and dermal contact with, floodplain soil, sediment, and surface water.

As shown in Table 2-20, for purposes of estimating potential risks in the off-property portion of the Site, the AMEC exposure scenario assumes that a recreational visitor/resident would visit Crawford Creek and its surrounding floodplain at a frequency of 12 days per year. The exposure frequency takes winter conditions into account. Specifically, local winter conditions limit exposure to affected soils, sediments, and surface waters as the floodplain and creek are likely to be snow and ice covered and/or frozen and therefore not available for incidental ingestion or direct contact. The exposure frequency for the recreational visitor/resident is assumed to be the same within each exposure area, despite the fact that recreational activities are less likely to occur in Area 2 and Area 3 which are further removed from the nearest residences than Area 1.

During each visit, the recreational visitor/resident receptor is assumed to only spend a fraction of the day in the off-property portions of the Site and, thus, to be exposed to floodplain soils and sediments for a total of two hours each and to Creek surface water for 1 hour. This means that only a fraction of a receptor's potential total daily exposure to soil/sediment comes from the Site. The remainder comes from other sources the receptor contacts during other portions of the day. The fraction of a receptor's total daily soil/sediment ingestion assumed to come from the off-property portions of the Site is estimated by the hours assumed to be on-Site contacting soils/sediments (i.e., 2 hours in the case of the recreational visitor/resident) by the total number of hours in a day (i.e., 24)) and assigning this value to the Fraction Intake from Site term (FI) in the exposure estimation equations shown below.

The AMEC exposure scenarios presented in Table 2-20 also assume that the hunter receptor is exposed to floodplain soils at a frequency of one four-hour visit per week for seven months per year. It is also assumed that the hunter would be exposed to sediments and surface water at a frequency of one one-half hour visit per week for four months per year. The exposure frequency for the hunter also takes winter conditions into account which will significantly limit potential exposure to affected soils, sediments, and surface waters due to snow cover and a hunter's protective winter clothing.

<u>WDNR exposure scenarios</u>

In response to WDNR comments dated May 12 and July 23, 2008, this HHRA also presents a set of potential risk estimates based on exposure scenarios recommended by the WDNR. A summary of the WDNR exposure scenarios is presented in Table 2-21. These include both age groups (i.e., older children/teens and adults) used to represent the recreational visitor and the hunter. The WDNR also requested that a trapper be evaluated.

The recreational visitor/resident (teen and adult) exposure scenarios are also presented in Table 2-21. At the request of WDNR, the teen age range is expanded in this exposure scenario to a child/teen with an age range of 7 to 18 years old and, thus, an increased exposure duration of 11 years, and an average body weight of 48 kilograms. The daily incidental soil and sediment ingestion rate of the child/teen receptor is assumed to be 100 milligrams, while the daily incidental soil and sediment ingestion rate of the adult receptor is assumed to be 50 milligrams. It is also assumed that the adult recreational visitor/resident receptor visits the exposure areas 120 times per year and contacts soils, sediments, and surface water 2 hours per visit. The child/teen recreational visitor/resident is assumed to visit the Creek and the surrounding floodplains on a daily basis (365 days per year) and contact soils, sediments, and surface water 2 hours per visit.

At the request of the WDNR, the age range of the teenaged hunter scenario was expanded in the WDNR exposure scenario to an age range of 7 to 18 years old and an average body weight of 48 kilograms. The daily incidental soil and sediment ingestion rate of the child/teen receptor is assumed to be 100 milligrams. The exposure parameters for the adult hunter are identical to the AMEC adult hunter exposure scenario summarized above.

As shown in Table 2-21, a trapper is assumed to visit the off-property portion of the Site on a daily basis during the 4 to 5 months of the trapping season (a total of 150 days per year). During each visit, trappers are assumed to spend two hours potentially contacting each of the three exposure media: floodplain soils, sediment, and surface water. The daily incidental soil and sediment ingestion rate of the adult trapper receptor is assumed to be 50 milligrams, while the daily incidental surface water ingestion rate is assumed to be 10 milliliters.

### 1.3.2 Identification of Potential Exposure Pathways

Potential exposure pathways are the ways by which potential receptors may be exposed to COPCs. The potential exposure pathways included in this HHRA were selected based on the most likely mechanisms of exposure and observations at the Site. The most likely potential exposure pathways at the Site are ingestion of and/or dermal contact with floodplain soils, sediments, and surface water.

Reasonable maximum exposure (RME) scenarios are evaluated in this HHRA. Conservative exposure assumptions are used to construct a reasonable maximum exposure scenario. Most individuals will not be subject to all the conditions that comprise the RME scenario. Individuals who do not meet all conditions in the RME scenario have lower potential exposures to COPCs, and, therefore, lower potential risks associated with those exposures.

The Chronic Average Daily Dose (CADD) is an estimate of a receptor's potential daily intake from oral and dermal exposure to COPCs with potential noncarcinogenic effects. Note that Average Daily Dose is a term-of-art used in risk assessment and does not represent a true average because the assumptions used to derive it do not represent "averages". According to USEPA (1989), the exposure dose should be calculated by averaging over the period of time for which the receptor is assumed to be exposed. The CADD for each COPC via each route of exposure is compared to the RfD for that COPC to estimate the potential hazard index due to exposure to that COPC via that route of exposure. Hazard indices are presented and discussed in Section 2.4.1.

For COPCs associated with potentially carcinogenic effects, the Lifetime Average Daily Dose (LADD) is an estimate of potential daily intake over the course of a lifetime. In accordance with USEPA (1989), the LADD is calculated by averaging the assumed exposure over the receptor's entire lifetime (assumed to be 70 years). The LADD for each COPC via each route of exposure is combined with the cancer slope factor for that COPC in order to estimate the excess lifetime cancer risk due to exposure to that COPC via that route of exposure. Excess lifetime cancer risks are presented and discussed in Section 2.4.2.

The equations and several of the exposure parameters used to estimate a receptor's potential average daily dose (both lifetime and chronic) are presented and discussed in the following paragraphs. The calculations for all receptors evaluated in this HHRA are presented in Appendix F.

Soil or Sediment Ingestion

$$A = \frac{B \times C \times D \times E \times F \times G \times H}{I \times J}$$

where:

A = Average Daily Dose Due to Soil Ingestion (mg/kg-day)
B = COPC Concentration in Soil or Sediment (mg/kg)
C = Unit Conversion Factor ($1 \times 10^{-6}$ kg/mg)
D = Soil or Sediment Ingestion Rate (mg/day)
E = Exposure Frequency (days/year)
F = Exposure Duration (years)
G = Oral-Soil/Sediment Absorption Adjustment Factor (unitless)
H = Fraction Intake from Site (unitless)

I = Body Weight (kg)
J = Averaging Time (days)

Dermal Contact with Soil or Sediment

$$A = \frac{B \times C \times D \times E \times F \times G \times H \times I}{J \times K}$$

where:

A = Average Daily Dose Due to Dermal Contact (mg/kg-day)
B = COPC Concentration in Soil or Sediment (mg/kg)
C = Unit Conversion Factor ($1 \times 10^{-6}$ kg/mg)
D = Soil/Sediment to Skin Adherence Factor (mg/cm$^2$)
E = Skin Surface Area Exposed (cm$^2$/day)
F = Exposure Frequency (days/year)
G = Exposure Duration (years)
H = Dermal-Soil/Sediment Absorption Adjustment Factor (unitless)
I = Fraction Intake from Site (unitless)
J = Body Weight (kg)
K = Averaging Time (days)

Ingestion of Surface Water

$$A = \frac{B \times C \times D \times E \times F \times G}{H \times I}$$

where:

A = Average Daily Dose Due to Surface Water Ingestion (mg/kg-day)
B = COPC Concentration in Surface Water (mg/L)
C = Surface Water Ingestion Rate (L/hr)
D = Exposure Time (hr/day)
E = Exposure Frequency (days/year)
F = Exposure Duration (years)
G = Oral-Water Absorption Adjustment Factor (unitless)
H = Body Weight (kg)
I = Averaging Time (days)

Dermal Contact with Surface Water

$$A = \frac{B \times C \times D \times E \times F \times G \times H \times I}{J \times K}$$

where:

A = Average Daily Dose Due to Dermal Contact with Surface Water (mg/kg-day)
B = COPC Concentration in Surface Water (mg/L)
C = Unit Conversion Factor ($L/cm^3$)
D = Dermal Permeability Constant (cm/hr)
E = Skin Exposed ($cm^2$)
F = Exposure Time (hr/day)
G = Exposure Frequency (days/year)
H = Exposure Duration (years)
I = Dermal-Water Absorption Adjustment Factor (unitless)
J = Body Weight (kg)
K = Averaging Time (days)

Tables 2-21 and 2-22 present the potential exposure assumptions used to evaluate each receptor in the risk assessment. The assumed exposure frequency, exposure duration, body weight, and exposure time (accounted for in the calculations as "Fraction Intake from Site") for each receptor were previously presented in section 2.3.1. A discussion of additional exposure assumptions is provided below.

Each receptor is assumed to potentially contact floodplain soils, sediments, and surface water within each of the exposure areas described in Section 2.1 of this HHRA. A soil/sediment ingestion rate of 50 mg/day and a surface water ingestion rate of 10 mL/day is assumed for each receptor. These values are equal to the soil ingestion and water ingestion rates recommended by USEPA (1999; 1997b). At the request of WDNR, potential risks assuming child/teen receptors have a potential soil/sediment ingestion rate of 100 mg/day are also presented.

For all receptors, this HHRA assumes that hands, forearms, and the face are potentially exposed to floodplain soils. Based on information from USEPA (2001), the soil adherence factor appropriate for the hands, forearms, and face (0.14 $mg/cm^2$) is used to estimate potential soil adherence to this area of skin for a receptor's exposure to floodplain soils. Weighted soil adherence factors are estimated for potential exposures to floodplain soils using surface area and body-part specific adherence data from USEPA (2001) and the following formula:

$$SA - Wt.\ AF = \frac{SA_h \times AF_h + SA_{fa} \times AF_{fa} + SA_f \times AF_f}{SA_h + SA_{fa} + SA_f}$$

where:

SA-Wt. AF = Surface Area-Weighted Adherence Factor (mg/cm$^2$)
$SA_h$ = Surface Area of Hands (cm$^2$)
$AF_h$ = Adherence Factor for Hands (mg/cm$^2$)
$SA_{fa}$ = Surface Area of Forearms (cm$^2$)
$AF_{fa}$ = Adherence Factor for Forearms (mg/cm$^2$)
$SA_f$ = Surface Area of Face (cm$^2$)
$AF_f$ = Adherence Factor for Face (mg/cm$^2$)

Alternately, this HHRA assumes that the receptor's hands, forearms, and feet are potentially exposed to sediment and surface water. The soil adherence factor appropriate for hands, forearms, and feet (0.18 mg/cm$^2$) is used to estimate potential soil adherence to this area of skin for a receptor's exposure to sediment and surface water. Weighted soil adherence factors are estimated for potential exposures to Creek floodplain soils using surface area and body-part specific adherence data from USEPA (2001) and the following formula:

$$SA - Wt.\ AF = \frac{SA_h \times AF_h + SA_{fa} \times AF_{fa} + SA_{feet} \times AF_{feet}}{SA_h + SA_{fa} + SA_{feet}}$$

where:

SA-Wt. AF = Surface Area-Weighted Adherence Factor (mg/cm$^2$)
$SA_h$ = Surface Area of Hands (cm$^2$)
$AF_h$ = Adherence Factor for Hands (mg/cm$^2$)
$SA_{fa}$ = Surface Area of Forearms (cm$^2$)
$AF_{fa}$ = Adherence Factor for Forearms (mg/cm$^2$)
$SA_{feet}$ = Surface Area of Feet (cm$^2$)
$AF_{feet}$ = Adherence Factor for Feet (mg/cm$^2$)

### 1.3.3 Exposure Areas and Exposure Point Concentrations

Exposure areas represent the sampling locations within an area of a site that receptors may potentially contact COPCs and are defined for each media based on the media-specific data relevant for potential exposure(s). The exposure point concentration (EPC) is defined as the COPC concentration in the environmental medium representing the exposure area that a potential receptor may potentially encounter. As described in Section 2.1 and depicted in Figure 2-2, the off-property portion of the Site was subdivided into three exposure areas: Area 1, Area 2, and Area 3.

The soil, sediment, and surface water data sets were divided into data collected from the three exposure areas. Samples assumed to be representative of each of these exposure areas are presented in Tables 2-11, 2-12, and 2-13. A summary of the off-property data considered in this HHERA, separated by exposure area, is also attached to this document as Appendix A. To account for the absence of sediment data in Area 1, sediment data available for Area 2 were used to estimate potential sediment exposures in Area 1. Similarly, to account for the absence of floodplain soil data in Area 3, downgradient of the railroad embankment, floodplain soil data available for Area 2 were conservatively used to estimate potential floodplain soil exposures in Area 3. As discussed in more detail in Section 2.5.1, actual floodplain soil concentrations in Area 3 are expected to be lower than the concentrations detected in Area 2 for several reasons.

As described in Section 2.2.2, TEFs were used to calculate 2,3,7,8-TCDD TEQ concentrations (van den Berg et al, 2006) for each sample in which 2,3,7,8-substituted dioxins and furans were detected and CPFs were used to calculate a BaP-TE concentration (USEPA 1993a) for each sample in which potentially carcinogenic PAHs were detected. TEFs for dioxins and furans are shown in 2-16 and CPFs for potentially carcinogenic PAHs are shown in Table 2-15.

EPCs were then estimated as the lower of either the maximum detected concentration or the one-sided 95% upper confidence limit (UCL) on the arithmetic mean concentration of COPCs in each medium from samples collected from the three exposure areas.

The 95% UCL was calculated using the following formula:

$$\mathrm{UCL} = x + t \cdot s / \sqrt{n}$$

where:

x = Arithmetic mean concentration of the sample data (mg/kg or mg/L)
t = Student's t-distribution statistic
s = Standard deviation of the sample data (mg/kg or mg/L)
n = Number of data points

Values equal to one-half the limit of detection (as reported by the laboratory) were used as a surrogate concentration when calculating the 95% UCL for those constituents that were not detected in a particular sample. Because of the higher detection limits (5 µg/L), surface water samples W1, W2, and W3, collected in August 1999, were not considered when calculating the EPCs for PAHs in Area 1. For each exposure area, the EPCs representing each COPC in are presented in Table 2-22.

## 1.4 Risk Characterization

The Risk Characterization combines the results of the Exposure Assessment with the results of the Toxicity Assessment to derive quantitative estimates of the potential for adverse health effects to occur as a result of potential exposure to Site-related constituents. Noncarcinogenic and carcinogenic risk characterizations are described separately below. Two sets of potential risks are estimated in the HHRA. Potential risks estimates developed according to the assumptions and approaches presented in the March 2006 and September 2007 technical memoranda, including the use of constituent-specific dermal (but not ingestion) AAFs developed by AMEC are presented in Table 2-23. The other set of potential risk estimates incorporating WDNR responses to the technical memoranda, including the use of default AAFs recommended by WDNR, are presented in Table 2-24.

### 1.4.1 Noncarcinogenic Risk Characterization

The potential for exposures to COPCs in floodplain soil, surface water, and sediment in the off-property portion of the Site to result in potential adverse noncarcinogenic health effects is estimated by comparing the Chronic Average Daily Dose (CADD) for each COPC (derived in Section 2.3.2) with the Reference Dose for that COPC (presented in Section 2.2.1). The resulting ratio, which is unitless, is known as the Hazard Quotient (HQ) for that COPC. The HQ is calculated using the following formula:

$$A = \frac{B}{C}$$

where:

A = Hazard Quotient (unitless);
B = Chronic Average Daily Dose (mg/kg-day); and
C = Reference Dose (mg/kg-day).

When the Hazard Quotient for a given COPC and pathway does not exceed 1, the Reference Dose has not been exceeded, and no potential adverse noncarcinogenic health effects are expected to occur as a result of exposure to that COPC via that pathway. The HQs for each COPC are summed to yield the Hazard Index (HI) for that pathway. A Total HI is then calculated for each exposure medium by summing the pathway-specific HIs. A Total HI that does not exceed 1 indicates that no potential adverse noncarcinogenic health effects are expected to occur as a result of that receptor's potential exposure to COPCs in the environmental medium evaluated (USEPA 2000).

The HI for total potential noncarcinogenic risk to recreational visitors/residents and hunters in all of the assessed off-property exposure areas (Area 1, Area 2, Area 3) is less than 1. This indicates that no potential adverse noncarcinogenic health effects are expected to occur for current and future recreational visitors/residents and hunters assuming AMEC- or WDNR-specific parameters (Tables 2-23 and 2-24, respectively).

At the request of WDNR, use of the off-property portion of the Site by a trapper was evaluated in the HHRA for informational purposes. The cumulative HI for a trapper from potential exposure to COPCs in floodplain soils, sediments, and surface water is less than 1 (Table 2-24) when using USEPA default AAFs. This suggests that potential adverse noncarcinogenic health effects are not expected to occur from potential exposure of a hypothetical trapper to COPCs in floodplain soils, sediments and surface water.

### 1.4.2 Potential Carcinogenic Risk Characterization

The purpose of carcinogenic risk characterization is to estimate the potential likelihood, over and above the background cancer rate, that a receptor will develop cancer in his or her lifetime as a result of potential Site-related exposures to COPC in various environmental media. This likelihood is a function of the dose of a COPC and the CSF for that COPC. The relationship between the Potential Excess Lifetime Cancer Risk (PELCR) and the estimated Lifetime Average Daily Dose (LADD) of a COPC may be expressed as an exponential equation:

$$A = 1 - e^{-B \times C}$$

where:

A = Potential Excess Lifetime Cancer Risk (unitless);
B = Cancer Slope Factor (1/(mg/kg-day)); and
C = Lifetime Average Daily Dose (mg/kg-day).

This is the general form of the equation, and may be used in all cases to estimate potential risk, regardless of the magnitude of the potential estimated risk. In particular, this equation should be used when the product of the dose and potency slope is greater than 0.01. This practice prevents calculation of potential risks that are greater than one.

The exponential equation can be simplified to a linear equation, which closely approximates the results of the exponential equation when the product of the dose and potency slope is less than 0.01. The simplified linear form of the equation is expressed as:

$$A = B \times C$$

where:

A = Potential Excess Lifetime Cancer Risk (PELCR) (unitless);
B = Cancer Slope Factor (1/(mg/kg-day)); and
C = Lifetime Average Daily Dose (mg/kg-day).

The product of the CSF and the LADD is unitless, and provides an estimate of the potential carcinogenic risk associated with a receptor's exposure to that COPC via that pathway. Pathway PELCRs are calculated for each COPC with potentially carcinogenic effects. The PELCRs for each pathway by which the receptor is assumed to be exposed are calculated by summing the potential risks derived for each COPC. A Total PELCR is then calculated for each exposure medium by summing the pathway-specific PELCRs.

The total PELCR for current and future recreational visitors/residents and hunters are within or less than the USEPA's allowable risk range of $1x10^{-6}$ to $1x10^{-4}$ (Tables 2-23 and 2-24) and less than the WDNR allowable risk limit of $1x10^{-5}$, regardless of whether WNDR-requested exposure scenarios and USEPA default AAFs are used or AMEC exposure scenarios are used.

As described above, WDNR requested that potential risks associated with potential use of the off-property portion of the Site by a trapper be considered. The total PELCR for hypothetical trapper exposed to floodplain soil, sediment and surface water in each exposure area is less than or within USEPA's allowable risk range and less than the WDNR allowable risk limit of $1x10^{-5}$ when using USEPA default AAFs (Table 2-24).

In summary, potential non cancer effects are not expected for any of the likely current or future off-property receptors included in the HHRA. Similarly, potential excess lifetime cancer risks fall within USEPA's allowable risk range of $1x10^{-6}$ to $1x10^{-4}$ for all potential receptors included in the HHRA. Potential excess lifetime cancer risks are also below WDNRs allowable risk range (i.e., less than $1x10^{-5}$), for all receptors. Thus, the risk assessment demonstrates that for current and the most likely future uses, the off-property portions of the Site evaluated in this HHRA do not pose an unacceptable cancer risk.

### 1.5 Uncertainty Assessment

Within any of the four steps of the risk assessment process, assumptions must be made due to a lack of absolute scientific knowledge. Some of the assumptions are supported by considerable scientific evidence, while others have less support. Every assumption introduces some degree of uncertainty into the risk assessment process. As a result, conservative assumptions have been made throughout the risk assessment to ensure that public health is protected and that potential risks and hazards are not underestimated. It is likely, therefore, that when all of the assumptions are combined, that actual risks, if any, are overestimated rather than underestimated.

While all exposure and toxicity assumptions have some level of uncertainty associated with them, the discussion of uncertainty in the following subsections focuses on those assumptions that are likely to introduce the greatest amount of uncertainty in this risk assessment.

### 1.5.1 Hazard Identification

During the Hazard Identification step, constituents are selected for inclusion in the quantitative risk assessment. All constituents detected in floodplain soil, sediment, and surface water in the off-property portion of the Site were considered COPCs and were evaluated in the risk assessment. There are some uncertainties associated with this step of the risk assessment including limited numbers of samples in some exposure areas.

In the absence of data in specific exposure areas (sediment data in Area 1 and floodplain soil data in Area 3), the HHRA assumed that concentrations were similar to nearby exposure areas. Given the close proximity of Area 1 sediments to the sediment samples collected from Area 2, it is likely that COPC concentrations in sediment from both these areas are similar. Further, total PAHs detected within shallow sediment samples collected within Area 1 in 1996 and 1999 (350 mg/kg at C4 (0-0.25') and 170 mg/kg at SD-08 (0-0.5')) are within the range of total PAH concentrations reported for sediment collected within Area 2 in 2005 (from 150 mg/kg to 1200 mg/kg) and are well below the total PAH sediment EPCs used for Area 1 (1,170 mg/kg). Therefore, the assumption made by this HHRA that Area 1 concentrations are equal to those detected in Area 2, would lead to either a representative estimate of, or an overestimate of, potential risk for Area 1.

As presented in Section 3.4.2 of the Off-Property Investigation Data Summary Report (BBL 2006), significant impacts to floodplain soils downstream of the railroad embankment are not anticipated due to the following observations:

- The absence of creosote-like product during the 1999 probing activities;
- Flow restrictions caused by the culvert beneath the railroad embankment which limits the potential for transport of COPCs;
- The majority of the floodplain downstream of the embankment is physically disconnected from the upstream portion by the barrier created by the embankment; and,
- There is a decreasing trend in COPC concentrations in surface soils with distance downgradient from the facility.

In a meeting between Beazer and WDNR on May 24, 2006, the WDNR concurred with the above observations and Beazer's conclusions regarding the limited impacts to floodplain soils downstream of the embankment. Therefore, using surrogate data from Area 2 to estimate potential risk associated with exposures to COPCs in Area 3 floodplain soils likely overestimates the risk.

### 1.5.2 Toxicity Assessment

Dose-response values are sometimes based on limited toxicological data. For this reason, a margin of safety is built into estimates of both carcinogenic and noncarcinogenic risk, and actual risks are lower than those estimated. The two major areas of uncertainty introduced in the dose-response assessment are: (1) animal to human extrapolation; and (2) high to low dose extrapolation. These are discussed below.

Human dose-response values are often extrapolated, or estimated, using the results of animal studies. Extrapolation from animals to humans introduces a great deal of uncertainty in the risk assessment because in most instances, it is not known how differently a human may react to the constituent compared to the animal species used to test the constituent. The procedures used to extrapolate from animals to humans involve conservative assumptions and incorporate several uncertainty factors that overestimate the potential adverse effects associated with a specific dose. As a result, overestimation of the potential for adverse effects to humans is more likely than underestimation.

Predicting potential health effects from exposure to media containing COPCs requires the use of models to extrapolate the observed health effects from the high doses used in laboratory studies to the anticipated human health effects from low doses experienced in the environment. The models contain conservative assumptions to account for the large degree of uncertainty associated with this extrapolation (especially for potential carcinogenic effects) and therefore, tend to be more likely to overestimate than underestimate potential risks.

No noncarcinogenic toxicity values were available for several PAH detected at the Site. In such cases, a surrogate toxicity value is used. The use of surrogate toxicity values introduces uncertainty into the risk assessment. For all of the potentially carcinogenic PAH, a cancer slope factor has been derived based on the cancer slope factor for benzo(a)pyrene and the application of USEPA's recommended comparative potency factors. Since the comparative potency factors are based on conservative assumptions, it is possible that the cancer potency of these PAH has been overestimated. In addition, for all PAH for which no noncarcinogenic toxicity value was available, it was assumed that noncarcinogenic effects would occur and the reference dose for pyrene was used as a surrogate. The reference dose for pyrene is the most stringent reference dose available for any PAH. Thus, it is likely that this approach has overestimated rather than underestimated potential noncarcinogenic hazards. In fact, it is possible that for some of the PAH compounds, there is no toxic potential so that potential health risks due to exposure to them could be zero. However, without additional toxicological information it is not possible to determine the impact of the use of these surrogate toxicity values.

This HHRA uses the currently available and long-standing carcinogenic toxicity information for 2,3,7,8-TCDD to evaluate TCDD-TEQ. Beazer is aware that in 2006 the National Academy of Science (NAS) completed its review of USEPA's 2003 draft reassessment of the CSF for TCDDS 2006). NAS was tasked to assess whether USEPA's more recent risk estimates for dioxin-like chemicals were scientifically robust and whether there is a clear delineation of all substantial uncertainties and variability. Key criticisms and recommendations from NAS for USEPA's assessment include: (1) the linear extrapolation to low doses reflects agency policy, and does not reflect the state of the science for TCDD; (2) USEPA should use a variety of different dose-response models (rather than just the multistage model with linear extrapolation (3) USEPA should use probabilistic methods to address uncertainty in the cancer potency; (4) USEPA should use the most current data in its risk estimates, in particular, the NTP (2006) cancer bioassay; and (5) the assessment should consider multiple dose measures, and CSFs based upon body burden should address species differences in body fat composition. In response to these comments, a revised reassessment is being prepared by USEPA, and it is estimated to become available in 2012.

Given these shortcomings of USEPA's most recent dioxin reassessment, this HHRA uses USEPA's published CSF of 150,000 $(mg/kg\text{-}day)^{-1}$ available from HEAST (USEPA 1997a). This too has substantial limitations because it is based upon an outdated assessment (USEPA

1984), and as such the data, methods, and policies used in the assessment are now obsolete. This CSF has never been verified for inclusion in USEPA's Integrated Risk Information System (IRIS). Specific limitations of the HEAST CSF for TCDD include: (1) the CSF relied upon conclusions originally reported in Kociba et al. (1978), which have since been updated to reflect more recent pathology guidelines (PWG 1990); (2) the CSF does not reflect more recent cancer bioassays conducted for TCDD; (3) the CSF relies upon dose-response data that were assessed in terms of administered dose, which is not considered to be a suitable dose measure for persistent chemicals such as TCDD; (4) the CSF relies upon an allometric scaling factor of 2/3 to scale doses from rats to humans, rather than a scaling factor of 3/4 as is current agency policy (USEPA 1992); and (5) the CSF relies upon a low-dose extrapolation method (linearized multistage model) that is not consistent with current agency guidelines for carcinogen risk assessment (USEPA 2005). Taken together, it is more likely than not that potential cancer risks estimated using this CSF overestimate potential cancer risk associated with exposure to TCDD.

### 1.5.3 Exposure Assessment

During the exposure assessment, average daily doses of COPC to which receptors are potentially exposed are estimated. This involves assumptions about how often exposure occurs. Such assumptions include location, accessibility, and use of an area. With this in mind, the receptor, or person who may potentially be exposed, and the location of exposure, were both defined for this risk assessment. The locations where certain activities were assumed to take place have been purposely selected to be consistent with the use of the Site.

EPA (2001) recommends that risk assessors assume that PAH are 100% absorbed after ingestion (oral AAF) and that thirteen percent of the dermally applied dose is absorbed (dermal AAF). As discussed in Section 2.2.3 and Appendix C, however, there is substantial empirical evidence to indicate that these estimates of absorption of PAH are overstated. In fact, based on Magee et al. (1998), it appears that an oral ingestion AAF of 27% is more appropriate for the potentially carcinogenic PAH and an oral AAF of 43% is more appropriate for the noncarcinogenic PAH. In addition, Magee et al. have reported that a dermal AAF of 2% is more representative for the potentially carcinogenic PAH. The effect on potential risk estimates is that if the Magee et al. (1998) AAFs are used, potential risks due to oral exposure to potentially carcinogenic PAH will be reduced by a factor of 3.7 compared to the use of USEPA's default oral AAFs, potential risks due oral ingestion of noncarcinogenic PAH will be reduced by a factor of 2.3, and potential risks due to dermal exposure to potentially carcinogenic PAH will be reduced by a factor of 6.5. However, as described in the September 2007 technical memorandum (BBL 2007a), only the AMEC dermal AAFs are used in the AMEC exposure scenarios presented in this HHRA. To capture the uncertainty associated with several of the key assumptions, including dermal AAFs, the HHRA presents potential risks using AMEC exposure scenarios and WNDR exposure scenarios. However, since USEPA's recommended default oral AAFs were used to evaluate potential risks in each exposure scenario, the range in uncertainty is not completely captured in this HHRA. Using USEPA's default oral AAFs within each scenario is more likely to overestimate than underestimate potential risks.

The risk assessment used soil adherence factors derived from studies that measured actual soil loading onto skin during various types of activities. The adherence factors were selected based upon similarity of the activities conducted by the study participants to the assumed activities of the receptors evaluated in the risk assessment. It was assumed, therefore, that the soil adherence for receptors in the risk assessment would be similar to soil adherence observed in the studies. It was also assumed that absorption of constituents from soil adhered to skin would be similar to absorption from soil observed in studies used to derive the absorption adjustment factors. However, such studies typically measure absorption by applying enough soil to the skin so that an "infinite source" of a constituent is available for absorption. This HHRA assumes that the amount of soil assumed to adhere to receptors' skin approximates the "infinite source" amount used to estimate dermal absorption of constituents from soil. However, rates of absorption measured in studies may not be representative of absorption that occurs when lower degrees of adherence occur.

EPA (2001) states that dermal absorption from soil tends to increase as the thickness of the soil layer decreases until a "monolayer" (the point where the skin is uniformly covered by soil), at which the absorption remains relatively constant. Because the risk assessment assumed dermal absorption rates for soil loadings that were a "monolayer," it is likely that dermal absorption has been overestimated because actual soil loading would likely be less than assumed and would not achieve the maximum absorption potential a "monolayer." Thus, there is some uncertainty regarding the amount of dermal absorption from soil. However, this uncertainty is minimized by the assumption of soil loading conditions meeting the criteria of a monolayer. If the dermal absorptions were to actually meet the criteria of a monolayer of soil, then the soil adherence factor assumed in the risk assessment would also need to be decreased to account for the reduced amount of soil assumed to be loaded onto skin. Consequently, although there is some uncertainty associated with the increased dermal absorption that occurs when a monolayer of soil is loaded onto skin, the approach used in the risk assessment is not likely to underestimate potential exposure because the soil adherence assumed in the dermal absorption factors used in the risk assessment "match" the dermal absorption rates used in the risk assessment.

EPA (1997b) recommends an upper bound soil ingestion rate for young children of 200 mg/day. However, based on more current information provided by the authors of the study upon which that estimate is derived, it appears that a more reasonable upper bound ingestion rate for young children is 100 mg/day (Stanek et al. 2000). Similarly, USEPA (1997b) does not specifically recommend an upper bound estimate of soil ingestion for older children and adults but does recommend an average ingestion rate for these age groups of 50 mg/day. More current information provided by Stanek et. al., (1997) however, indicate that 50 mg/day is a more reasonable upper bound estimate for these age groups. Thus, for the child/teen receptor, including hunters and recreational visitors/residents, it is likely that soil ingestion has been overestimated in those scenarios that used soil ingestion rates of 100 mg/day.

The exposure point locations were defined in such a manner as to represent conservative, yet realistic, locations where receptors may potentially encounter COPCs. Receptors were assumed to have equal access to the three exposure areas defined in this HHERA. However, exposure to COPCs in exposure Areas 2 and 3 is likely to be less than exposures in Area 1 due to the significant distance from the residential neighborhoods along Hammond Avenue and the presence of the railroad embankment. Therefore, it is likely that exposures have been overestimated in Area 2 and Area 3.

It should be noted that it is likely that winter conditions will significantly limit exposure to affected soils, sediments, and surface waters during winter months. The floodplain and creek are likely to be covered by snow and ice for the majority of this period, thus preventing contact with soils and sediments. Additionally, receptors will likely be wearing winter clothes that limit contact with soils and sediments. Further, frozen soils are also less likely to be available for ingestion or dermal adsorption. Daily exposure to affected soils, sediments, and surface waters (up to 365 days/year) recommended by the WDNR is highly unlikely. As such, potential exposure and risk estimates based on WDNR assumptions are likely to be significant overestimates of any actual exposure or risk. In order to capture this source of potential uncertainty, estimates of potential risk were estimated using both WDNR recommended exposure frequencies and more representative but still conservative AMEC exposure frequencies.

To the extent possible, EPCs have been derived in a manner that ensures that concentrations in the media and exposure areas of concern are not underestimated. This is generally true even when arithmetic average concentrations are used because more samples are generally collected from areas suspected of having elevated COPC concentrations than from areas suspected of having low COPC concentrations. Such sampling introduces an inherent "high" bias in EPCs that do not specifically account for biased sampling and the spatial dependence of COPC concentrations in many site media. Use of the 95% upper confidence limit of the arithmetic mean without accounting for this bias or spatial dependence, as was done in this HHRA, makes it far more likely that the EPCs used herein overstate rather than understate potential exposures.

### 1.5.4 Risk Characterization

The risk of potential adverse human health effects depends on estimated levels of potential exposure and on dose-response relationships. Once potential exposure to, and potential risk from, each of the COPCs is estimated, the total risk posed by potential exposure to COPCs is determined by combining the health risk contributed by each COPC. Where COPCs do not interact, do not affect the same target organ or do not have the same mechanism of action, summing the risks for multiple COPCs results in an overestimate of risk posed by the Site. However, in order not to understate the potential risk, it was conservatively assumed that the potential effects of different COPCs are additive. Had potential risks assuming additivity exceeded and HI of 1.0, an endpoint specific HI could have been calculated for each of the different endpoints potentially affected by the COPCs.

## 2.0 ECOLOGICAL RISK ASSESSMENT

This section presents the evaluation of potential ecological risks associated with the off-property portions of the Site. This evaluation was conducted using methods described in two previous submittals to the WDNR describing the approach for evaluating potential ecological exposures associated with the Site and revisions to those methods as requested by the WDNR (BBL 2006; BBL, 2007). The first, submitted to WDNR on March 31, 2006, presented the conceptual site model (CSM) and ecological receptors to be evaluated (BBL 2006). The second, submitted to the WDNR on September 24, 2007, incorporated the results of discussions and correspondence between WDNR and Beazer in response to the first memorandum. In a letter dated October 30, 2006, WDNR commented on the first memorandum (WDNR 2006). In a letter dated January 16, 2007, Beazer responded to WDNR's letter and incorporated decisions made on subsequent conference calls with WDNR (AMEC 2007b). WDNR commented on the second memorandum (WDNR 2008) in a letter dated May 28, 2008. In a letter dated July 18, 2008, Beazer responded to WDNR's letter (AMEC 2008).

As stated in BBL's February 10, 2005 letter to the WDNR, the investigations conducted to date in the off-property areas are consistent with USEPA's eight -step process for conducting ecological risk assessments (ERAs) and WDNR's three-tiered approach for assessing sediment quality (BBL 2005). In the ERA guidance document (USEPA 1997c), USEPA outlines eight steps involved in conducting an ERA. These steps include:

1. Preliminary Problem Formulation and Ecological Effects Evaluation;
2. Preliminary Exposure Estimate and Risk Calculation;
3. Baseline Risk Assessment Problem Formulation;
4. Study Design and Data Quality Objectives;
5. Field Verification of Sampling Design;
6. Site Investigation and Analysis of Exposure and Effects;
7. Risk Characterization; and
8. Risk Management.

According to USEPA (1997c), "this eight-step approach is not a simple linear or sequential process."

In 2000, BBL submitted the document *Supplemental Surface Water and Streambed Sediment Investigation Report* (BBL 2000) summarizing habitat, benthic macroinvertebrate and fish surveys performed in 1999. These surveys, along with the Site characterization data collected prior to 2005 and the evaluations of potential concentrations in fish tissue, formed the basis of the preliminary problem formulation for the Site (Tier 1 of WDNR's sediment quality assessment outline and Steps 1 and 2 of U.S.EPA's ERA eight-step process). From the results of these initial investigations, potentially complete exposure pathways and receptors were identified and additional Site-specific data were collected in 2005 to further characterize the Site and aid in refining potential estimates of ecological risk. These additional field investigations, which included sampling collocated media (for bioaccumulation evaluations), in conjunction with the previous investigations, provided the information necessary to characterize potential ecological risks as described under Tier 3 of the WDNR sediment assessment outline and in steps 5-7 of the U.S.EPA eight-step ERA process.

Section 3.1 describes the Site and Section 3.2 presents the Initial Screening, including the comparison of Site data to screening values. Section 3.3 presents the Problem Formulation, including development of assessment endpoints (valued ecological "entities" and their characteristics and functions) and the measurement endpoints used to evaluate them; identification of representative ecological receptors; identification of constituents of potential ecological concern (COPECs); and development of a CSM presenting potential pathways of exposure to COPECs. Section 3.4 describes the Analysis, including the Exposure Assessment and Effects Evaluation. Section 3.5 presents the Risk Characterization, which consists of the calculation of toxicity quotients, the evaluation of the benthic macroinvertebrate community, and the fish community evaluation. Section 3.6 summarizes the uncertainties associated with the analysis.

### 2.1 Site Description and Environmental Setting

As described above, the "off-property" portion of the Site includes portions of the tributary to Crawford Creek, Crawford Creek, and the floodplain areas downstream from the property boundary, as depicted in Figure 2-1.

As described in Section 2.3.1, several different habitat classifications were identified within the floodplain of Crawford Creek and the adjacent areas during the habitat evaluation conducted by BBL biologists on July 12 and 13, 1999. These habitat classifications include emergent wetland, bottomland hardwood forest, upland hardwood forest, upland mixed forest, and ruderal (i.e., human-impacted) cover types. The majority of the vegetation in the Crawford Creek floodplain is classified as "emergent wetland", dominated by plants that can sustain long periods of inundation: grasses, sedges and occasional willows and dogwoods (BBL 2000). The floodplain is bordered by a forested habitat containing mainly hardwood tree species with variable amounts of understory vegetation (BBL 2000).

As described in Section 2.1 and shown in Figure 2-2, for the purposes of this ERA the Site has been divided into three areas:

- Area 1: The portion of the tributary to Crawford Creek and the surrounding floodplain that is upstream/upgradient of the confluence with Crawford Creek.

- Area 2: Crawford Creek and the surrounding floodplain from the confluence with the tributary to Crawford Creek downstream to the railroad embankment.

- Area 3: Crawford Creek and the surrounding floodplain downstream of the railroad embankment to the confluence with the Nemadji River.

As stated above for the HHRA, potential exposures to the remaining portions of the tributary to Crawford Creek will not be assessed in the ERA because remediation activities are planned for the area.

Sediment, soil, fish, and adult flying insect, and surface water analytical data considered in the ERA are summarized in Tables 2-1 through 2-5. Samples assumed to be representative of each of the Exposure Areas are presented in Tables 2-11, 2-12, and 2-13. A summary of the off-property data considered in this ERA, separated by exposure area, is also attached to this document as Appendix A.

## 2.2 Initial Screening

An initial screening can be conducted to determine the need to conduct a baseline ERA (BERA). If the concentration of a constituent exceeds its respective ecological screening value (ESV), or no ESV is available, then further evaluation of that constituent is warranted. If the maximum concentration is below the ESV then further ecological evaluation is not necessary. If concentrations exceed ESVs, a BERA is warranted. Frequency of detection and a comparison to background concentrations was not considered when identifying COPECs.

As agreed upon by WDNR and Beazer (WDNR 2006 and AMEC 2007), constituents detected in off-property media warrant further ecological evaluation and therefore, a BERA was conducted. The BERA is presented in the following sections.

## 2.3 Baseline Ecological Risk Assessment

### 2.3.1 Problem Formulation

Problem Formulation includes identifying COPECs, identifying assessment and measurement endpoints, selecting ecological receptors, and developing a CSM that illustrates potential exposure pathways for ecological receptors. Each of these is discussed below.

#### 2.3.1.1 Selection of Constituents of Potential Ecological Concern

COPECs were identified for each exposure area and medium considered in the BERA. The Off-Property Investigation Data Summary Report summarized 2005 sampling efforts at the Site. These data were used to determine COPECs in sediment, floodplain soil, flying insects, and forage fish. Because surface water samples were not collected in 2005, surface water data collected in June 1996 and August 1999 were used to evaluate exposure to this medium.

As proposed in the September 2007 technical memoranda (BBL 2007), constituents detected in each medium will be included for evaluation as COPECs for that medium. In floodplain soils, sediment, and forage fish, the COPECs will include PAHs, pentachlorophenol, and dioxins and furans. In surface water, the COPECs will include PAHs and pentachlorophenol. In flying insects, COPECs will include PAHs and dioxins and furans. A revised screening approach may have eliminated some of the COPECs (i.e., pentachlorophenol in sediments), but to remain consistent with the September 2007 technical memoranda (BBL 2007), such a screening was not conducted in this BERA.

#### 2.3.1.2 Assessment and Measurement Endpoints

Assessment endpoints are defined by USEPA (1997c) as "explicit expression[s] of an environmental value that is to be protected." Similarly, measurement endpoints are defined as "measurable ecological characteristic[s] that [are] related to the environmental value chosen as the assessment endpoint" (USEPA 1997c).

Aquatic and terrestrial receptors may potentially be exposed to COPECs in Crawford Creek, the tributary to Crawford Creek and the surrounding floodplain. Therefore, assessment and measurement endpoints are focused on evaluating aquatic organisms potentially exposed to COPECs in sediments and surface water, and upper trophic level wildlife potentially exposed to COPECs through ingestion of aquatic and terrestrial prey organisms (e.g., invertebrates, plants, and small mammals) in Crawford Creek, the tributary to Crawford Creek, and the surrounding floodplain.

EPA (1997c) further defines a measurement endpoint as "a measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint and is a measure of biological effects (e.g., death, reproduction, growth) of particular species, and can include measures of exposure as well as measures of effects". For this evaluation, measurement endpoints include comparison of measured COPEC concentrations to benchmarks assumed to be protective of ecological receptors, comparison of estimated daily COPEC intakes of upper trophic level receptors to allowable daily intakes, or comparison of populations of biota between potentially affected and reference areas. Measurement endpoints were selected on the basis of the potential presence of receptors in various feeding guilds in the off-property area, the existence of potentially complete exposure pathways, and the sensitivity of representative receptors ("indicator species") to COPECs. The assessment and measurement endpoints selected for the off-property assessment are summarized below and are consistent with the approach agreed upon with the WDNR through the technical memos and associated response letters (BBL 2006; BBL 2007; WDNR 2008a; WDNR 2008b; WDNR 2008c).

- Assessment Endpoint 1 – Potential effects on benthic macroinvertebrate populations evaluated as a prey base for upper trophic level species resulting from potential exposure to COPECs in sediment.

    - Measurement Endpoint 1 – Comparison of sediment concentrations to available sediment ecological screening benchmarks, such as WDNR's Criteria-Based Sediment Quality Goals (CBSQGs) and USEPA's Equilibrium Partitioning Sediment Benchmarks (ESBs) expressed as sum of Toxic Units (Sum TU).
    - Measurement Endpoint 2 – Evaluation of Site-specific benthic macroinvertebrate community data.

- Assessment Endpoint 2 – Potential effects on fish populations evaluated as a prey base for upper trophic level species resulting from exposure to COPECs in surface water and sediment.

    - Measurement Endpoint 1 – Comparison of concentrations of COPECs in surface water to ecological screening benchmarks, such as ambient water quality criteria (AWQC).
    - Measurement Endpoint 2 – Evaluation of Site-specific fish community data.
    - Measurement Endpoint 3 – Comparison of bioaccumulated TCDD-TEQ to fish tissue body burden-based Toxicity Reference Values (TRVs).

- Assessment Endpoint 3 – Potential effects on herbivorous mammalian populations resulting from consumption of floodplain vegetation potentially exposed to COPECs in Crawford Creek floodplain soils and surface water.

    - Measurement Endpoint 1 – Comparison of estimated potential average daily doses (ADDs) of COPECs for a representative mammalian herbivore (e.g., meadow vole) to mammalian TRVs. ADDs were estimated using measured and/or modeled Site-specific COPEC concentrations, and Site- and receptor-specific exposure factors to assess potential risk associated with consumption of floodplain vegetation and incidental soil ingestion. Surface water ingestion was also evaluated.

- Assessment Endpoint 4 – Potential effects on aerial insectivorous mammalian populations resulting from consumption of prey potentially exposed to COPECs in Crawford Creek floodplain soils, sediment and surface water.

    - Measurement Endpoint 1 – Comparison of estimated potential ADDs of COPECs for a representative mammalian insectivore (e.g., little brown bat) to mammalian TRVs. ADDs were estimated using measured and/or modeled Site-specific COPEC concentrations and Site- and receptor-specific exposure factors to assess potential risk associated with consumption of insects and surface water ingestion.

- Assessment Endpoint 5 – Potential effects on aerial insectivorous avian populations resulting from potential consumption of prey potentially exposed to COPECs in Crawford Creek floodplain soils, sediment and surface water.

    - Measurement Endpoint 1 – Comparison of estimated potential ADDs of COPECs for a representative avian insectivore, that feeds aerially (e.g., tree swallow), to avian TRVs. ADDs were estimated using measured and/or modeled Site-specific COPEC concentrations and Site- and receptor-specific exposure factors to assess potential risk associated with consumption of insects and surface water ingestion.

- Assessment Endpoint 6 – Potential effects on omnivorous avian populations resulting from potential consumption of vegetation and prey potentially exposed to COPECs in Crawford Creek floodplain soils, sediment and surface water.

  - Measurement Endpoint 1 – Comparison of estimated potential ADDs of COPECs for a representative avian omnivore, that feeds primarily terrestrially (e.g., American robin) to avian TRVs. ADDs were estimated using measured and/or modeled Site-specific COPEC concentrations, and Site- and receptor-specific exposure factors to assess potential risk associated with consumption of floodplain vegetation and soil invertebrates and incidental ingestion of soil and surface water.

- Assessment Endpoint 7 – Potential effects on piscivorous mammalian populations resulting from consumption of aquatic prey potentially exposed to COPECs in Crawford Creek sediment and surface water.

  - Measurement Endpoint 1 – Comparison of estimated ADDs of COPECs for a representative mammalian piscivore (e.g., mink) to mammalian TRVs. ADDs were estimated using measured and/or modeled Site-specific COPEC concentrations and Site- and receptor-specific exposure factors to assess potential risk associated with consumption of fish and benthic macroinvertebrates and ingestion of surface water and sediments.

- Assessment Endpoint 8 – Potential effects on piscivorous avian populations resulting from consumption of aquatic prey potentially exposed to COPECs in Crawford Creek sediment and surface water.

  - Measurement Endpoint 1 – Comparison of estimated potential ADDs of COPECs for a representative avian piscivore (e.g., belted kingfisher) to avian TRVs. ADDs were estimated using measured or modeled Site-specific COPEC concentrations and Site- and receptor-specific exposure factors to assess potential risk associated with consumption of fish and benthic macroinvertebrates and ingestion of surface water.

#### 2.3.1.3 Ecological Receptors

Potential ecological receptors were selected for evaluation of each assessment endpoint listed above. The same set of ecological receptors is used in each of the three exposure areas. This section describes the selection of the specific species (upper level receptors) used to evaluate Assessment endpoints 3 through 8, which evaluate various types of feeding guilds. Assessment endpoints 1 and 2 evaluate the benthic macroinvertebrate and fish communities as a whole and species specific receptors do not need to be identified for those assessment endpoints.

Feeding guilds present on the Site include insectivores, herbivores, omnivores and carnivores. Based on observations made during visits to the Site and literature evaluations, the following feeding guilds were evaluated in the ERA:

- Avian Insectivore;
- Avian Carnivore;
- Mammalian Herbivore;
- Mammalian Omnivore; and
- Mammalian Carnivore.

Specific ecological receptors were selected to represent these feeding guilds. While these receptors may not actually be present at the Site and evaluated areas, they may be used to represent species that occupy similar feeding guilds and are a component of food webs that may potentially exist on the Site. Representative ecological receptors were selected based on the following criteria identified in USEPA guidance (USEPA 1997c):

- potential occurrence in the ecological exposure areas;
- potential for exposure to COPECs in the ecological exposure areas;
- reported sensitivities to the potential adverse effects of COPECs, generally because of greater relative exposure than experienced by other receptors rather than greater sensitivity to the effects caused by COPECs included in the ERA;

- representativeness to other similar or phylogenetically related species (in terms of potential for exposure and potential sensitivity to COPECs); and,
- importance as recreational, economic, or protected species.

The species to be evaluated in the ERA, and the feeding guilds they represent, are:

- the meadow vole (*Microtus pennsylvanicus*) represents mammalian herbivores that may be exposed to COPECs in floodplain soils via consumption of floodplain vegetation (grasses, shoots and bark) that may have accumulated COPECs and incidental ingestion of soils and. The meadow vole is known to inhabit grassy fields and marshes (USEPA 1993b);
- the little brown bat (*Myotis lucifugus*) represents mammalian insectivores that feed solely upon insects (USEPA 1993b) that may have accumulated COPECs from sediments and floodplain soils;
- the tree swallow (*Tachycineta bicolor*) represents aerial avian insectivores that catch their prey (flying insects that may have accumulated COPECs from sediments and floodplain soils) while flying over land or water and, consequently, are not expected to incidentally ingest soil (Stokes 1996);
- the American robin (*Turdus migratorius*) represents terrestrial avian omnivores that may be exposed to COPECs in floodplain soils via consumption of soil invertebrates and floodplain vegetation (e.g., dogwood and currant fruits) (USEPA 1993b) that may have accumulated COPECs and incidental soil ingestion;
- the mink (*Mustela vison*) represent mammalian piscivores (fish compose the primary fraction of their diet) and are opportunistic feeders (generally nocturnal) feeding on whatever may be the most abundant prey in an area (USEPA 1993b) and may incidentally ingest sediments and surface water; and
- the belted kingfisher (*Cerlye alcyon*) represents avian piscivores that typically inhabit shores of streams, rivers and ponds, feeding primarily on fish (USEPA 1993b) and are not assumed to incidentally ingest sediments.

As noted in the WDNR October 30, 2006 comment letter (WDNR 2006), amphibians were not considered as receptors in the ERA. Although amphibians (e.g., frogs) may inhabit portions of the floodplain system, the unstable, flooding nature of the Crawford Creek area does not likely provide substantial habitat for frogs that generally need ponded water for egg-rearing. Moreover, as AMEC discussed in the December 1, 2006 phone call with Mr. Janisch of the WDNR, no amphibians (adult or juvenile) were observed during the spring/summer 2005 biological sampling of Crawford Creek. Amphibians were also not observed in the upstream reference locations. For this reason, and because published toxicity data or effects-based screening benchmarks for COPECs for amphibians are limited, potential risks to amphibians were not quantified in this ERA.

Reptiles have not been selected as receptors to be quantitatively evaluated in this BERA because only limited toxicity information is available to assess potential risks from food web exposures. It is important to note that reptiles have been observed in the floodplain. During the ecological survey performed in 1999 (BBL 2000), a wood turtle (*Clemmys insculpta*) was observed in the Crawford Creek floodplain. Wisconsin lists the wood turtle as a threatened species that is "rare or uncommon". The wood turtle is not federally protected. However, in AMEC's experience, potential risks estimated for reptiles are lower than potential risks estimated for avian species. This is based on the following:

- reptiles (in this case, the wood turtle) have much lower metabolic rates (and, consequently, lower intake rates) than birds; and
- the TRVs used for reptiles are often the same as used for birds because reptile-specific TRVs are usually not available and avian TRVs are used in their stead (due to the phylogenetic similarity of birds and reptiles).

As a result of their higher intake rate per unit body weight, birds, which were evaluated in this BERA, are generally a more sensitive receptor than reptiles.

In addition to the above receptors, soil invertebrates (e.g., earthworms, beetles, etc.) are conservatively evaluated in this BERA as a food source to upper trophic-level organisms.

#### 2.3.1.4 Conceptual Site Model

A CSM illustrating direct and indirect ecological exposure pathways is provided in Figure 3. This CSM was included in the March 2006 technical memoranda (BBL 2006) and has been modified based on WDNR comments and discussions (WDNR 2006).

As noted in Figure 3, upon entering the tributary to Crawford Creek and Crawford Creek itself from the various secondary sources, COPECs may have migrated or been transported in various forms. These forms may include COPECs in a dissolved phase, sorbed to sediment or soil particles, or as constituents in a nonaqueous phase liquid (NAPL). NAPLs might have been comprised of one of the materials used to treat wood (i.e., creosote), as the carrier oil, or a mixture of the two. The NAPL may have been weathered or unweathered and may have been present as a light NAPL (LNAPL) potentially in a surface water as a sheen on the water's surface or as a dense NAPL (DNAPL) potentially present in a surface water in an immiscible form in the water column or at the sediment-surface water interface. The exact form(s) of COPECs that may have been released from historical operations is not known, but likely included each of these forms.

Floodplain soil- and sediment-dwelling invertebrates, floodplain plants, forage fish, surface water- and sediment-dwelling adult flying forms of insects (including midge larvae), and small mammals were included in the food web model as prey species. The CSM depicts the potential relationship between the concentration of COPECs in sediments, soils and surface water and COPEC concentrations in prey species and potentially consumed by upper trophic level ecological receptors included in the BERA (i.e., insectivorous birds represented by the tree swallow), omnivorous birds represented by the American robin, herbivorous mammals represented by the meadow vole, insectivorous mammals represented by the little brown bat, piscivorous mammals represented by the mink, and piscivorous birds represented by the belted kingfisher. Concentrations of COPECs in invertebrates and fish are based upon COPEC concentrations in biota collected from the off-property portions of the Site. Concentrations in plants and insects living in soils (i.e., earthworms) were estimated by combining off-property specific data on COPEC concentrations in soils with literature-derived biotransfer factors (BTFs).

The BERA assumes that the COPEC concentrations measured in flying insects collected from the floodplain are representative of the COPEC concentration in the diet of aerial feeding insectivores (i.e., the bat and tree swallow). During the December 1, 2006 phone call between AMEC and Mr. Janisch, Mr. Janisch raised a concern about whether the insects collected from the floodplain can be assumed to be representative of COPEC concentrations in terrestrial insects (including different life-stages) in floodplain soils. The BERA uses soil-to-earthworm BTFs, not the aerial insect body burden data, to estimate COPEC concentrations in earthworms. The COPEC concentrations detected in flying insects are representative of the overall population of flying insects in the floodplain. These could have emerged from either sediments or floodplain soils. Given that COPEC concentrations are generally lower in floodplain soils than sediments, COPEC concentrations in insects emerging from floodplain soils may well be lower than concentrations in insects emerging from sediments. Regardless, the aerial insects collected from along the floodplain are representative of the insects available to flying insectivores and, thus, are expected to represent the potential COPEC exposures encountered by such receptors. It is not necessary for the BERA to try and estimate what the COPEC concentration might be in just the fraction of insects emerging from sediments, the source of insects with assumed higher COPEC concentrations, because the aerial insectivores are not expected to preferentially feed on flying insects that have emerged from the creek. Aerial insectivores are assumed to be opportunistic feeders and capture and eat whatever is most abundant and readily available. These are the same types of insects that would have been collected in the floodplain insect samples.

### 2.3.2 Analysis

The analysis phase of BERA includes the exposure assessment and ecological effects assessment. These tasks are described below.

#### 2.3.2.1 Exposure Assessment

This section details the dose equations and exposure parameters used to estimate potential exposures of each receptor to COPECs identified in each exposure area. The exposure parameters have been presented and agreed to previously by Beazer in technical memoranda and associated response letters (BBL 2006; BBL 2007; WDNR 2008a; WDNR 2008b; WDNR

2008c). The derivation of exposure point concentrations used in the dose equations is also described, followed by the approach for the sediment benthic macroinvertebrate assessment and an evaluation of the fish community.

Dose Equations

Dose equations and the exposure parameters used in each equation are presented below for each receptor.

**American Robin**

The equation used to estimate the potential dose for the robin is:

$$Dose = \frac{[(IRworm \times Cworm + IRsoil \times Csoil + IRsw \times Csw + IRplant \times Cplant)]}{BW \times SUF \times AUF}$$

Where:

$$Cworm = Csoil \times BTFworm;$$
$$Cplant = Csoil \times BTFplant;$$

and

| | | |
|---|---|---|
| Dose | = | estimated dose from ingestion (mg COPEC/kg body weight/day); |
| IRworm | = | ingestion rate of earthworms (kg/day) wet weight (ww); |
| IRsoil | = | ingestion rate of soil (kg/day) dry weight (dw); |
| IRsw | = | ingestion rate of surface water (L/day); |
| IRplant | = | ingestion rate of plants (kg/day) ww; |
| Csoil | = | COPEC concentration in soil (mg/kg) dw; |
| Csw | = | COPEC concentration in surface water (mg/L); |
| SUF | = | seasonal use factor (dimensionless); |
| AUF | = | area use factor (dimensionless); |
| BW | = | body weight (kg); |
| BTFworm | = | soil-to-earthworm biotransfer factor (BTF) (mg COPEC/kg ww earthworm) / mg COPEC/kg dw soil); and, |
| BTFplant | = | soil-to-plant biotransfer factor (BTF) (mg COPEC/kg ww plant) / mg COPEC/kg dw soil). |

Table 3-2 presents the exposure parameters for the robin used in the above equation, and their sources. Soil-to-earthworm BTFs and soil-to-plant BTFs for all COPECs are listed in Table 3-3. For dry weight/wet weight conversions in this dose equation, vegetation was assumed to be 80 percent water (USEPA 1993b) and soils were assumed to be 60 percent solids. A seasonal use factor of 0.5 was used in this dose equation to account for the presence of the American robin 6 months out of the year.

**Little Brown Bat**

The equation used to estimate the potential dose for the little brown bat is:

$$Dose = \frac{[(IRins \times Cins + IRsw \times Csw)]}{BW \times SUF \times AUF}$$

Where:

| | | |
|---|---|---|
| Dose | = | estimated dose from ingestion (mg COPEC/kg body weight/day); |
| IRins | = | ingestion rate of insects (kg/day) ww; |
| IRsw | = | ingestion rate of surface water (L/day); |
| Cins | = | COPEC concentration in insects (mg/kg); |
| Csw | = | COPEC concentration in surface water (mg/L); |
| SUF | = | seasonal use factor (dimensionless); |
| AUF | = | area use factor (dimensionless); and, |
| BW | = | body weight (kg). |

Table 3-2 presents the exposure parameters for the little brown bat used in the above equation, and their sources. No dry weight/wet weight conversions were necessary for this dose equation. A seasonal use factor of 0.5 was used in this dose equation to account for the presence of the little brown bat 6 months out of the year.

**Meadow Vole**

The equation used to estimate the potential dose for the meadow vole is:

$$Dose = \frac{[(IRworm \times Cworm + IRsoil \times Csoil + IRsw \times Csw + IRplant \times Cplant)]}{BW \times SUF \times AUF}$$

Where:

$$Cworm = Csoil \times BTFworm;$$

$$Cplant = Csoil \times BTFplant;$$

and

| | | |
|---|---|---|
| Dose | = | estimated dose from ingestion (mg COPEC/kg body weight/day); |
| IRworm | = | ingestion rate of earthworms (kg/day) ww; |
| IRsoil | = | ingestion rate of soil (kg/day) dw; |
| IRsw | = | ingestion rate of surface water (L/day); |
| IRveg | = | ingestion rate of plants (kg/day) ww; |
| Csoil | = | COPEC concentration in soil (mg/kg) dw; |
| Csw | = | COPEC concentration in surface water (mg/L); |
| SUF | = | seasonal use factor (dimensionless); |
| AUF | = | area use factor (dimensionless); |
| BW | = | body weight (kg); |
| BTFworm | = | soil-to-earthworm biotransfer factor (BTF)<br>(mg COPEC/kg ww earthworm) / mg COPEC/kg dw soil); |
| BTFplant | = | soil-to-plant biotransfer factor (BTF); and,<br>(mg COPEC/kg ww plant) / mg COPEC/kg dw soil). |

Table 3-2 presents the exposure parameters for the meadow vole used in the above equation, and their sources. Soil-to-earthworm BTFs and soil-to-plant BTFs for all COPECs are listed in Table 3-3. For dry weight/wet weight conversions in this dose equation, vegetation was assumed to be 80 percent water (USEPA 1993b) and soils were assumed to be 60 percent solids. A seasonal use factor of 1 was used in this dose equation.

**Tree Swallow**

The equation used to estimate the potential dose for the tree swallow is:

$$\text{Dose} = \frac{[(\text{IRins} \times \text{Cins} + \text{IRsw} \times \text{Csw})]}{\text{BW} \times \text{SUF} \times \text{AUF}}$$

Where:

| | | |
|---|---|---|
| Dose | = | estimated dose from ingestion (mg COPEC/kg body weight/day); |
| IRins | = | ingestion rate of insects (kg/day) ww; |
| IRsw | = | ingestion rate of surface water (mg/L); |
| Cins | = | COPEC concentration in insects (mg/L); |
| Csw | = | COPEC concentration in surface water (mg/L); |
| SUF | = | seasonal use factor (dimensionless); |
| AUF | = | area use factor (dimensionless); and, |
| BW | = | body weight (kg). |

Table 3-2 presents the exposure parameters for the swallow used in the above equation, and their sources. No dry weight/wet weight conversions were necessary for this dose equation. A seasonal use factor of 0.5 was used in this dose equation to account for the presence of the tree swallow 6 months out of the year.

**Mink**

The equation used to estimate the potential dose for the mink is:

$$Dose = \frac{[(IRinv \times Cinv + IRfish \times Cfish + IRsw \times Csw)]}{BW \times SUF \times AUF}$$

Where:

| | | |
|---|---|---|
| Dose | = | estimated dose from ingestion (mg COPEC/kg body weight/day); |
| IRinv | = | ingestion rate of invertebrates (kg/day) ww; |
| IRfish | = | ingestion rate of soil (kg/day) dw; |
| IRsw | = | ingestion rate of surface water (L/day); |
| Cinv | = | COPEC concentration in invertebrates (mg/kg) dw; |
| Cfish | = | COPEC concentration in fish (mg/kg) dw; |
| Csw | = | COPEC concentration in surface water (mg/L); |
| SUF | = | seasonal use factor (dimensionless); |
| AUF | = | area use factor (dimensionless); and, |
| BW | = | body weight (kg). |

Table 3-2 presents the exposure parameters for the mink used in the above equation, and their sources. A seasonal use factor of 1 was used in this dose equation.

**Kingfisher**

The equation used to estimate the potential dose for the kingfisher is:

$$Dose = \frac{[(IRinv \times Cinv + IRfish \times Cfish + IRsw \times Csw)]}{BW \times SUF \times AUF}$$

Where:

| | | |
|---|---|---|
| Dose | = | estimated dose from ingestion (mg COPEC/kg body weight/day); |
| IRinv | = | ingestion rate of invertebrates (kg/day) ww; |
| IRfish | = | ingestion rate of soil (kg/day) dw; |
| IRsw | = | ingestion rate of surface water (L/day); |
| Cinv | = | COPEC concentration in soil (mg/kg) dw; |
| Cfish | = | COPEC concentration in fish (mg/kg) dw; |
| Csw | = | COPEC concentration in surface water (mg/L); |

| | | |
|---|---|---|
| SUF | = | seasonal use factor (dimensionless); |
| AUF | = | area use factor (dimensionless); and, |
| BW | = | body weight (kg). |

Table 3-2 presents the exposure parameters for the mink used in the above equation, and their sources. A seasonal use factor of 0.5 was used in this dose equation to account for the presence of the kingfisher 6 months out of the year.

Exposure Point Concentrations

Because the railroad embankment divides the floodplain into two habitats, each representing different magnitudes of potential Site-related impact, the floodplain and Crawford Creek data were divided into data collected from upstream of the railroad embankment (Areas 1 and 2) and data collected from downstream of the railroad embankment (Area 3). Also, since the portion of the tributary to Crawford Creek and the surrounding floodplains that is directly upgradient and within the confluence with Crawford Creek (Area 1) represents a distinct area where COPEC concentrations may be substantially greater, the area upstream of the railroad embankment was further subdivided for the purposes of developing EPCs for the BERA. Samples collected considered representative of each of the three exposure areas (Area 1, Area 2, and Area 3) are summarized in Tables 2-11, 2-12, and 2-13. A summary of the off-property data considered in the HHERA, separated by exposure area, is also attached as Appendix A.

To account for the absence of sediment data in Area 1, sediment data available for Area 2 were used to estimate potential sediment exposures in Area 1. Similarly, to account for the absence of floodplain soil and insect data in Area 3, downgradient of the railroad embankment, floodplain soil and insect data available for Area 2 was conservatively used to estimate potential floodplain soil and insect exposures in Area 3.

EPCs for fish and flying insects are based upon results of Site-specific tissue analysis. Site-specific fish concentrations were used as a surrogate EPC for aquatic macroinvertebrates (i.e., for crayfish that may be consumed by an avian or mammalian receptor). Concentrations of COPECs in soil invertebrates (e.g., earthworms) or plants living in or growing on floodplain soils were estimated by combining floodplain soil EPCs with BTFs. BTFs are presented in Table 3-3. The BTFs shown in Table 3-3 have been published and accepted by USEPA and are commonly used. They are also generally recognized as conservative, i.e., more likely than not to overestimate rather than underestimate potential COPEC concentrations in biota.

As previously stated, TEFs were used to calculate TCDD TEQ concentrations for mammalian (van den Berg et al. 2006) and avian (van den Berg et al. 1998) receptors for each sample in which dioxins and furans were detected.

Methods used to calculate EPCs in each exposure area (Area 1, Area 2, and Area 3) for each exposure route for each receptor are outlined in Table 3-4.

Values equal to one-half the limit of detection (as reported by the laboratory) were used as a surrogate concentration for those COPECs that were not detected in a particular sample when determining arithmetic averages and maximum EPCs. Because of elevated detection limits (5 µg/L), surface water samples W1, W2, and W3, collected in August 1999, were not considered when calculating the EPCs for PAHs in Area 1. For each exposure area, the EPCs representing each COPEC in are presented in Tables 3-5, 3-6, and 3-7.

EPCs for the Benthic Macroinvertebrate Assessment

Because benthic macroinvertebrates have limited mobility, they are likely exposed to the COPEC concentrations equal to those in sediments in their immediate vicinity. Therefore, potential adverse effects to the benthic macroinvertebrate community in Crawford Creek were evaluated for each individual sediment sampling location, when data allowed.

#### 2.3.2.2 Ecological Effects Assessment

Two general types of effects that may potentially be caused by a COPEC are evaluated in this BERA: direct effects and indirect effects. Direct effects are effects that may be manifested by an ecological receptor after the ecological receptor "directly" ingests or contacts an environmental medium (e.g., soil, surface water, sediment, air) containing a COPEC. All COPECs have the potential to cause direct effects at sufficiently high exposures. However, direct effects are not necessarily the most sensitive effect associated with a COPEC. Some COPECs have the potential to bioaccumulate. That is, the COPEC may be taken up by an organism (either because the organism eats, drinks or inhales an environmental medium with the COPEC or absorbs the COPEC through its skin) but not at a level that causes direct toxicity. If the organism is then eaten by a higher trophic level ecological receptor, the COPEC concentration in the prey item may be sufficiently high to cause an adverse effect in the higher trophic level receptor. This type of effect is referred to as an "indirect" effect because the COPEC had to pass through the food chain for the higher trophic level receptor to be exposed rather than the upper trophic level receptor being exposed directly to an environmental medium with the COPEC. For some COPECs, indirect effects may be a more sensitive endpoint than direct effects.

COPECs that bioaccumulate tend to have some key characteristics that distinguish them from COPECs that do not bioaccumulate. For example, they tend to partition preferentially to fat or lipid rather than water (i.e., they have an octanol water partition coefficient ($K_{ow}$) greater than 1,000). They also tend to degrade slowly once released into the environment. Several, but not all, of the semi-volatile organic compounds (SVOCs), which include chlorinated pesticides, can bioaccumulate. The chlorinated phenolics tend not to bioaccumulate. Similarly, several of the multiple ringed PAH tend not to bioaccumulate in higher trophic levels, despite their relatively high $K_{ow}$ and persistence in the environment, because they are metabolized by vertebrates once ingested. In addition, pentachlorophenol and dioxins and furans can bioaccumulate.

This BERA evaluates both direct and indirect effects in all exposure areas. Measurement endpoints include a screening evaluation of the potential direct toxicity of COPECs to sediment-dwelling invertebrates and fish as well as an evaluation of the potential for direct and indirect toxicity to higher trophic level receptors (both mammals and birds) that may incidentally ingest sediment or consume invertebrates, living in the Crawford Creek, that may have accumulated COPECs.

The effects evaluation entails reviewing the ecotoxicology of the COPEC and then selecting toxicity reference values (TRVs) for each COPEC and receptor evaluated in the ecological risk assessment. In addition, this section includes a discussion of the evaluation of sediment benthic macroinvertebrates and an evaluation of fish community.

Toxicity Reference Values

TRVs for avian receptors were taken from Nosek et al. (1992), Hill and Camardese (1986), and Schafer et al. (1983). TRVs for the mammalian receptors were taken from Sample et al. (1996), USEPA's Integrated Risk Information System (IRIS) (2008), and EFA West (1998). TRVs for each COPEC and receptor are summarized in Tables 3-8 through 3-11 and were previously presented to the WDNR in the September 2007 technical memoranda (BBL 2007).

For the purpose of selecting applicable TRVs from the above-cited sources, the effects considered ecologically relevant are growth, reproduction and mortality. The highest no-observable-adverse-effect-level (NOAEL) that is lower than the lowest LOAEL was used when available. For chemicals without chronic dose-response-based NOAELs, but for which other toxicity values were available, uncertainty factors were applied to extrapolate these other toxicity values to chronic NOAELs. These other toxicity values include less than chronic NOAELs (e.g., subchronic NOAELs), LOAELs, and $LD_{50}$ values (lethal dose for 50% of study population). Specifically, an uncertainty factor (UF) of 10 was used to adjust a LOAEL TRV to NOAEL TRV, and a UF of 10 was used to adjust TRVs derived from subchronic studies to chronic TRVs. An uncertainty factor of 100 was used to adjust $LD_{50}$ values to chronic NOAEL equivalent values.

If no toxicity values were available for a particular compound, surrogate chemicals were selected based on structural chemistry. For avian TRVs, acenaphthene was used as a surrogate for acenaphthylene; and anthracene was used as a surrogate for naphthalene and pyrene. The avian TRV for fluorene was used as a surrogate for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene and indeno(1,2,3-c,d)pyrene.

For mammalian TRVs, pyrene was used as a surrogate for phenanthrene and acenaphthalene was used as a surrogate for acenaphthylene. The mammalian TRV for benzo(a)pyrene was used for acenaphthylene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-c,d)pyrene.

A conversion based on body size (i.e., weight) was used to extrapolate between species for all mammalian TRVs. The body weight-adjusted TRVs were calculated using the allometric equation described in Sample et al. (1996):

$$TRV_{adj} = TRV_t\,(BW_t/BW_r)^{0.25}$$

Where:

| | | |
|---|---|---|
| $TRV_{adj}$ | = | Adjusted NOAEL-equivalent TRV (mg/kg body weight-day); |
| $TRV_t$ | = | NOAEL-equivalent TRV for test organism (mg/kg body weight-day); |
| $BW_t$ | = | Body weight for test organism (kg); and, |
| $BW_r$ | = | Body weight for receptor species (kg). |

The body weight for each receptor used in the above equation was obtained from USEPA (1993b), with the exception of the little brown bat (0.009 kg) which was obtained from Nagy, 2001 and the Tree swallow (0.02 kg) which was obtained from Robertson et al., 1992.

Sediment Evaluation

As indicated above, five lines of evidence were developed to evaluate potential effects to benthic macroinvertebrates:

1.) Sediment concentrations, dry weight normalized based on 1% organic carbon (OC), were compared to available WDNR CBSQGs, identified in WDNR *Consensus-Based Sediment Quality Guidelines Recommendations for Use & Application* (WDNR 2003).
2.) OC-adjusted concentrations of total PAH were compared to OC-adjusted sediment quality benchmarks for total PAH (Swartz 1999).
3.) The Sum TUs were estimated using the methods outlined in Swartz et al., (1995) and compared to USEPA benchmarks.
4.) OC-normalized total PAH concentrations were compared to a range of PAH concentrations that, in Beazer's experience based upon sediment investigations at several other wood treating sites, is not expected to adversely affect benthic macroinvertebtrates.
5.) The results of the previously conducted Site-specific macroinvertebrate community analysis (BBL 2000) were reviewed and summarized.

Fish Community Analysis

To further evaluate potential effects on fish populations as a prey base for upper trophic level species, two lines of evidence were investigated:

1.) Measured TCDD-TEQ body burdens were compared to a range of allowable TCDD-TEQ body burdens.
2.) Previously collected data on the Site-specific fish community (BBL 2000) were reviewed and summarized.

### 2.3.3 Risk Characterization

In the risk characterization, the risks associated with estimated exposures are characterized for each assessment endpoint, and sources of potential uncertainty are addressed. Potential risks were estimated using the toxicity quotient (TQ) method and are presented below. This section also includes an evaluation of potential risk to the benthic macroinvertebrate community and the fish community using a weight of evidence approach.

#### 2.3.3.1 Toxicity Quotient Analysis

Toxicity quotients (TQs) describe the ratio of the predicted exposure (i.e., intake or dose) to an acceptable exposure (i.e., TRV) and are used to evaluate the potential for ecological risk. For each receptor, TQs were calculated for each COPEC in each exposure area and medium using the following equation:

$$TQ = \frac{Dose}{TRV}$$

Where:

TQ = hazard quotient (dimensionless);
Dose = measured or estimate dose (mg/kg-day); and,
TRV = toxicity reference value (mg/kg-day).

When the TQ is less than 1.0, the estimated potential exposure is less than the TRV, indicating that a potential risk likely does not exist. When the TQ is greater than 1.0, the estimated potential exposure exceeds the TRV and a potential risk may exist.

Estimated TQs, based on TRVs derived from LOAELs and NOAELs, are presented in Tables 3-15 and 3-16, respectively. The supporting calculations are provided in Appendix I. TQs are discussed by exposure area in the following sections.

Area 1

When LOAEL-based TRVs are used, the estimated potential TQs are less than one for all receptors. When using the NOAEL-based TRVs, the estimated potential TQs in Exposure Area 1 are less than 1.0 for the bat and slightly greater than 1.0 for the kingfisher (4.6 associated with potential exposure to PAHs in fish), mink (1.1 associated with potential exposure to PAHs in invertebrates and fish), American robin (1.5 associated with potential exposure to TCDD-TEQ in earthworms), swallow (1.7 associated with potential exposure to PAHs in insects), and vole (1.2 associated with potential exposure to TCDD-TEQ in soils). With the exception of the vole, potential risks are driven by potential food chain exposures. For the kingfisher, mink and swallow, COPECs in sediments of the tributary to Crawford Creek are the dominant source of food chain exposures, while for the vole and American robin, dioxin exposures associated with TCDD-TEQ in soils are the principal risk drivers. The potential TQs estimated for Area 1 are summarized in Tables 3-15 and 3-16.

Given the limited size of Area 1 and the relatively low TQs, potential ecological risks in this area to upper trophic level receptors are not likely, and if they exist, are likely limited to individual receptors that may forage in this area most of the time. Given the limited potential risk to individual receptors, population-level effects are not expected to upper trophic level receptors feeding in Area 1.

Area 2

When using the LOAEL-based TRVs, the estimated potential TQs are less than 1.0 for all receptors. When using the NOAEL-based TRVs, the estimated potential TQs in Area 2 are less than or equal to 1.0 for the bat, American robin, swallow and vole and are slightly greater than

1.0 for the kingfisher (4.6 associated with potential exposure to PAHs in fish) and mink (1.1 associated with potential exposure to PAHs in invertebrates and fish). The potential TQs estimated for Area 2 are summarized in Tables 3-15 and 3-16.

Potential ecological risks in Area 2 are driven by exposures to PAH concentrations within the Creek, including PAHs in fish, estimated PAH concentrations for benthic invertebrates, and insects. Given that COPEC concentrations are substantially higher in sediments than in floodplain soils, the source of PAHs in flying insects is assumed to be dominated by PAHs in sediments. As with Area 1, given the relatively slight exceedances of NOAEL-based TRVs, the incorporation of uncertainty factors in the derivation of those TRVs, and that all LOAEL-based TRVs are less than 1.0, potential risks to individual upper trophic level receptors are not expected to occur in this area, nor are population-level risks expected for upper trophic level receptors.

<u>Area 3</u>

When using the NOAEL-based or LOAEL-based TRVs, the estimated potential TQs in Area 3 are less than 1.0 for all receptors (Tables 3-15 and 3-16). Given the absence of either NOAEL- or LOAEL-based TQs of greater than 1.0, no potential risks to individual upper trophic level receptors or populations of upper trophic level receptors are expected in Area 3.

#### 2.3.3.2 Sediment Evaluation

This section presents the characterization of potential risk to benthic invertebrates in Crawford Creek. As described above, the benthic invertebrate risk characterization is structured as a weight of evidence approach with five lines of evidence.

The first line of evidence is a comparison of OC-normalized sediment concentrations to OC-normalized WDNR CBSQGs (WDNR 2003). As presented in WDNR *Consensus-Based Sediment Quality Guidelines Recommendations for Use & Application* (WDNR 2003), the CBSQGs have a lower (threshold effect concentration - TEC) middle (median effect concentration - MEC) and upper (probable effect concentration - PEC) effect level at which toxicity to benthic-dwelling organisms are predicted to be unlikely, possible and probable, respectively. The comparison of sediment concentrations, dry weight normalized based on 1% OC per WDNR methodology, to available WDNR CBSQGs is presented in Table 3-12. As shown in Table 3-12, one or more individual PAHs exceeds the PECs for one or more of the WDNR CBSQG screening benchmarks in each sediment sample collected from Crawford Creek. This suggests that COPECs in Crawford Creek sediments have the potential to pose a risk the benthic macroinvertebrate community, at least when compared to screening benchmarks developed from observations about toxicity of COPECs derived from a variety of sources.

The second line of evidence is a comparison of OC-adjusted total PAH concentrations to the following benchmarks: the threshold effects concentration (TEC), median effects concentration (MEC) and extreme effects concentration (EEC) developed by Swartz (1999). The TEC, MEC and EEC for total PAH are 290, 1,800 and 10,000 µg total PAH/g organic carbon, respectively. The comparison of organic carbon adjusted total PAH concentrations to these benchmarks is presented in Table 3-13. Total PAH concentrations in all samples exceed the TEC and MEC. Total PAH concentrations are less than the EEC in SED-R1 collected in July 2005, SED-R3, SED-R4 and SED-R5 collected in July 2005. These results suggest PAHs in Crawford Creek sediments have the potential to pose a risk to the benthic macroinvertebrate community, at least when compared to screening benchmarks developed from observations about toxicity of COPECs derived from a variety of sources.

The third line of evidence is the use of the USEPA equilibrium partitioning (EqP) approach to account for the varying biological availability of chemicals in different sediments and allow for the incorporation of the appropriate biological effects concentration. This approach includes a comparison of PAH sediment concentrations in Crawford Creek to USEPA ESBs. PAH concentrations in Crawford Creek sediments were converted to toxic units (TUs) using the methods outlined in Swartz et al., 1995. The Final Chronic Value (FCV) for PAHs was used as the toxicity endpoint for the ESB. The Sum TUs calculated for each sediment sampling location are presented in Table 3-14. Sum TUs are greater than 1.0 for all sampling locations suggesting that the concentration of PAHs in sediments at each sampling location may be high enough to result in a concentration of PAHs in porewater that has the potential to be toxic to sediment-dwelling macroinvertebrates.

The fourth line of evidence is a comparison of OC-normalized total PAH concentrations to a range of PAH concentrations that, in Beazer's experience based upon sediment investigations at several other wood treating sites, are not expected to adversely affect the benthic macroinvertebrate community. Beazer has investigated and summarized the toxicity of wood treating-derived PAH to benthic macroinvertebrates at five other sites. In those investigations, concentrations of PAH were determined, as was the toxicity of sediments to laboratory organisms. At most of the sites, the in situ benthic macroinvertebrate community was also enumerated. PAH concentrations were expressed on a wet weight and OC-normalized basis and an attempt was made to relate any observed effects to PAH concentrations in sediments. However, at most sites, no effect was observed in the laboratory or in the field even though PAH concentrations exceeded typical screening criteria by many fold. In fact, based upon observations from these other sites, total PAH concentrations of less than 100 mg/kg, OC-normalized total PAH concentrations of less than 10,000 mg/kg OC, and less than 100 Sum TU, do not pose an adverse effect to benthic macroinvertebrates. A summary of the information gathered from the other Beazer sites is attached as Appendix G. The summary was presented at the 2006 Annual Society of Environmental Toxicology and Chemistry (SETAC) meeting in Montreal. While total PAH concentrations on a whole sediment basis exceed 100 mg/kg in five Crawford Creek sediment samples (Table 2-1) and also exceed the OC-normalized concentration of 10,000 mg/kg OC at five of nine locations (Table 3-14), most locations have a Sum TU concentration of less than 100 (Table 3-15). Given that Beazer's experience at the other sites suggests that these concentration thresholds are lower limits, the results of this line of evidence could be interpreted as suggesting that when wood treating specific PAH benchmarks are used, PAH concentrations in Crawford Creek sediment may not pose a risk to the benthic macroinvertebrate community. The reason that the wood treating-derived PAH benchmarks are not higher is the lack of toxicity testing results at higher concentration of PAHs in sediments. Had more such sediments been tested, it is possible that higher PAH concentrations would also have been found to be without adverse effect.

The fifth line of evidence relies on the results of the Site-specific benthic invertebrate community analysis conducted as part of 1999 field investigation (BBL 2000). The 1999 investigation included the collected of macroinvertebrate samples from four locations along Crawford Creek (including three locations in Exposure Areas 1, 2, and 3 considered in this BERA) using three sampling methods: dredge sampling, Hester-Dendy artificial substrates, and sweepnet sampling. The results of the sampling were presented in Tables 6-5, 6-6, and 6-7 of the July 2000 Supplemental Surface Water and Streambed Sediment Investigation Report (BBL 2000) and are also provided in this BERA as Appendix H. While the benthic metrics for the dredge samples and sweepnet samples are different among upstream (reference) survey locations and downstream locations, BBL did not consider the differences in the macroinvertebrate community to be significant and to likely be related to differences in habitat (BBL 2000). In its review of these data, WDNR indicated that the downstream communities exhibited either moderate or severe impacts based upon a scoring system that combined the results of 10 metrics (WDNR 2006).

Combined, the five lines of evidence do not permit a firm conclusion about whether COPECs in Crawford Creek are affecting the benthic macroinvertebrate community. Comparisons of Crawford Creek sediment concentrations to commonly used default screening benchmarks, derived from toxicity results that included PAHs from multiple sources, are suggestive of potentially severe effects. However, wood treating PAHs are of pyrogenic origin and such PAHs are suspected of being substantially less toxic that PAHs of petrogenic origin. Comparison of Crawford Creek sediment concentrations to benchmarks derived from toxicity results of wood treating PAHs are more equivocal. At least two of the three comparisons suggest the absence of wood treating-related PAH toxicity at several of the sediment sampling locations. The Site-specific macroinvertebrate community data reveal the presence of a relatively diverse macroinvertebrate community at all locations, though BBL and WDNR differ in their interpretation of the health of that community and the cause of observed differences between locations (i.e., the presence of COPECs vs. habitat differences). The macroinvertebrate lines of evidence preclude a firm conclusion about the presence or absence of an effect of COPECs on the invertebrate community in Crawford Creek.

#### 2.3.3.3 Fish Community Evaluation

Two lines of evidence were developed as part of the evaluation of the fish community in Crawford Creek. The findings of each of these are presented below. In WDNR's October 2006 comment letter (WDNR 2006) the agency requested development of a third line of evidence comparing surface water concentrations to available USEPA National Recommended Water Quality Criteria and the NR 105 Wisconsin Administrative Code acute and chronic toxicity criteria for the protection of aquatic. However, other than a national criterion for pentachlorophenol, no recommended criteria are available for the COPECs evaluated in this BERA. Therefore, this comparison could not be conducted.

The first line of evidence of the fish community evaluation, conducted at the direction of the WDNR (WDNR 2006), compared lipid-normalized TCDD concentrations in Crawford Creek fish to allowable body burden concentrations developed by Steevens et al. (2005). Lipid normalized TCDD-TEQ concentrations in Crawford Creek forage fish ranged from 34.8 to 93.2 pg TCDD-TEQ/g lipid in fish (Table 3-18) with generally lower concentrations occurring downstream of the railroad embankment. When these concentrations are compared to ranges of allowable mean body burden concentrations developed by Steevens et al. (2005) for protection of egg and embryo development, a sensitive reproductive endpoint, more than 97.5% of potentially exposed fish are predicted to not be adversely effected. At two locations downstream of the railroad embankment, more than 99% of potentially exposed fish are expected to have no adverse effect. Even if the lower confidence limit of the allowable body burden concentrations is used (i.e., the most stringent range of allowable body burden concentrations), more than 95% of exposed fish are expected to have no adverse effect from TCDD-TEQ at most sampling locations (Table 3-18) In their comments (WDNR 2006), WDNR notes that Steevens et al. (2005) developed the range of allowable TCDD-TEQ body burdens based upon data from larger game fish species rather than the smaller forage fish found in Crawford Creek. Given the diversity of species used by Steevens et al. and also present in Crawford Creek, it seems likely that a range of species sensitivities are present and that substantial overlap in sensitivity exists. Thus, there is little reason to believe that forage fish populations in Crawford Creek would be substantially more sensitive to the potential effects of TCDD-TEQ than the species used by Steevens et al. to develop their range of allowable body burden concentrations. These results provide a strong line of evidence showing that TCDD-TEQ concentrations in fish in Crawford Creek do not pose a potential ecological risk to the fish.

The second line of evidence of the fish community evaluation consists of an evaluation of the Site-specific fish community data collected as part of the 1999 investigation (BBL 2000). The survey collected and enumerated fish at two reference locations and three locations within Exposure Areas 2 and 3. The survey found the greatest number and species of fish at one of the sampling locations within Exposure Area 2, equal to and greater than the number and species of at the two reference locations (BBL 2000). The number and species of fish at the other two locations within Areas 2 and 3 were lower than found at the reference locations (BBL 2000). BBL (2000) ascribes habitat differences as the most likely cause for the differences in numbers and kinds of fish between the different sampling locations (BBL 2000). WDNR (2006) calculate the Index of Biological Integrity (IBI) for four of the five locations (they did not calculate an IBI for the second reference location) and conclude that the lower IBI scores in Areas 2 and 3 than in the reference location indicate an impact. While the lower IBI scores do indicate an impact, based upon the habitat differences discussed by BBL (2000) it remains unclear whether the changes in number of and species of fish is related to elevated levels of COPECs in Crawford Creek or to habitat changes or both. Thus, this line of evidence is suggestive of an impact compared to one of the reference locations, but the cause remains unclear.

Taken together, the two lines of evidence do not permit a firm conclusion about whether COPECs in Crawford Creek are affecting the fish community. The comparison of TCDD-TEQ body burdens to allowable body burdens suggest no adverse effects are expected from the evaluated COPECs. However, several other COPECs may be present in Crawford Creek for which similar comparisons could not be conducted. The absence of available criteria for several COPECs combined with the changes observed in the fish community in Crawford Creek preclude a firm conclusion about the presence or absence of an effect of COPECs on the fish community.

### 2.3.4 Uncertainty Analysis

Several sources of uncertainty exist in ERAs and can be broadly grouped into three categories: conceptual model uncertainty, natural variation and parameter error, and model error. Each of these is discussed below.

Conceptual Model Uncertainty: The CSM summarized the fate and transport processes that had occurred and are ongoing at the Site and formed the basis for the field investigations, the exposure pathways that were assessed, the receptors of concern, and the assessment and measurement endpoints that were used. The selection of habitats, feeding guilds and representative receptors, complete exposure pathways, COPECs for quantitative evaluation, and assessment and measurement endpoints was based on this comprehensive understanding of Site conditions. Accordingly, little uncertainty is considered to be associated with the CSMs developed for the Site.

Parameter Values: Uncertainty in parameter values include the representativeness of the field sampling and surveys, the exposure assumptions that were used for dose calculations, and the TRVs that were used to estimate the risks.

- *Representativeness of sampling* – Adult flying insects were collected from Crawford Creek during a mid-July time period. Beazer recognizes that the optimum time for the insect collections would have been in the May-June time period as this is a peak hatch period for flying insects (e.g., midges). As a result, the insects collected may not be fully representative of the sensitive, early life nestling stages of most of the avian species. Therefore, foodchain exposures calculated for avian species may be underestimated.

  In the WDNR comment letter dated October 30, 2006, the WDNR notes that PAH sediment sampling locations are not representative of the locations included in the 1999 benthic study. Therefore, according to WDNRs interpretation of the 1999 survey, effects to benthic invertebrates may be underestimated in this BERA.

- *Exposure Point Concentrations* - Exposure point concentrations were calculated using data collected during one season of the year and are therefore are not representative of seasonal fluctuations in COPEC concentrations. However, due to winter conditions along Crawford Creek and limited exposure due to snow cover during the winter months, the use of the summer data is a conservative estimate of year-round exposures.

- *Conservative exposure assumptions* - Many of the exposure assumptions were based on conservative estimates obtained from USEPA guidance. As a result, the calculated risks are biased high.

- *TRVs* - TRVs were identified for compounds evaluated in this BERA from USEPA sources and from an extensive review of the toxicological literature. Identifying appropriate TRVs involves uncertainty for several reasons. In some cases, assumptions must be made in estimating the responses of ecological receptors to low doses of a compound based on information generally gathered from studies that tested the responses of laboratory animals to high doses of the compound.

  In other cases, multiple toxicity studies have been conducted for a constituent, and the lowest concentration at which no effect was observed in any study is commonly selected as the recommended TRV by USEPA sources. However, this practice may introduce considerable uncertainty into the BERA if the conditions in the selected study are not comparable to the conditions evaluated in the BERA. For example, the recommended TRV may have been based on a study using an especially sensitive species that is not present at the Site.

  Given these potential uncertainties associated with TRVs, the values selected for use in the ERA, based geochemical characteristics of media at the Site, are (to the extent possible) as representative of conditions at the Site as possible. As such, little uncertainty is introduced into the ERA by the methods used to select TRVs.

- *Habitat characterization* - A formal habitat characterization was performed as part of previous investigations and observations of plant species and animal species were made during the various sampling efforts performed in this area, which occurred over different seasons. As such, little uncertainty is introduced into the ERA by the habitat characterization.

Model Error: The most common example for model error uncertainty is the method used to derive indirect (food-chain) uptake. Although these were based on established fate and transport processes and food web models, they are generic and may not be representative of the processes that may be occurring at the Site.

## 3.0 SUMMARY AND CONCLUSIONS

### Potential Human Health Risks

The HHRA presented in Section 2 indicates that potential noncarcinogenic effects are not expected for any of the likely current or future receptors included in this evaluation. Similarly, the HHRA also indicates that potential excess lifetime cancer risks fall within USEPA's allowable risk range of $1x10^{-6}$ to $1x10^{-4}$ and WDNRs allowable risk threshold of $1x10^{-5}$ for all potential receptors included in this evaluation. Thus, the risk assessment demonstrates that for the most likely and expected current and future uses, the off-property portions of the Site evaluated in this HHRA (i.e., Crawford Creek and its associated flood plain from the confluence with tributary to Crawford Creek to the Nemadji River, and the portion of the tributary to Crawford Creek located within the Crawford Creek floodplain) do not pose an unacceptable potential non-cancer or cancer risk.

### Potential Ecological Risks

The BERA presented in Section 3 included three primary risk characterization components: TQ analysis, sediment evaluation, and fish community evaluation.

The TQ analysis evaluated potential food chain risks associated with COPECs in the off-property portion of the Site. It found that potential risks to populations of upper trophic receptors were unlikely in any of the three exposure areas because all LOAEL-based TQs were less than 1.0 and most NOAEL-based TQs were either less than 1.0, or slightly greater than 1.0 (TQs between 1.0 and 5.0). Given that potential exposures of some receptors to some COPECs exceed NOAEL-based TRVs in Areas 1 and 2, but not in Area 3, a potential risk to individual upper trophic level receptors may exist in Areas 1 and 2. However, actual adverse effects in Areas 1 and 2 seem unlikely given that: 1.) uncertainty factors are used in the derivation of TRVs and, thus, estimated exposures do not exceed actual effect levels (i.e., do not exceed the NOAEL or LOAEL); 2.) upper trophic level receptors are unlikely to forage in only a single exposure area; and 3.) all LOAEL-based TRVs are less than 1.0. The potential for risk is driven primarily by potential exposures to COPECs in Crawford Creek sediments via the food chain (i.e., from consumption of fish, benthic macroinvertebrates or emergent insects by receptors such as the kingfisher, mink or swallow). Other than a NOAEL-based TQ of 1.5 for the robin in Area 1 associated with potential exposure to TCDD-TEQ, COPECs in floodplain soils do not appear to pose a potential ecological risk.

The sediment evaluation component considered five lines of evidence to assess potential sediment-related effects to the benthic macroinvertebrate community. Taken together, the five lines of evidence do not permit a firm conclusion about whether COPECs in Crawford Creek are affecting the benthic macroinvertebrate community. Comparisons of Crawford Creek sediment concentrations to commonly used default screening benchmarks, derived from toxicity results that included PAHs from multiple sources, are suggestive of potentially severe effects. However, comparison to benchmarks based upon wood treating-derived PAHs suggest the absence of wood treating-related PAH toxicity at several of the sediment sampling locations. The Site-specific macroinvertebrate community data reveal the presence of a relatively diverse macroinvertebrate community at all locations, though BBL and WDNR differ in their interpretation of the health of the community and the cause of any impacts. In sum, the existing data preclude a firm conclusion about the presence or absence of an effect of COPECs on the macroinvertebrate community.

Regarding the fish community evaluation, the comparison of surface water concentrations of the three COPECs for which aquatic life criteria are available to their respective criteria and the comparison of TCDD-TEQ body burdens to allowable body burdens suggest no adverse effects to the fish community are expected from the evaluated COPECs. The absence of available criteria for several COPECs combined with the changes observed in the downstream fish community in Crawford Creek preclude a firm conclusion about the presence or absence of an effect of COPECs on the Crawford Creek fish community.

While the HHRA suggests no unacceptable risks to potentially foreseeable human receptors in the portion of the off-property area evaluated in this HHERA, the uncertainties of the BERA and observations of periodic sheens on surface water within Crawford Creek , Beazer proposes a Corrective Measure Study to identify and evaluate potential corrective actions for:

- Sediments in the tributary to Crawford Creek within Area 1;
- Floodplain soils within Area 1; and
- Crawford Creek sediments within Area 2.

In addition, potential corrective actions for sediments and adjacent soils along the tributary to Crawford Creek between the Koppers Inc. property boundary and the Crawford Creek floodplain would also be identified and evaluated in the Corrective Measures Study.

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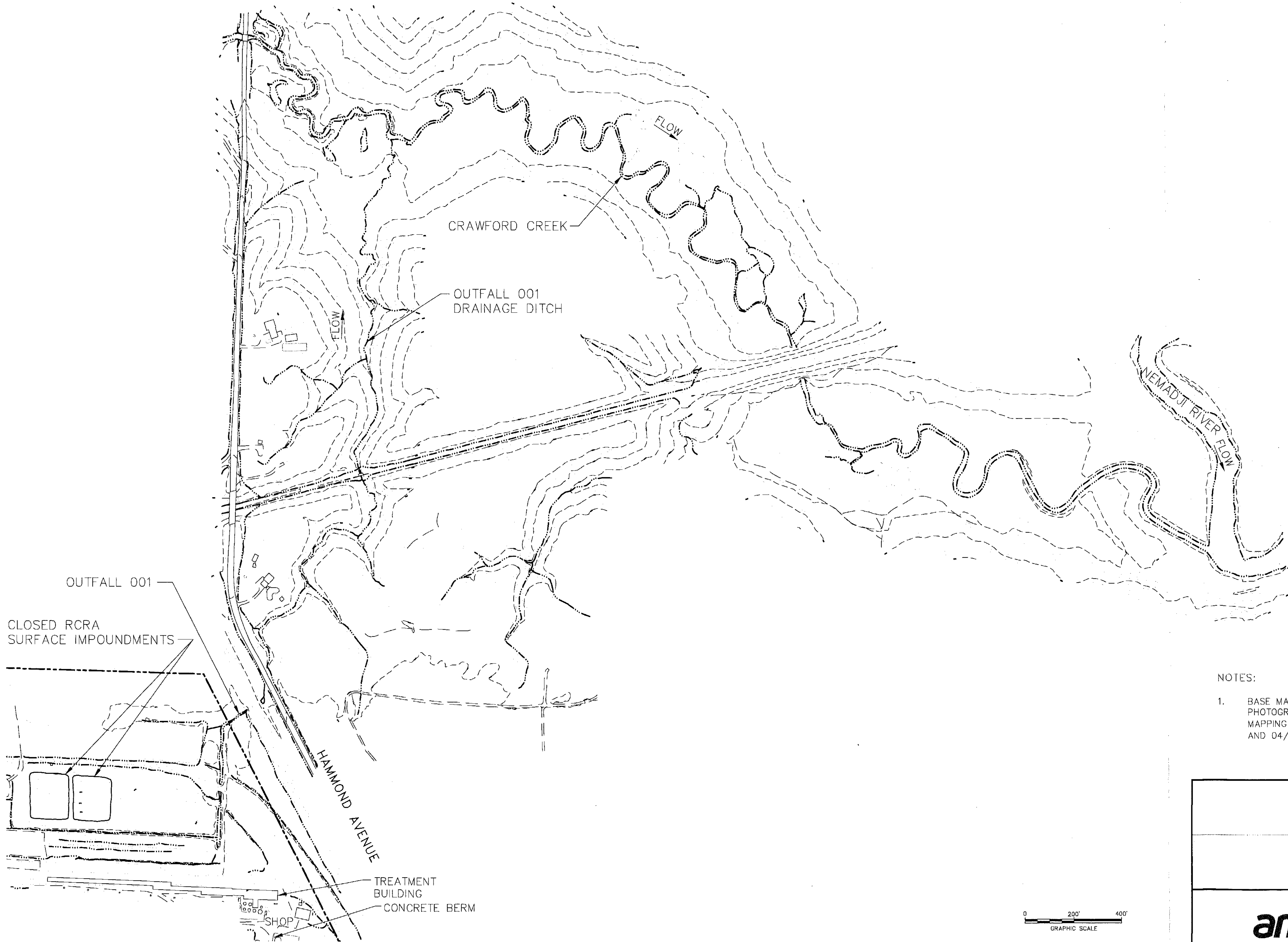



NOTES:

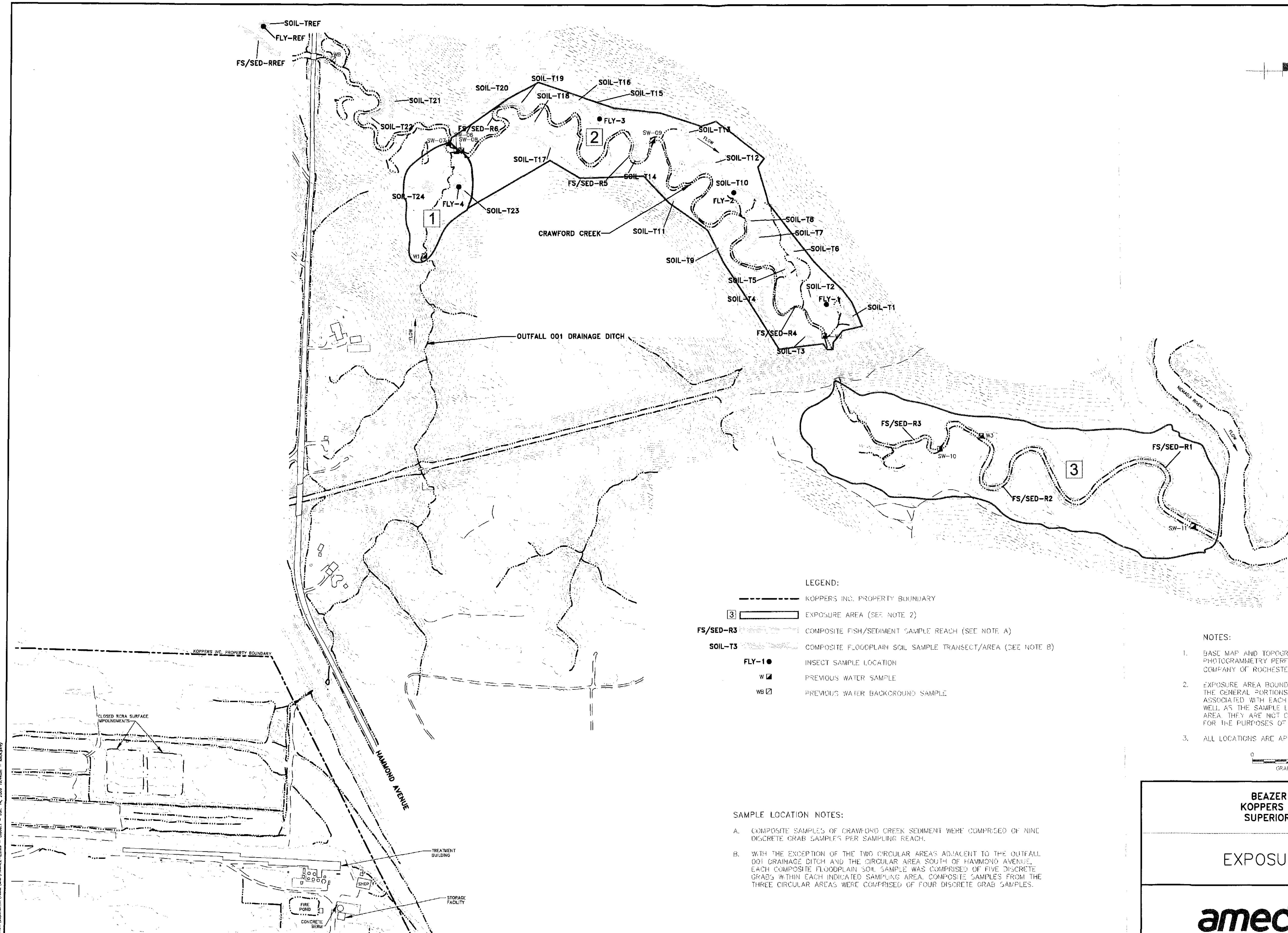
1. BASE MAP AND TOPOGRAPHY OBTAINED FROM PHOTOGRAMMETRY PERFORMED BY LOCKWOOD MAPPING COMPANY OF ROCHESTER, NY (12/28/01 AND 04/04/03).

**BEAZER EAST, INC.**
**KOPPERS INC. FACILITY**
**SUPERIOR, WISCONSIN**

SITE LOCATION

amec

FIGURE
2–1




LEGEND:

| | |
|---|---|
| | KOPPERS INC. PROPERTY BOUNDARY |
| 3 | EXPOSURE AREA (SEE NOTE 2) |
| FS/SED-R3 | COMPOSITE FISH/SEDIMENT SAMPLE REACH (SEE NOTE A) |
| SOIL-T3 | COMPOSITE FLOODPLAIN SOIL SAMPLE TRANSECT/AREA (SEE NOTE B) |
| FLY-1 ● | INSECT SAMPLE LOCATION |
| W | PREVIOUS WATER SAMPLE |
| WB | PREVIOUS WATER BACKGROUND SAMPLE |

SAMPLE LOCATION NOTES:

A. COMPOSITE SAMPLES OF CRAWFORD CREEK SEDIMENT WERE COMPRISED OF NINE DISCRETE GRAB SAMPLES PER SAMPLING REACH.

B. WITH THE EXCEPTION OF THE TWO CIRCULAR AREAS ADJACENT TO THE OUTFALL 001 DRAINAGE DITCH AND THE CIRCULAR AREA SOUTH OF HAMMOND AVENUE, EACH COMPOSITE FLOODPLAIN SOIL SAMPLE WAS COMPRISED OF FIVE DISCRETE GRABS WITHIN EACH INDICATED SAMPLING AREA. COMPOSITE SAMPLES FROM THE THREE CIRCULAR AREAS WERE COMPRISED OF FOUR DISCRETE GRAB SAMPLES.

NOTES:

1. BASE MAP AND TOPOGRAPHY OBTAINED FROM PHOTOGRAMMETRY PERFORMED BY LOCKWOOD MAPPING COMPANY OF ROCHESTER, NY (12/28/01).
2. EXPOSURE AREA BOUNDARIES ARE INTENDED TO REPRESENT THE GENERAL PORTIONS OF THE FLOODPLAIN AND CREEK ASSOCIATED WITH EACH AREA EVALUATED IN THE HHERA, AS WELL AS THE SAMPLE LOCATIONS REPRESENTATIVE OF EACH AREA. THEY ARE NOT CONSIDERED DEFINITIVE BOUNDARIES FOR THE PURPOSES OF REMEDIAL ALTERNATIVES.
3. ALL LOCATIONS ARE APPROXIMATE.

0 200' 400'
GRAPHIC SCALE

**BEAZER EAST, INC.**
**KOPPERS INC. FACILITY**
**SUPERIOR, WISCONSIN**

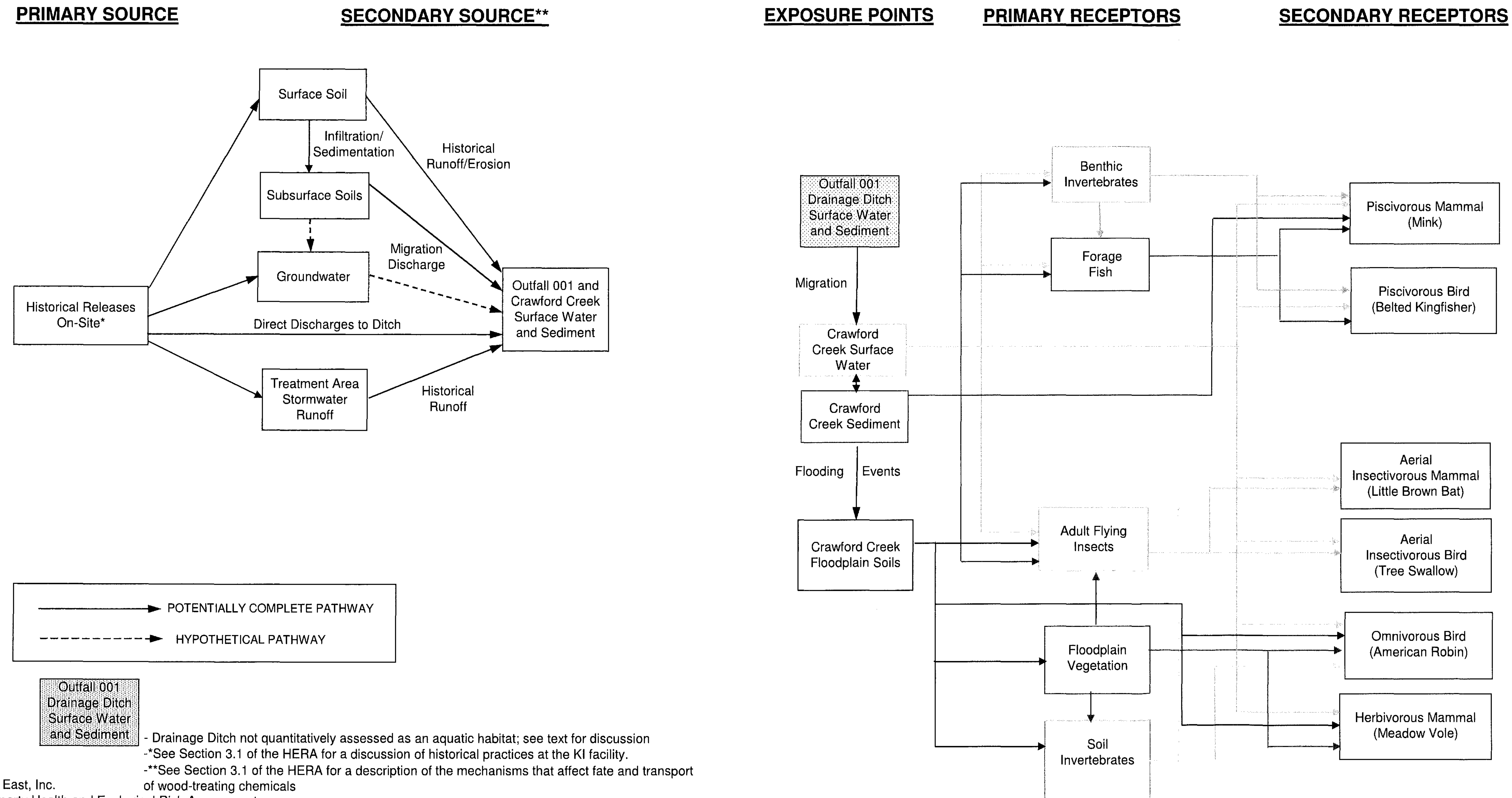
EXPOSURE AREAS

amec

FIGURE
2-2

# FIGURE 3
## Conceptual Site Model for Off-Property Ecological Exposures
## KI Facility, Superior, Wisconsin

**FIGURE 3-1**
**Conceptual Site Model**
**Beazer East, Inc.**
**Off-Sit Portion of Koppers Inc. Facility**
**Superior, WI**




- Drainage Ditch not quantitatively assessed as an aquatic habitat; see text for discussion
-*See Section 3.1 of the HERA for a discussion of historical practices at the KI facility.
-**See Section 3.1 of the HERA for a description of the mechanisms that affect fate and transport of wood-treating chemicals

**Table 2-1**
**Summary of Sediment Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| **Sample ID** | | | SED-R1 & Dup* | | SED-R2 | | SED-R1 | | SED-R2 | | SED-R3 | | SED-R4 | | SED-R5 | | SED-R6 | | SED-RREF | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample Date** | | | 6/8/2008 | | 6/8/2005 | | 7/12/2005 | | 7/12/2005 | | 7/12/2005 | | 7/12/2005 | | 7/13/2005 | | 7/13/2005 | | 7/13/2005 | |
| **Sample Depth** | | | 0-3" | | 0-3" | | 0-3" | | 0-3" | | 0-3" | | 0-3" | | 0-3" | | 0-3" | | 0-3" | |
| | TEFs | | | | | | | | | | | | | | | | | | | |
| **PAH and Penta (mg/kg)** | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | | | 8.8E+00 | | 4.9E+01 | D | 1.3E+00 | | 1.3E+01 | | 4.3E+00 | D | 1.6E+01 | D | 9.3E+01 | D | 6.2E+00 | D | 4.2E-03 | J |
| Acenaphthylene | | | 1.4E+00 | | 3.6E+00 | | 2.0E-01 | | 9.5E-01 | | 1.2E-01 | | 1.4E-01 | | 2.0E+00 | | 3.5E-01 | | 1.4E-03 | U |
| Anthracene | | | 7.3E+01 | D | 7.0E+01 | D | 2.6E+00 | | 1.7E+01 | | 1.8E+01 | D | 3.8E+00 | D | 1.4E+02 | D | 5.1E+00 | D | 8.5E-03 | J |
| Benzo(a)anthracene | 0.1 | | 2.9E+01 | D | 6.6E+01 | D | 2.8E+00 | | 1.7E+01 | | 2.4E+00 | D | 4.2E+00 | D | 4.3E+01 | D | 5.4E+00 | D | 7.6E-03 | J |
| Benzo(a)pyrene | 1 | | 1.2E+01 | | 2.7E+01 | D | 1.6E+00 | | 7.6E+00 | | 9.4E-01 | | 1.5E+00 | D | 1.4E+01 | | 2.6E+00 | | 5.8E-03 | J |
| Benzo(b)fluoranthene | 0.1 | | 1.7E+01 | D | 3.6E+01 | D | 2.3E+00 | | 1.1E+01 | | 1.6E+00 | D | 2.3E+00 | D | 1.9E+01 | | 4.3E+00 | D | 9.2E-03 | |
| Benzo(ghi)perylene | | | 5.1E+00 | | 1.0E+01 | | 7.1E-01 | | 2.8E+00 | | 3.6E-01 | | 3.3E-01 | | 6.0E+00 | | 1.1E+00 | | 3.9E-03 | J |
| Benzo(k)fluoranthene | 0.01 | | 5.9E+00 | | 1.6E+01 | | 7.8E-01 | | 4.6E+00 | | 4.3E-01 | | 7.1E-01 | | 7.2E+00 | | 1.4E+00 | | 3.8E-03 | J |
| Chrysene | 0.001 | | 4.9E+01 | D | 6.0E+01 | D | 3.9E+00 | D | 1.7E+01 | | 2.9E+00 | D | 3.6E+00 | D | 6.0E+01 | D | 6.3E+00 | D | 9.5E-03 | |
| Dibenzo(a,h)anthracene | 1 | | 1.4E+00 | | 2.9E+00 | | 1.9E-01 | | 8.1E-01 | | 9.8E-02 | | 1.1E-01 | | 1.6E+00 | | 3.2E-01 | | 9.5E-04 | U |
| Fluoranthene | | | 9.2E+01 | D | 2.7E+02 | D | 1.1E+01 | D | 1.1E+02 | D | 1.1E+01 | D | 2.2E+01 | D | 1.8E+02 | D | 1.8E+01 | D | 1.9E-02 | |
| Fluorene | | | 1.4E+01 | D | 5.0E+01 | D | 1.4E+00 | | 1.3E+01 | | 5.9E+00 | D | 1.2E+01 | D | 8.4E+01 | D | 4.9E+00 | D | 4.8E-03 | J |
| Indeno(1,2,3-cd)pyrene | 0.1 | | 4.6E+00 | | 9.6E+00 | | 6.4E-01 | | 2.7E+00 | | 3.3E-01 | | 3.2E-01 | | 5.5E+00 | | 1.1E+00 | | 3.5E-03 | J |
| Naphthalene | | | 1.6E+00 | | 2.4E+00 | | 2.9E-01 | | 8.9E-01 | | 2.1E+00 | D | 2.7E+01 | D | 1.4E+02 | D | 4.5E+00 | D | 3.7E-03 | J |
| Phenanthrene | | | 5.4E+01 | D | 2.1E+02 | D | 7.0E+00 | D | 8.8E+01 | D | 1.7E+01 | D | 3.7E+01 | D | 2.4E+02 | D | 1.5E+01 | D | 1.5E-02 | |
| Pyrene | | | 7.1E+01 | D | 2.1E+02 | D | 9.0E+00 | D | 8.2E+01 | D | 7.9E+00 | D | 1.5E+01 | D | 1.3E+02 | D | 1.4E+01 | D | 1.7E-02 | |
| Pentachlorophenol | | | 2.8E-01 | U | 5.0E-01 | U | 7.5E-02 | U | 5.0E-01 | U | 2.4E-02 | U | 2.5E-02 | U | 5.0E-01 | U | 8.0E-02 | U | 4.5E-04 | U |
| **Total PAH** | | | 4.4E+02 | | 1.1E+03 | | 4.6E+01 | | 3.9E+02 | | 7.5E+01 | | 1.5E+02 | | 1.2E+03 | | 9.1E+01 | | 1.2E-01 | |
| **BaP-TE** | | | 1.9E+01 | | 4.1E+01 | | 2.4E+00 | | 1.2E+01 | | 1.5E+00 | | 2.3E+00 | | 2.2E+01 | | 4.0E+00 | | 8.8E-03 | |
| **Dioxins (ug/kg)** | mamm | avian | | | | | | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 0.01 | 0.01 | 1.6E+00 | | 3.1E+00 | | 2.3E-01 | | 1.4E+00 | | 2.1E-01 | | 1.1E-02 | | 1.8E+00 | | 1.0E+00 | | 7.2E-03 | |
| 1,2,3,4,6,7,8-HpCDF | 0.01 | 0.01 | 4.4E-01 | | 7.9E-01 | B | 6.1E-02 | | 3.9E-01 | | 5.0E-02 | B | 2.8E-03 | J,B | 4.9E-01 | B | 2.9E-01 | B | 7.3E-04 | J,B |
| 1,2,3,4,7,8,9-HpCDF | 0.01 | 0.01 | 3.1E-02 | | 4.5E-02 | | 5.8E-03 | | 2.5E-02 | | 3.9E-03 | | 2.1E-04 | U | 3.8E-02 | | 3.2E-02 | | 1.4E-04 | U |
| 1,2,3,4,7,8-HxCDD | 0.1 | 0.1 | 3.4E-03 | J | 1.4E-02 | | 9.8E-04 | J | 2.9E-03 | J | 5.6E-04 | J | 1.2E-04 | U | 4.0E-03 | J | 3.1E-03 | J | 1.3E-04 | U |
| 1,2,3,4,7,8-HxCDF | 0.1 | 0.1 | 2.1E-02 | J | 5.9E-02 | | 7.0E-03 | | 2.2E-02 | | 4.1E-03 | | 6.9E-05 | U | 3.5E-02 | | 4.3E-02 | | 8.3E-05 | U |
| 1,2,3,6,7,8-HxCDD | 0.1 | 0.1 | 4.5E-02 | | 8.6E-02 | | 7.6E-03 | | 3.8E-02 | | 5.5E-03 | | 4.5E-04 | J | 5.1E-02 | | 2.9E-02 | | 2.6E-04 | J |
| 1,2,3,6,7,8-HxCDF | 0.1 | 0.1 | 5.6E-03 | J | 1.3E-02 | D | 2.8E-03 | J | 7.0E-03 | D | 1.6E-03 | J,D | 6.4E-05 | U | 9.6E-03 | D | 1.7E-02 | D | 7.1E-05 | U |
| 1,2,3,7,8,9-HxCDD | 0.1 | 0.1 | 7.3E-03 | J | 1.2E-02 | | 1.7E-03 | J | 7.1E-03 | | 1.2E-03 | J | 1.1E-04 | U | 1.0E-02 | | 6.1E-03 | | 1.2E-04 | U |
| 1,2,3,7,8,9-HxCDF | 0.1 | 0.1 | 4.5E-03 | J | 9.1E-03 | | 2.0E-03 | J | 3.9E-03 | J | 9.9E-04 | J | 1.2E-04 | U | 7.0E-03 | | 9.8E-03 | | 1.4E-04 | U |
| 1,2,3,7,8-PeCDD | 1 | 1 | 1.3E-03 | J | 1.6E-03 | J | 1.7E-04 | U | 8.7E-04 | J | 5.7E-05 | U | 8.0E-05 | U | 1.1E-03 | J | 8.6E-04 | J | 6.2E-05 | U |
| 1,2,3,7,8-PeCDF | 0.03 | 0.05 | 2.1E-03 | J | 2.9E-03 | | 9.7E-04 | J | 1.8E-03 | J | 3.8E-04 | J | 1.2E-04 | U | 2.0E-03 | J | 3.1E-03 | J | 1.1E-04 | U |
| 2,3,4,6,7,8-HxCDF | 0.1 | 0.1 | 8.0E-03 | J | 1.5E-02 | | 2.8E-03 | J | 7.4E-03 | | 1.5E-03 | J | 7.3E-05 | U | 1.2E-02 | | 1.3E-02 | | 8.5E-05 | U |
| 2,3,4,7,8-PeCDF | 0.3 | 0.5 | 3.4E-03 | J | 6.9E-03 | | 1.7E-03 | J | 3.5E-03 | J | 7.0E-04 | J | 9.9E-05 | U | 5.6E-03 | | 7.6E-03 | | 9.7E-05 | U |
| 2,3,7,8-TCDD | 1 | 1 | 2.0E-04 | U | 4.4E-04 | J | 1.3E-04 | U | 1.6E-04 | U | 6.0E-05 | U | 9.0E-05 | U | 1.3E-04 | U | 2.9E-04 | J | 3.8E-05 | U |
| 2,3,7,8-TCDF | 0.1 | 0.1 | 4.6E-04 | J | 6.3E-04 | | 5.8E-04 | J | 7.9E-04 | J | 1.3E-04 | J | 4.9E-05 | U | 4.9E-04 | J | 8.1E-04 | J | 1.0E-04 | J |
| OCDD | 0.0003 | 0.0001 | 1.7E+01 | | 3.4E+01 | | 2.8E+00 | | 1.7E+01 | | 2.3E+00 | | 9.9E-02 | | 2.0E+01 | | 1.3E+01 | | 4.7E-02 | |
| OCDF | 0.0003 | 0.0001 | 2.5E+00 | | 4.6E+00 | | 2.7E-01 | | 2.2E+00 | | 2.7E-01 | | 1.6E-02 | | 2.7E+00 | | 1.2E+00 | | 1.9E-03 | J |
| **2,3,7,8-TCDD TEQ (avian)** | | | 3.6E-02 | | 6.9E-02 | | 7.0E-03 | | 3.2E-02 | | 4.9E-03 | | 4.8E-04 | | 4.3E-02 | | 3.2E-02 | | 3.8E-04 | |
| **2,3,7,8-TCDD TEQ (mamm)** | | | 3.9E-02 | | 7.6E-02 | | 7.2E-03 | | 3.5E-02 | | 5.3E-03 | | 4.9E-04 | | 4.6E-02 | | 3.3E-02 | | 3.3E-04 | |
| **Miscellaneous** | | | | | | | | | | | | | | | | | | | | |
| Total Organic Carbon (mg/kg) | | | 16050 | | 12600 | | 10000 | | 14400 | | 9230 | | 14800 | | 27600 | | 14400 | | 7080 | |
| Percent Solids | | | 62 | | 66 | | 68 | | 67 | | 69 | | 68 | | 64 | | 63 | | 75 | |

Notes:
non detects are at half detection limit
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (2006) TEFs for mammals, assuming 1/2 the sample-specific estimated detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimated detection limit.
*"SED-R1 & Dup" incorporates the results from both SED-R1 and SED-DUP. The listed value is one of the following: #1) the average of detected values, #2) the lower detection limits if both values were non-detect, #3) the average of one-half the detection limit and the detected value if one value was detected, while the other was non-detect.

Penta/PAH data qualifiers:
U - Analyte not detected above reporting limit.
Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 the estimated maximum possible concentration or 1/2 the sample-specific estimated detection limit)

B- Analyte detected in Method Blank.
1,2,3,4,6,7,6,8-HpCDF detected in Blank at 4.9E-2 ug/kg in June sampling and 9.6E-5 ug/kg in July.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Table 2-2**
**Summary of Soil Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Sample ID | TEFs | | SOIL-T1 | SOIL-T2 | SOIL-T3 | SOIL-T4 | SOIL-T5 | SOIL-T6 | SOIL-T7 |
|---|---|---|---|---|---|---|---|---|---|
| Sample Date | | | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 |
| Sample Depth | | | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 |
| **Penta and PAHs (mg/kg)** | | | | | | | | | |
| Acenaphthene | | | 3.6E-02 J | 1.6E-02 J | 1.8E-02 J | 1.6E-02 J | 2.5E-01 U | 1.6E-02 J | 2.7E-01 U |
| Acenaphthylene | | | 6.0E-01 J | 1.9E-01 J | 1.3E-01 J | 9.8E-02 J | 2.5E-01 U | 1.3E-01 J | 7.0E-02 J |
| Anthracene | | | 9.6E-01 | 3.1E-01 J | 1.8E-01 J | 1.3E-01 J | 2.5E-01 U | 1.4E-01 J | 8.0E-02 J |
| Benzo(a)anthracene | 1.0E-01 | | 2.2E-01 J | 7.9E-02 J | 7.4E-02 J | 6.6E-02 J | 2.5E-01 U | 5.9E-02 J | 2.5E-02 J |
| Benzo(a)pyrene | 1.0E+00 | | 7.2E-01 | 1.4E-01 J | 1.7E-01 J | 1.1E-01 J | 1.3E-02 J | 1.8E-01 J | 9.3E-02 J |
| Benzo(b)fluoranthene | 1.0E-01 | | 9.3E-01 | 1.7E-01 J | 2.1E-01 J | 1.8E-01 J | 2.2E-02 J | 2.5E-01 J | 9.7E-02 J |
| Benzo(g,h,i)perylene | | | 1.4E+00 | 5.4E-01 J | 4.0E-01 J | 2.4E-01 J | 3.0E-02 J | 2.3E-01 J | 2.4E-01 J |
| Benzo(k)fluoranthene | 1.0E-02 | | 2.7E-01 J | 3.9E-02 J | 5.0E-02 J | 4.2E-02 J | 2.5E-01 U | 4.8E-02 J | 2.4E-02 J |
| Chrysene | 1.0E-03 | | 2.9E-01 J | 8.3E-02 J | 2.1E-01 J | 1.7E-01 J | 2.1E-02 J | 1.3E-01 J | 5.7E-02 J |
| Dibenzo(a,h)anthracene | 1.0E+00 | | 2.7E-01 J | 7.2E-02 J | 5.8E-02 J | 3.9E-02 J | 2.5E-01 U | 4.9E-02 J | 2.7E-01 U |
| Fluoranthene | | | 1.6E-01 J | 7.2E-02 J | 8.9E-02 J | 9.6E-02 J | 1.1E-02 J | 7.8E-02 J | 2.7E-01 U |
| Fluorene | | | 8.0E-02 J | 4.4E-02 J | 4.0E-02 J | 3.5E-02 J | 2.5E-01 U | 3.3E-02 J | 2.7E-01 U |
| Indeno(1,2,3-cd)Pyrene | 1.0E-01 | | 1.2E+00 | 4.4E-01 J | 3.2E-01 J | 1.9E-01 J | 2.0E-02 J | 2.2E-01 J | 1.8E-01 J |
| Naphthalene | | | 4.6E-02 J | 1.7E-02 J | 2.1E-02 J | 2.3E-02 J | 2.5E-01 U | 2.2E-02 J | 2.7E-01 U |
| Phenanthrene | | | 5.6E-02 J | 2.9E-02 J | 3.8E-02 J | 4.1E-02 J | 2.5E-01 U | 3.1E-02 J | 2.7E-01 U |
| Pyrene | | | 2.4E-01 J | 5.8E-02 J | 6.5E-02 J | 6.5E-02 J | 2.5E-01 U | 4.8E-02 J | 3.6E-02 J |
| Pentachlorphenol | | | 1.6E+00 U | 1.4E+00 U | 1.5E+00 U | 1.7E+00 U | 1.2E+00 U | 1.5E+00 U | 1.3E+00 U |
| **Total PAHs** | | | 7.5E+00 J | 2.3E+00 J | 2.1E+00 J | 1.5E+00 J | 1.2E-01 J | 1.7E+00 J | 9.0E-01 J |
| **BaP-TE** | | | 1.2E+00 | 2.8E-01 | 2.9E-01 | 1.9E-01 | 2.2E-02 | 2.8E-01 | 1.3E-01 |
| **PCDDs/PCDFs (ug/kg)** | avian | mamm | | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 1.0E-02 | 1.0E-02 | 6.3E+00 | 2.4E+00 | 1.8E-01 | 3.9E-01 | 1.6E-01 | 1.3E+00 | 4.4E-01 |
| 1,2,3,4,6,7,8-HPCDF | 1.0E-02 | 1.0E-02 | 2.3E+00 B | 6.6E-01 | 4.7E-02 B | 1.0E-01 B | 4.6E-02 | 3.8E-01 | 1.2E-01 |
| 1,2,3,4,7,8,9-HPCDF | 1.0E-02 | 1.0E-02 | 1.3E-01 | 6.6E-02 | 5.4E-03 | 9.6E-03 | 4.3E-03 | 3.3E-02 | 9.8E-03 |
| 1,2,3,4,7,8-HxCDD | 1.0E-01 | 1.0E-01 | 1.7E-02 | 1.0E-02 | 1.1E-03 J | 2.2E-03 J | 7.6E-04 J | 5.6E-03 | 1.6E-03 J |
| 1,2,3,4,7,8-HxCDF | 1.0E-01 | 1.0E-01 | 6.7E-02 B | 6.9E-02 | 6.8E-03 B | 1.2E-02 B | 5.0E-03 | 3.5E-02 | 1.1E-02 |
| 1,2,3,6,7,8-HxCDD | 1.0E-01 | 1.0E-01 | 2.1E-01 | 8.0E-02 | 6.7E-03 | 1.2E-02 | 4.7E-03 | 3.9E-02 | 1.3E-02 |
| 1,2,3,6,7,8-HxCDF | 1.0E-01 | 1.0E-01 | 2.4E-02 BD | 2.3E-02 D | 3.8E-03 BD | 4.0E-03 B | 1.5E-03 J | 8.9E-03 D | 3.0E-03 D |
| 1,2,3,7,8,9-HxCDD | 1.0E-01 | 1.0E-01 | 3.5E-02 | 1.8E-02 | 1.9E-03 J | 3.8E-03 | 1.3E-03 J | 1.0E-02 | 3.0E-03 |
| 1,2,3,7,8,9-HxCDF | 1.0E-01 | 1.0E-01 | 1.1E-02 | 1.9E-02 | 2.2E-03 J | 3.0E-03 | 1.3E-03 J | 7.1E-03 | 2.6E-03 |
| 1,2,3,7,8-PeCDD | 1.0E+00 | 1.0E+00 | 3.3E-03 | 2.6E-03 | 4.9E-04 J | 8.3E-04 J | 2.6E-04 J | 1.6E-03 J | 5.5E-04 J |
| 1,2,3,7,8-PeCDF | 5.0E-02 | 3.0E-02 | 2.1E-03 J | 6.1E-03 | 9.5E-04 J | 1.5E-03 J | 5.1E-04 J | 2.3E-03 J | 9.5E-04 J |
| 2,3,4,6,7,8-HxCDF | 1.0E-01 | 1.0E-01 | 3.6E-02 | 2.6E-02 | 3.1E-03 | 4.6E-03 | 1.9E-03 J | 1.3E-02 | 4.3E-03 |
| 2,3,4,7,8-PeCDF | 5.0E-01 | 3.0E-01 | 6.1E-03 | 1.2E-02 | 2.0E-03 J | 2.4E-03 J | 1.1E-03 J | 4.8E-03 | 2.4E-03 J |
| 2,3,7,8-TCDD | 1.0E+00 | 1.0E+00 | 3.3E-04 J | 3.8E-04 J | 2.3E-04 J | 9.8E-05 U | 7.3E-05 U | 3.7E-04 J | 4.6E-05 U |
| 2,3,7,8-TCDF | 1.0E-01 | 1.0E-01 | 5.2E-04 | 1.0E-03 | 3.2E-04 J | 3.6E-04 J | 2.1E-04 J | 5.1E-04 | 3.2E-04 J |
| OCDD | 1.0E-04 | 3.0E-04 | 6.1E+01 * | 2.3E+01 | 1.7E+00 | 4.1E+00 | 2.0E+00 | 1.6E+01 | 5.4E+00 |
| OCDF | 1.0E-04 | 3.0E-04 | 1.1E+01 | 2.7E+00 | 1.9E-01 | 4.0E-01 | 1.9E-01 | 1.6E+00 | 6.1E-01 |
| Total HpCDD | | | 1.1E+01 | 4.9E+00 | 3.7E-01 | 8.0E-01 | 3.2E-01 | 2.7E+00 | 8.9E-01 |
| Total HpCDF | | | 1.1E+01 B | 4.0E+00 | 2.7E-01 B | 4.7E-01 B | 2.1E-01 | 1.7E+00 | 6.8E-01 |
| Total HxCDD | | | 7.0E-01 | 4.1E-01 | 4.7E-02 | 7.9E-02 | 2.7E-02 | 2.1E-01 | 7.9E-02 |
| Total HxCDF | | | 2.4E+00 D | 1.3E+00 BD | 1.4E-01 BD | 1.7E-01 BD | 7.8E-02 BD | 5.1E-01 BD | 2.5E-01 BD |
| Total PeCDD | | | 2.4E-02 | 2.5E-02 | 1.0E-02 | 1.3E-02 | 4.6E-03 | 1.9E-02 | 9.1E-03 |
| Total PeCDF | | | 2.1E-01 D | 1.8E-01 D | 3.4E-02 D | 3.3E-02 D | 1.0E-02 D | 5.6E-02 D | 2.6E-02 D |
| **Total TCDD** | | | 1.3E-02 | 1.3E-02 | 9.5E-03 | 9.3E-03 | 6.8E-03 | 1.1E-02 | 7.7E-03 |
| **Total TCDF** | | | 3.2E-02 D | 4.3E-02 D | 1.3E-02 D | 1.1E-02 D | 2.0E-03 | 1.4E-02 D | 5.9E-03 D |
| **2,3,7,8-TCDD TEQ (mamm)** | | | 1.5E-01 | 7.1E-02 | 6.8E-03 | 1.2E-02 | 5.1E-03 | 3.8E-02 | 1.3E-02 |
| **2,3,7,8-TCDD TEQ (avian)** | | | 1.4E-01 | 6.8E-02 | 6.8E-03 | 1.2E-02 | 4.9E-03 | 3.6E-02 | 1.2E-02 |
| **Miscellaneous** | | | | | | | | | |
| Percent Solids (%) | | | 50.8 | 58.8 | 52.6 | 47.7 | 66.7 | 54.4 | 62.6 |
| Total Organic Carbon (mg/kg) | | | 3.8E+04 | 1.5E+04 | 2.8E+04 | 4.4E+04 | 2.4E+04 | 3.5E+04 | 3.6E+04 |

| Sample ID | SOIL-T8 | SOIL-T9 | SOIL-T10 | SOIL-T11 | SOIL-T12 | SOIL-T13 | Soil-T15 & Duplicate* | SOIL-T24 & Duplicate* |
|---|---|---|---|---|---|---|---|---|
| Sample Date | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 |
| Sample Depth | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/06/05 |
| **Penta and PAHs (mg/kg)** | | | | | | | | |
| Acenaphthene | 2.5E-01 U | 2.7E-01 U | 3.0E-01 U | 3.2E-02 J | 2.5E-01 U | 3.2E-01 U | 1.6E-01 J | 6.3E-02 J |
| Acenaphthylene | 7.3E-02 J | 8.8E-02 J | 7.7E-02 J | 4.8E-01 J | 1.7E-02 J | 6.5E-02 J | 2.0E-01 J | 1.1E+00 |
| Anthracene | 1.0E-01 J | 1.2E-01 J | 9.7E-02 J | 6.8E-01 | 2.1E-02 J | 1.1E-01 J | 4.4E-01 J | 2.1E+00 |
| Benzo(a)anthracene | 9.8E-02 J | 5.2E-02 J | 3.9E-02 J | 1.8E-01 J | 2.1E-02 J | 4.7E-02 J | 1.1E-01 J | 6.4E-01 J |
| Benzo(a)pyrene | 2.1E-01 J | 5.5E-02 J | 7.4E-02 J | 6.0E-01 | 2.3E-02 J | 5.3E-02 J | 1.6E-01 J | 2.1E+00 |
| Benzo(b)fluoranthene | 2.3E-01 J | 9.2E-02 J | 1.1E-01 J | 7.4E-01 | 4.5E-02 J | 9.2E-02 J | 2.7E-01 J | 2.2E+00 |
| Benzo(g,h,i)perylene | 2.9E-01 J | 2.4E-01 J | 1.9E-01 J | 1.8E+00 | 4.0E-02 J | 9.8E-02 J | 3.5E-01 J | 2.8E+00 |
| Benzo(k)fluoranthene | 7.4E-02 J | 2.6E-02 J | 3.1E-02 J | 1.6E-01 J | 2.5E-01 U | 2.5E-02 J | 8.8E-02 J | 8.4E-01 J |
| Chrysene | 2.6E-01 J | 1.2E-01 J | 9.0E-02 J | 3.1E-01 J | 4.3E-02 J | 8.5E-02 J | 1.5E-01 J | 3.6E+00 |
| Dibenzo(a,h)anthracene | 6.1E-02 J | 3.2E-02 J | 3.0E-01 U | 2.9E-01 J | .25 U | 2.2E-02 J | 2.1E-01 J | 4.8E-01 J |
| Fluoranthene | 6.2E-02 J | 6.3E-02 J | 4.9E-02 J | 2.0E-01 J | 3.2E-02 J | 6.7E-02 J | 1.2E-01 J | 5.7E-01 J |
| Fluorene | 2.5E-01 U | 2.6E-02 J | 3.0E-01 U | 8.1E-02 J | 2.5E-01 U | 2.3E-02 J | 1.8E-01 J | 1.5E-01 J |
| Indeno(1,2,3-cd)Pyrene | 2.3E-01 J | 1.6E-01 J | 1.5E-01 J | 1.7E+00 | 2.7E-02 J | 9.3E-02 J | 3.3E-01 J | 2.4E+00 |
| Naphthalene | 2.5E-01 U | 1.4E-02 J | 3.0E-01 U | 3.9E-02 J | 2.5E-01 U | 3.2E-01 U | 1.6E-01 J | 6.5E-01 J |
| Phenanthrene | 2.9E-02 J | 2.6E-02 J | 3.0E-01 U | 7.8E-02 J | 1.9E-02 J | 2.6E-02 J | 1.8E-01 J | 2.1E-01 J |
| Pyrene | 6.4E-02 J | 4.7E-02 J | 4.6E-02 J | 1.9E-01 J | 3.0E-02 J | 4.7E-02 J | 1.1E-01 J | 5.5E-01 J |
| Pentachlorphenol | 1.2E+00 U | 1.3E+00 U | 1.5E+00 U | 1.3E+00 U | 1.2E+00 U | 1.6E+00 U | 1.4E+00 U | 2.8E+00 U |
| **Total PAHs** | 1.8E+00 J | 1.2E+00 J | 9.5E-01 J | 7.6E+00 J | 3.2E-01 J | 8.5E-01 J | 2.5E+00 J | 2.0E+01 J |
| **BaP-TE** | 3.3E-01 | 1.2E-01 | 1.1E-01 | 1.2E+00 | 3.7E-02 | 9.9E-02 | 3.0E-01 | 3.1E+00 |
| **PCDDs/PCDFs (ug/kg)** | | | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 1.0E+00 | 2.1E+00 | 1.4E+00 | 1.8E+00 | 2.9E-01 | 2.3E-01 | 3.2E-01 | 5.4E+00 |
| 1,2,3,4,6,7,8-HPCDF | 2.7E-01 | 6.1E-01 B | 3.4E-01 | 4.7E-01 B | 7.5E-02 | 6.0E-02 | 9.2E-02 | 1.5E+00 |
| 1,2,3,4,7,8,9-HPCDF | 3.1E-02 | 6.6E-02 | 2.2E-02 | 4.6E-02 | 7.9E-03 | 5.1E-03 | 8.5E-03 | 1.6E-01 |
| 1,2,3,4,7,8-HxCDD | 4.2E-03 | 8.8E-03 | 4.1E-03 | 7.4E-03 | 1.7E-03 J | 1.3E-03 J | 1.7E-03 J | 1.8E-02 |
| 1,2,3,4,7,8-HxCDF | 4.5E-02 | 8.6E-02 B | 1.7E-02 | 5.1E-02 B | 1.1E-02 | 5.5E-03 | 9.1E-03 | 1.8E-01 |
| 1,2,3,6,7,8-HxCDD | 3.7E-02 | 7.1E-02 | 3.9E-02 | 5.3E-02 | 9.3E-03 | 7.3E-03 | 1.0E-02 | 1.6E-01 |
| 1,2,3,6,7,8-HxCDF | 1.1E-02 D | 5.3E-02 BD | 6.2E-03 D | 2.1E-02 BD | 2.9E-03 D | 2.2E-03 JD | 2.5E-03 J | 5.0E-02 D |
| 1,2,3,7,8,9-HxCDD | 8.0E-03 | 1.6E-02 | 7.5E-03 | 1.2E-02 | 2.9E-03 | 2.1E-03 J | 3.0E-03 J | 3.2E-02 |
| 1,2,3,7,8,9-HxCDF | 1.1E-02 | 3.3E-02 | 3.6E-03 | 1.3E-02 | 2.6E-03 | 1.5E-03 J | 2.1E-03 J | 4.4E-02 |
| 1,2,3,7,8-PeCDD | 1.5E-03 J | 2.8E-03 | 7.3E-04 J | 2.2E-03 J | 5.8E-04 J | 4.2E-04 J | 5.7E-04 J | 5.2E-03 |
| 1,2,3,7,8-PeCDF | 3.6E-03 | 1.3E-02 | 1.0E-03 J | 4.1E-03 | 9.3E-04 J | 6.2E-04 J | 1.2E-03 J | 1.3E-02 |
| 2,3,4,6,7,8-HxCDF | 1.6E-02 | 3.5E-02 | 6.9E-03 | 1.9E-02 | 3.7E-03 | 2.7E-03 | 3.5E-03 J | 6.0E-02 |
| 2,3,4,7,8-PeCDF | 8.9E-03 | 3.4E-02 | 2.7E-03 | 9.3E-03 | 2.0E-03 J | 1.4E-03 J | 1.6E-03 J | 3.1E-02 |
| 2,3,7,8-TCDD | 3.5E-04 J | 5.3E-04 | 1.9E-04 J | 3.6E-04 J | 6.4E-05 U | 2.2E-04 J | 1.4E-04 J | 8.8E-04 |
| 2,3,7,8-TCDF | 6.1E-04 | 3.5E-03 | 3.4E-04 J | 8.4E-04 | 3.1E-04 J | 3.2E-04 J | 3.1E-04 J | 2.0E-03 |
| OCDD | 1.2E+01 | 2.4E+01 | 1.4E+01 | 2.0E+01 | 3.2E+00 | 2.3E+00 | 3.1E+00 | 7.4E+01 * |
| OCDF | 1.1E+00 | 2.3E+00 | 2.0E+00 | 2.0E+00 | 3.0E-01 | 2.9E-01 | 3.8E-01 | 6.4E+00 |
| Total HpCDD | 2.3E+00 | 4.2E+00 | 2.5E+00 | 3.6E+00 | 6.2E-01 | 4.6E-01 | 6.5E-01 | 1.1E+01 |
| Total HpCDF | 1.8E+00 | 3.1E+00 B | 1.9E+00 | 2.3E+00 B | 3.9E-01 | 3.1E-01 | 4.9E-01 | 7.8E+00 |
| Total HxCDD | 2.2E-01 | 3.8E-01 | 1.8E-01 | 2.8E-01 | 6.1E-02 | 4.5E-02 | 6.2E-02 | 8.1E-01 |
| Total HxCDF | 7.5E-01 BD | 1.7E+00 BD | 4.5E-01 BD | 8.3E-01 BD | 1.6E-01 BD | 1.1E-01 BD | 1.5E-01 BD | 2.7E+00 BD |
| Total PeCDD | 1.8E-02 | 2.9E-02 | 9.9E-03 | 2.1E-02 | 8.9E-03 | 8.1E-03 | 9.9E-03 | 4.4E-02 |
| Total PeCDF | 8.3E-02 D | 4.8E-01 D | 4.3E-02 D | 1.6E-01 D | 2.0E-02 D | 1.8E-02 D | 2.0E-02 | 3.5E-01 D |
| **Total TCDD** | 8.9E-03 | 1.3E-02 | 6.3E-03 | 9.3E-03 | 7.9E-03 | 8.3E-03 | 9.0E-03 | 1.2E-02 |
| **Total TCDF** | 1.2E-02 D | 1.3E-01 D | 1.0E-02 D | 5.1E-02 D | 5.5E-03 D | 8.0E-03 D | 8.0E-03 | 6.4E-02 D |
| **2,3,7,8-TCDD TEQ (mamm)** | 3.5E-02 | 8.0E-02 | 3.2E-02 | 5.3E-02 | 9.4E-03 | 7.1E-03 | 9.8E-03 | 1.7E-01 |
| **2,3,7,8-TCDD TEQ (avian)** | 3.4E-02 | 8.2E-02 | 3.0E-02 | 5.0E-02 | 9.2E-03 | 6.9E-03 | 9.4E-03 | 1.6E-01 |
| **Miscellaneous** | | | | | | | | |
| Percent Solids (%) | 66.2 | 61.5 | 55.8 | 61.6 | 65.8 | 51.9 | 56.65 | 56.25 |
| Total Organic Carbon (mg/kg) | 3.1E+04 | 3.9E+04 | 3.2E+04 | 2.8E+04 | 2.9E+04 | 3.7E+04 | 3.9E+04 | 3.6E+04 |

Notes:
non detects are at half detection limit
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (1998) TEFs for mammals, assuming 1/2 the sample-specific estimated detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimated detection limit.
*These samples were incorporated the results from both duplicate sampling locations. The listed value is one of the following: #1) the average of detected values, #2) the lower detection limits if both values were non-detect, #3) the average of one-half the detection limit and the detected value if one value was detected, while the other was non-detect

Penta/PAH data qualifiers:
U - Analyte not detected above reporting limit.
Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 the estimated maximum possible concentration or 1/2 the sample-specific estimated detection limit)

B- Analyte detected in Method Blank.
1,2,3,4,6,7,6,8-HpCDF detected in Blank at 4.9E-2 ug/kg in June 2005 sampling and 9.6E-5 ug/kg in July 2005.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Table 2-2**
**Soil Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Sample ID | SOIL-T14 | SOIL-T16 | SOIL-T17 | SOIL-T18 | SOIL-T19 | SOIL-T20 | SOIL-T21 | SOIL-T22 | SOIL-T23 | SOIL-TREF |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample Date** | **0 - 0.5** | **0 - 0.5** | **0 - 0.5** | **0 - 0.5** | **0 - 0.5** | **0 - 0.5** | **0 - 0.5** | **0 - 0.5** | **0 - 0.5** | **0 - 0.5** |
| **Sample Depth** | **06/06/05** | **06/07/05** | **06/07/05** | **06/07/05** | **06/06/05** | **06/06/05** | **06/06/05** | **06/06/05** | **06/07/05** | **06/06/05** |
| **Penta and PAHs (mg/kg)** | | | | | | | | | | |
| Acenaphthene | 1.3E-02 J | 3.1E-01 U | 2.8E-01 U | 2.6E-01 U | 2.3E-02 J | 2.0E-02 J | 2.7E-01 U | 2.3E-01 U | 6.6E-02 J | 2.5E-01 U |
| Acenaphthylene | 1.1E-01 J | 3.1E-01 U | 3.5E-02 J | 7.1E-02 J | 2.1E-01 J | 2.0E-01 J | 2.7E-01 U | 2.3E-01 U | 7.2E-01 | 2.5E-01 U |
| Anthracene | 1.4E-01 J | 3.1E-01 U | 3.7E-02 J | 1.0E-01 J | 4.1E-01 J | 3.3E-01 J | 2.7E-01 U | 2.3E-01 U | 1.5E+00 | 2.5E-01 U |
| Benzo(a)anthracene | 9.9E-02 J | 3.1E-01 U | 4.1E-02 J | 8.8E-02 J | 2.8E-01 J | 1.1E-01 J | 1.9E-02 J | 2.2E-02 J | 6.6E-01 | 2.1E-02 J |
| Benzo(a)pyrene | 1.6E-01 J | 3.1E-01 U | 4.5E-02 J | 2.2E-01 J | 6.0E-01 | 2.3E-01 J | 1.7E-02 J | 2.0E-02 J | 1.2E+00 | 1.7E-02 J |
| Benzo(b)fluoranthene | 2.3E-01 J | 3.1E-01 U | 6.8E-02 J | 3.0E-01 J | 7.2E-01 | 3.3E-01 J | 2.3E-02 J | 3.2E-02 J | 1.4E+00 | 2.3E-02 J |
| Benzo(g,h,i)perylene | 3.4E-01 J | 3.1E-01 U | 9.1E-02 J | 3.1E-01 J | 9.5E-01 | 6.6E-01 | 1.5E-02 J | 1.8E-02 J | 2.8E+00 | 1.5E-02 J |
| Benzo(k)fluoranthene | 6.9E-02 J | 3.1E-01 U | 2.1E-02 J | 8.4E-02 J | 2.5E-01 J | 9.3E-02 J | 2.7E-01 U | 1.4E-02 J | 4.9E-01 J | 2.5E-01 U |
| Chrysene | 2.3E-01 J | 3.1E-01 U | 7.7E-02 J | 2.2E-01 J | 1.4E+00 | 2.3E-01 J | 1.8E-02 J | 3.8E-02 J | 3.2E+00 | 1.9E-02 J |
| Dibenzo(a,h)anthracene | 6.0E-02 J | 3.1E-01 U | 1.7E-02 J | 6.0E-02 J | 1.9E-01 J | 1.1E-01 J | 2.7E-01 U | 2.3E-01 U | 4.5E-01 J | 2.5E-01 U |
| Fluoranthene | 1.7E-01 J | 3.1E-01 U | 5.8E-02 J | 1.2E-01 J | 2.5E-01 J | 1.6E-01 J | 3.3E-02 J | 5.8E-02 J | 4.7E-01 J | 3.5E-02 J |
| Fluorene | 2.6E-02 J | 3.1E-01 U | 2.8E-01 U | 2.2E-02 J | 4.4E-02 J | 4.5E-02 J | 2.7E-01 U | 2.3E-01 U | 1.8E-01 J | 2.5E-01 U |
| Indeno(1,2,3-cd)Pyrene | 3.0E-01 J | 3.1E-01 U | 7.2E-02 J | 2.8E-01 J | 8.5E-01 | 5.7E-01 J | 1.3E-02 J | 1.6E-02 J | 2.3E+00 | 1.4E-02 J |
| Naphthalene | 2.0E-02 J | 3.1E-01 U | 2.8E-01 U | 1.5E-02 J | 3.6E-02 J | 2.9E-02 J | 2.7E-01 U | 2.3E-01 U | 9.4E-02 J | 2.5E-01 U |
| Phenanthrene | 4.3E-02 J | 3.1E-01 U | 2.3E-02 J | 3.3E-02 J | 8.6E-02 J | 6.3E-02 J | 1.4E-02 J | 1.8E-02 J | 2.8E-01 J | 1.4E-02 J |
| Pyrene | 1.2E-01 J | 3.1E-01 U | 4.7E-02 J | 2.5E-01 J | 2.1E-01 J | 1.7E-01 J | 2.5E-02 J | 5.2E-02 J | 4.4E-01 J | 3.3E-02 J |
| Pentachlorphenol | 1.3E+00 U | 1.5E+00 U | 1.4E+00 U | 1.3E+00 U | 1.2E+00 U | 1.5E+00 U | 1.3E+00 U | 1.1E+00 U | 1.4E+00 U | 1.2E+00 U |
| **Total PAHs** | 2.1E+00 J | | 6.3E-01 J | 2.2E+00 J | 6.5E+00 J | 3.4E+00 J | 1.8E-01 J | 2.9E-01 J | 1.6E+01 J | 1.9E-01 J |
| **BaP-TE** | 2.8E-01 | | 8.0E-02 | 3.5E-01 | 9.8E-01 | 4.4E-01 | 2.7E-02 | 3.1E-02 | 2.1E+00 | 2.7E-02 |
| **PCDDs/PCDFs (ug/kg)** | | | | | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 3.0E-01 | 1.5E-01 | 1.7E-01 | 2.1E-01 | 1.0E+00 | 8.5E-02 | 1.2E-02 | 9.9E-03 | 5.0E+00 | 1.4E-02 |
| 1,2,3,4,6,7,8-HPCDF | 8.1E-02 B | 3.9E-02 | 4.4E-02 B | 5.9E-02 B | 2.9E-01 B | 2.6E-02 B | 2.8E-03 B | 1.4E-03 JB | 1.4E+00 B | 0.00111 JB |
| 1,2,3,4,7,8,9-HPCDF | 8.7E-03 | 4.1E-03 | 4.0E-03 | 5.7E-03 | 2.9E-02 | 2.4E-03 J | 3.1E-04 J | 5.5E-05 U | 1.4E-01 | 3.4E-05 U |
| 1,2,3,4,7,8-HxCDD | 1.3E-03 J | 8.8E-04 J | 1.1E-03 J | 1.0E-03 J | 2.7E-03 | 6.5E-04 J | 9.2E-05 U | 1.7E-04 J | 2.0E-02 | 8.0E-04 J |
| 1,2,3,4,7,8-HxCDF | 1.1E-02 B | 5.0E-03 | 5.0E-03 B | 7.0E-03 B | 3.5E-02 B | 2.9E-03 B | 3.5E-04 JB | 1.8E-04 JB | 1.7E-01 B | 0.000175 JB |
| 1,2,3,6,7,8-HxCDD | 9.4E-03 | 4.7E-03 | 5.7E-03 | 6.3E-03 | 2.9E-02 | 3.0E-03 | 2.6E-04 U | 3.6E-04 J | 1.5E-01 | 1.1E-03 J |
| 1,2,3,6,7,8-HxCDF | 9.3E-03 BD | 1.7E-03 J | 1.7E-03 JBD | 2.7E-03 BD | 1.5E-02 BD | 1.3E-03 JB | 3.5E-04 JB | 1.9E-04 JB | 4.4E-02 BD | 0.000231 JB |
| 1,2,3,7,8,9-HxCDD | 2.2E-03 J | 1.6E-03 J | 1.9E-03 J | 1.9E-03 J | 5.2E-03 | 1.3E-03 J | 3.7E-04 J | 2.6E-04 J | 3.5E-02 | 1.5E-03 J |
| 1,2,3,7,8,9-HxCDF | 3.5E-03 | 1.3E-03 J | 1.4E-03 J | 1.9E-03 J | 6.9E-03 | 7.1E-04 J | 1.4E-04 J | 2.3E-05 U | 4.4E-02 | 4.5E-05 U |
| 1,2,3,7,8-PeCDD | 5.2E-04 J | 4.0E-04 J | 4.6E-04 J | 4.3E-04 J | 9.1E-04 J | 4.5E-04 J | 1.7E-04 J | 6.4E-05 U | 6.1E-03 | 7.4E-04 J |
| 1,2,3,7,8-PeCDF | 1.4E-03 J | 2.5E-04 U | 5.7E-04 J | 1.1E-03 J | 2.2E-03 J | 5.8E-04 J | 2.0E-04 J | 1.5E-04 J | 1.4E-02 | 5.1E-05 U |
| 2,3,4,6,7,8-HxCDF | 4.4E-03 | 1.9E-03 J | 2.1E-03 J | 2.4E-03 J | 1.1E-02 | 1.4E-03 J | 2.7E-04 J | 1.5E-04 J | 6.0E-02 | 1.7E-04 J |
| 2,3,4,7,8-PeCDF | 3.2E-03 | 1.0E-03 J | 1.2E-03 J | 1.4E-03 J | 4.9E-03 | 1.1E-03 J | 3.2E-04 J | 7.1E-05 U | 3.1E-02 | 1.9E-04 J |
| 2,3,7,8-TCDD | 2.2E-04 J | 7.5E-05 U | 1.7E-04 J | 4.9E-05 U | 9.0E-05 U | 8.2E-05 U | 5.7E-05 U | 4.4E-05 U | 9.8E-04 | 1.9E-04 J |
| 2,3,7,8-TCDF | 4.0E-04 J | 2.4E-04 J | 2.5E-04 J | 2.3E-04 J | 4.5E-04 J | 5.4E-04 | 2.3E-04 J | 1.2E-04 J | 2.0E-03 | 6.7E-05 U |
| OCDD | 3.8E+00 | 1.6E+00 | 1.8E+00 | 2.7E+00 | 1.4E+01 | 8.3E-01 | 9.1E-02 | 8.2E-02 | 6.9E+01 * | 5.8E-02 |
| OCDF | 3.2E-01 | 1.5E-01 | 1.7E-01 | 2.3E-01 | 1.3E+00 | 8.7E-02 | 7.0E-03 | 3.6E-03 J | 5.3E+00 | 2.3E-03 J |
| Total HpCDD | 6.2E-01 | 3.2E-01 | 3.5E-01 | 4.3E-01 | 2.0E+00 | 1.7E-01 | 3.0E-02 | 4.2E-02 | 1.0E+01 | 4.6E-02 |
| Total HpCDF | 4.0E-01 B | 1.9E-01 | 1.9E-01 B | 2.7E-01 B | 1.4E+00 B | 1.0E-01 B | 9.6E-03 B | 3.8E-03 B | 6.8E+00 B | 2.9E-03 B |
| Total HxCDD | 5.3E-02 | 3.3E-02 | 3.6E-02 | 3.7E-02 | 1.4E-01 | 2.2E-02 | 6.8E-03 | 7.4E-03 | 7.9E-01 | 2.6E-02 |
| Total HxCDF | 2.2E-01 BD | 7.3E-02 BD | 7.2E-02 BD | 9.8E-02 BD | 5.1E-01 BD | 4.1E-02 BD | 6.0E-03 BD | 2.8E-03 BD | 2.4E+00 BD | 3.0E-03 B |
| Total PeCDD | 7.7E-03 | 8.7E-03 | 8.3E-03 | 7.9E-03 | 1.1E-02 | 5.2E-03 | 4.6E-03 | 3.8E-03 | 4.9E-02 | 1.4E-02 |
| Total PeCDF | 7.0E-02 D | 1.1E-02 D | 1.3E-02 D | 2.1E-02 D | 1.1E-01 D | 1.4E-02 D | 4.9E-03 D | 2.2E-03 D | 3.3E-01 D | 2.5E-03 D |
| **Total TCDD** | 5.8E-03 | 8.2E-03 | 7.2E-03 | 7.0E-03 | 6.3E-03 | 6.4E-03 | 6.2E-03 | 3.6E-03 | 1.3E-02 | 7.1E-03 |
| **Total TCDF** | 2.2E-02 D | 7.2E-03 D | 5.3E-03 D | 9.6E-03 D | 4.0E-02 D | 1.7E-02 D | 8.0E-03 D | 4.0E-03 D | 5.3E-02 D | 4.3E-03 D |
| **2,3,7,8-TCDD TEQ (mamm)** | 1.1E-02 | 4.9E-03 | 5.7E-03 | 6.9E-03 | 3.1E-02 | 3.4E-03 | 7.1E-04 | 4.2E-04 | 1.6E-01 | 1.5E-03 |
| **2,3,7,8-TCDD TEQ (avian)** | 1.1E-02 | 4.8E-03 | 5.5E-03 | 6.6E-03 | 2.9E-02 | 3.5E-03 | 7.6E-04 | 4.2E-04 | 1.5E-01 | 1.5E-03 |
| **Miscellaneous** | | | | | | | | | | |
| Percent Solids (%) | 62.2 | 52.9 | 58.4 | 64.1 | 67.3 | 52.6 | 60.9 | 72.3 | 59.9 | 66.5 |
| Total Organic Carbon (mg/kg) | 2.6E+04 | 3.7E+04 | 3.1E+04 | 3.0E+04 | 2.5E+04 | 9.8E+04 | 3.0E+04 | 2.3E+04 | 3.8E+04 | 2.9E+04 |

Notes:
non detects are at half detection limit
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (1998) TEFs for mammals, assuming 1/2 the sample-specific estimated detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimated detection limit.
*These samples were incorporated the results from both duplicate sampling locations. The listed value is one of the following: #1) the average of detected values, #2) the lower detection limits if both values were non-detect, #3) the average of one-half the detection limit and the detected value if one value was detected, while the other was non-detect

Penta/PAH data qualifiers:
U - Analyte not detected above reporting limit.
Concentration reported in table is 1/2 the reporting
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 the estimated maximum possible concentration or 1/2 the sample-specific estimated detection limit)
B- Analyte detected in Method Blank.
1,2,3,4,6,7,8-HpCDF detected in Blank at 4.9E-2 ug/kg in June 2005 sampling and 9.6E-5 ug/kg in July 2005.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

## Table 2-3
## Summary of Surface Water Data
## Beazer East, Inc.
## Off-Site Portion of Koppers Inc. Facility
## Superior, WI

| Sample ID<br>Sample Date | TEF | SW-06-<br>06/13/1996 | | SW-07-<br>06/10/1996 | | SW-08-<br>06/12/1996 | | SW-09-<br>06/12/1996 | | SW-10-<br>06/11/1996 | | SW-11-<br>06/11/1996 | | W1<br>8/9/1999 | | W2<br>8/9/1999 | | W3<br>8/9/1999 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Penta and PAHs (ug/L)** | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | | 1.0E+00 | U | 1.0E+00 | U | 1.0E+00 | UJ | 1.0E+00 | UJ | 1.0E+00 | U | 1.0E+00 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Acenaphthylene | | 1.0E+00 | U | 1.0E+00 | U | 1.0E+00 | UJ | 1.0E+00 | UJ | 1.0E+00 | U | 1.0E+00 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Anthracene | | 1.6E-01 | | 5.0E-02 | U | 5.0E-02 | UJ | 5.0E-02 | UJ | 5.0E-02 | U | 5.0E-02 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Benzo(a)anthracene | 0.1 | 1.0E-02 | U | 1.0E-02 | U | 1.0E-02 | UJ | 1.0E-02 | UJ | 1.0E-02 | U | 1.0E-02 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Benzo(a)pyrene | 1 | 1.0E-01 | | 1.0E-02 | U | 4.0E-02 | J | 1.0E-02 | UJ | 1.0E-02 | U | 1.0E-02 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Benzo(b)fluoranthene | 0.1 | 2.6E-01 | | 1.0E-02 | U | 6.1E-02 | J | 3.3E-02 | J | 4.4E-02 | | 1.0E-02 | U | 2.5E+00 | U | 2.7E-01 | | 2.5E+00 | U |
| Benzo(g,h,i)perylene | | 3.0E-02 | U | 3.0E-02 | U | 3.0E-02 | UJ | 3.0E-02 | UJ | 3.0E-02 | U | 2.5E-02 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Benzo(k)fluoranthene | 0.01 | 6.6E-02 | | 1.0E-02 | U | 4.2E-02 | J | 1.0E-02 | UJ | 1.0E-02 | U | 1.0E-02 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Chrysene | 0.001 | 7.5E-02 | U | 8.0E-02 | U | 7.5E-02 | UJ | 8.0E-02 | UJ | 8.0E-02 | U | 7.5E-02 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Dibenzo(a,h)anthracene | 1 | 1.5E-02 | U | 1.5E-02 | U | 1.5E-02 | UJ | 1.5E-02 | UJ | 1.5E-02 | U | 1.5E-02 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Fluoranthene | | 1.0E-01 | U | 1.0E-01 | U | 1.0E-01 | UJ | 2.3E-01 | | 1.0E-01 | U | 1.0E-01 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Fluorene | | 1.0E-01 | U | 1.0E-01 | U | 1.0E-01 | UJ | 1.0E-01 | UJ | 1.0E-01 | U | 1.0E-01 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Indeno(1,2,3-cd)pyrene | 0.1 | 6.6E-02 | | 3.0E-02 | U | 3.0E-02 | UJ | 3.0E-02 | UJ | 3.0E-02 | U | 2.5E-02 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Methylnaphthalene | | 1.0E+00 | U | 1.0E+00 | U | 1.0E+00 | UJ | 1.0E+00 | UJ | 1.0E+00 | U | 1.0E+00 | U | NA | | NA | | NA | |
| Naphthalene | | 1.0E+00 | U | 1.0E+00 | U | 1.0E+00 | UJ | 1.0E+00 | UJ | 1.0E+00 | U | 1.0E+00 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Phenanthrene | | 3.0E-01 | U | 3.0E-01 | U | 3.0E-01 | UJ | 3.0E-01 | UJ | 3.0E-01 | U | 2.5E-01 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Pyrene | | 1.0E-01 | U | 1.0E-01 | U | 1.0E-01 | UJ | 1.0E-01 | UJ | 1.0E-01 | U | 1.0E-01 | U | 2.5E+00 | U | 2.5E+00 | U | 2.5E+00 | U |
| Pentachlorophenol | | 2.5E-01 | U | 2.5E-01 | U | 2.5E-01 | U | 2.5E-01 | U | 2.5E-01 | U | 2.5E-01 | U | 4.1E-01 | | 7.5E-02 | | 2.5E-01 | U |
| **Total PAHs** | | 6.5E-01 | | ND | | 1.4E-01 | J | 2.6E-01 | | 4.4E-02 | | ND | | ND | | 2.7E-01 | J | ND | |
| **BaP-TE** | | 1.5E-01 | | 3.0E-02 | | 6.6E-02 | | 3.3E-02 | | 3.4E-02 | | 3.0E-02 | | 5.8E+00 | | 5.6E+00 | | 5.8E+00 | |

Notes:
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
NA: Not Analyzed, ND: individual PAHs were all Non-detect
Penta/PAH data qualifiers:
U - Analyte not detected above reporting limit. Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

**Table 2-4**
**Summary of Fish Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| **Sample ID**<br>**Sample Date**<br>**Sample Total Weight** | **TEFs** | | **FS-R1**<br>**7/14/2005**<br>**11.4g** | | **FS-R2**<br>**7/14/05**<br>**25g** | | **FS-R3**<br>**7/14/05**<br>**16g** | | **FS-R4**<br>**7/14/05**<br>**22.8g** | | **FS-R5**<br>**7/14/05**<br>**16g** | | **FS-R6**<br>**7/13/05**<br>**17g** | | **FS-RREF**<br>**7/13/05**<br>**23g** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analytes** | | | | | | | | | | | | | | | | |
| **PAH and Penta (mg/kg)** | | | | | | | | | | | | | | | | |
| Acenaphthene | | | 4.0E-02 | J | 1.4E-01 | | 4.6E-01 | | 2.4E+00 | | 5.8E+00 | | 4.9E-01 | | 3.6E-03 | J |
| Acenaphthylene | | | 4.4E-02 | U | 2.0E-02 | U | 1.6E-02 | J | 9.0E-02 | U | 8.5E-02 | J | 6.0E-02 | U | 4.4E-03 | U |
| Anthracene | | | 2.9E-02 | J | 6.0E-02 | | 1.3E-01 | | 2.9E-01 | | 1.0E+00 | | 1.1E-01 | J | 2.4E-03 | J |
| Benzo(a)anthracene | 0.1 | | 2.5E-02 | J | 2.0E-02 | U | 1.7E-01 | | 1.1E-01 | J | 2.0E-01 | | 2.5E-02 | J | 4.4E-03 | U |
| Benzo(a)pyrene | 1 | | 4.4E-02 | U | 2.0E-02 | U | 8.1E-02 | | 9.0E-02 | U | 1.1E-01 | J | 6.0E-02 | U | 4.4E-03 | U |
| Benzo(b)fluoranthene | 0.1 | | 4.4E-02 | U | 1.4E-02 | J | 1.9E-01 | | 9.0E-02 | U | 2.1E-01 | | 6.0E-02 | U | 4.4E-03 | U |
| Benzo(ghi)perylene | | | 4.4E-02 | U | 2.0E-02 | U | 3.3E-02 | J | 9.0E-02 | U | 8.0E-02 | | 6.0E-02 | U | 4.4E-03 | U |
| Benzo(k)fluoranthene | 0.01 | | 4.4E-02 | U | 2.0E-02 | U | 3.8E-02 | U | 9.0E-02 | U | 6.4E-02 | J | 6.0E-02 | U | 4.4E-03 | U |
| Chrysene | 0.001 | | 1.9E-02 | J | 2.0E-02 | U | 8.2E-02 | | 1.1E-01 | J | 2.1E-01 | | 4.4E-02 | J | 4.4E-03 | U |
| Dibenzo(a,h)anthracene | 1 | | 4.4E-02 | U | 2.0E-02 | U | 3.8E-02 | U | 9.0E-02 | U | 9.5E-02 | U | 6.0E-02 | U | 4.4E-03 | U |
| Fluoranthene | | | 7.9E-02 | J | 1.8E-01 | | 1.1E+00 | | 1.3E+00 | | 3.4E+00 | | 1.9E-01 | | 3.3E-03 | J |
| Fluorene | | | 2.1E-02 | J | 9.1E-02 | | 2.8E-01 | | 1.4E+00 | | 3.7E+00 | | 2.9E-01 | | 3.1E-03 | J |
| Indeno(1,2,3-cd)pyrene | 0.1 | | 4.4E-02 | U | 2.0E-02 | U | 3.8E-02 | U | 9.0E-02 | U | 9.5E-02 | U | 6.0E-02 | U | 4.4E-03 | U |
| Naphthalene | | | 4.4E-02 | U | 2.1E-02 | J | 4.6E-01 | | 1.4E+00 | | 2.3E+00 | | 1.7E-01 | | 3.1E-03 | J |
| Phenanthrene | | | 7.6E-02 | J | 2.6E-01 | | 7.4E-01 | | 2.2E+00 | | 6.8E+00 | | 3.5E-01 | | 6.1E-03 | J |
| Pyrene | | | 9.8E-02 | | 1.3E-01 | | 3.6E-01 | | 7.6E-01 | | 1.6E+00 | | 3.7E-01 | | 4.4E-03 | U |
| Pentachlorophenol | | | | | | | | | | | | | | | | |
| **Total PAH** | | | **3.87E-01** | | **8.96E-01** | | **4.10E+00** | | **9.97E+00** | | **2.56E+01** | | **2.04E+00** | | **2.00E-02** | |
| **BaP-TE** | | | **9.98E-02** | | **4.56E-02** | | **1.59E-01** | | **2.10E-01** | | **2.56E-01** | | **1.35E-01** | | **1.01E-02** | |
| **Dioxins (ug/kg)** | mamm | avian | | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 0.01 | 0.01 | 5.6E-03 | | 3.5E-03 | | 8.1E-03 | | 4.8E-03 | | 1.1E-02 | | 1.2E-02 | | 1.2E-03 | J |
| 1,2,3,4,6,7,8-HpCDF | 0.01 | 0.01 | 6.9E-04 | U | 9.5E-04 | J | 1.8E-03 | | 1.3E-03 | J | 3.4E-03 | | 3.5E-03 | | 2.6E-04 | J |
| 1,2,3,4,7,8,9-HpCDF | 0.01 | 0.01 | 7.3E-05 | U | 8.9E-05 | U | 1.3E-04 | U | 8.5E-05 | U | 4.2E-04 | | 3.7E-04 | J | 2.1E-05 | U |
| 1,2,3,4,7,8-HxCDD | 0.1 | 0.1 | 1.4E-04 | U | 1.9E-04 | U | 1.8E-04 | U | 2.7E-04 | J | 3.2E-04 | | 3.8E-04 | J | 5.9E-05 | U |
| 1,2,3,4,7,8-HxCDF | 0.1 | 0.1 | 6.2E-04 | J | 5.0E-04 | J | 8.9E-04 | J | 9.7E-04 | J | 1.3E-03 | | 1.6E-03 | J | 5.3E-05 | U |
| 1,2,3,6,7,8-HxCDD | 0.1 | 0.1 | 7.7E-04 | J | 7.4E-04 | J | 1.4E-03 | J | 1.5E-03 | J | 2.0E-03 | | 2.1E-03 | J | 3.0E-04 | J |
| 1,2,3,6,7,8-HxCDF | 0.1 | 0.1 | 2.8E-04 | J | 2.0E-04 | J | 3.2E-04 | J | 5.4E-04 | J | 2.5E-04 | U | 1.1E-03 | J | 7.6E-05 | U |
| 1,2,3,7,8,9-HxCDD | 0.1 | 0.1 | 1.3E-04 | U | 1.8E-04 | U | 1.3E-04 | U | 3.1E-04 | J | 3.7E-04 | | 4.5E-04 | J | 4.6E-05 | U |
| 1,2,3,7,8,9-HxCDF | 0.1 | 0.1 | 6.4E-05 | U | 5.8E-05 | U | 6.0E-05 | U | 4.0E-05 | U | 8.0E-05 | U | 7.5E-05 | U | 1.6E-05 | U |
| 1,2,3,7,8-PeCDD | 1 | 1 | 7.2E-05 | U | 8.7E-05 | U | 1.2E-04 | U | 3.8E-04 | J | 1.8E-04 | U | 4.8E-04 | J | 1.4E-04 | J |
| 1,2,3,7,8-PeCDF | 0.03 | 0.05 | 2.1E-04 | J | 1.4E-04 | U | 2.2E-04 | J | 3.7E-04 | J | 4.6E-04 | | 5.0E-04 | J | 3.6E-05 | U |
| 2,3,4,6,7,8-HxCDF | 0.1 | 0.1 | 1.8E-04 | J | 8.3E-05 | U | 2.3E-04 | J | 1.3E-04 | U | 3.2E-04 | | 4.6E-04 | J | 6.2E-05 | J |
| 2,3,4,7,8-PeCDF | 0.3 | 0.5 | 2.5E-04 | J | 1.3E-04 | U | 5.1E-04 | J | 7.2E-04 | J | 9.3E-04 | | 9.9E-04 | J | 1.3E-04 | J |
| 2,3,7,8-TCDD | 1 | 1 | 6.1E-05 | U | 7.1E-05 | U | 7.2E-05 | U | 9.4E-05 | U | 1.9E-04 | | 2.0E-04 | J | 3.6E-05 | U |
| 2,3,7,8-TCDF | 0.1 | 0.1 | 7.9E-05 | U | 1.0E-04 | U | 5.4E-05 | U | 3.6E-04 | J | 3.1E-04 | | 3.8E-04 | J | 1.7E-04 | J |
| OCDD | 0.0003 | 0.0001 | 3.3E-02 | | 2.3E-02 | | 5.6E-02 | | 2.3E-02 | | 1.1E-01 | | 8.3E-02 | | 4.6E-03 | B |
| OCDF | 0.0003 | 0.0001 | 3.1E-03 | J | 2.2E-03 | J | 4.8E-03 | | 2.8E-03 | J | 1.1E-02 | | 7.0E-03 | | 2.7E-04 | J |
| **2,3,7,8-TCDD TEQ (mamm)** | | | **5.2E-04** | | **4.6E-04** | | **8.0E-04** | | **1.2E-03** | | **1.3E-03** | | **1.8E-03** | | **3.1E-04** | J |
| **2,3,7,8-TCDD TEQ (avian)** | | | **5.6E-04** | | **4.8E-04** | | **8.9E-04** | | **1.3E-03** | | **1.5E-03** | | **2.0E-03** | | **3.4E-04** | J |
| **Miscellaneous** | | | | | | | | | | | | | | | | |
| Percent Lipids (%) | | | 1.56 | | 1.38 | | 1.16 | | 1.77 | | 1.61 | | 3.14 | | 6.16 | |

Notes:
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (1998) TEFs for mammals, assuming 1/2 the sample-specific estimated detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimated detection limit.

Penta/PAH data qualifiers:
U - Analyte not detected above reporting limit. Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 of the estimated detection limit)
B- Analyte detected in Method Blank.
OCDD detected in FS-REF and FLY-REF blank at 3.47E-4 ug/kg.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Table 2-5**
**Summary of Insect Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| **Sample ID**<br>**Sample Date**<br>**Sample Total Weight** | **TEFs** | | **FLY-1**<br>**7/15/05**<br>**17g** | | **FLY-2**<br>**6/7/05**<br>**25g** | | **FLY-3**<br>**7/14/05**<br>**25g** | | **FLY-4**<br>**7/14/05**<br>**25g** | | **FLY-REF**<br>**7/13/05**<br>**25g** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PAH and Penta (mg/kg)** | | | | | | | | | | | | |
| Acenaphthene | | | 3.0E-02 | J | 2.0E-02 | U | 8.0E-02 | U | 1.2E-01 | U | 1.6E-01 | U |
| Acenaphthylene | | | 5.4E-01 | | 2.0E-02 | U | 8.0E-02 | U | 1.2E-01 | U | 1.6E-01 | U |
| Anthracene | | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U | 1.2E-01 | U | 1.6E-01 | U |
| Benzo(a)anthracene | 0.1 | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U | 1.2E-01 | U | 1.6E-01 | U |
| Benzo(a)pyrene | 1 | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U | 1.2E-01 | U | 1.6E-01 | U |
| Benzo(b)fluoranthene | 0.1 | | 5.3E-02 | j | 2.0E-02 | U | 8.0E-02 | U | 1.2E-01 | U | 1.6E-01 | U |
| Benzo(ghi)perylene | | | 7.5E-02 | U | 2.0E-02 | U | 8.0E-02 | U | 1.2E-01 | U | 1.6E-01 | U |
| Benzo(k)fluoranthene | 0.01 | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U | 1.2E-01 | U | 1.6E-01 | U |
| Chrysene | 0.001 | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U | 1.2E-01 | U | 1.6E-01 | U |
| Dibenzo(a,h)anthracene | 1 | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U | 1.2E-01 | U | 1.6E-01 | U |
| Fluoranthene | | | 2.2E-01 | | 2.0E-02 | U | 4.3E-01 | | 2.3E-01 | J | 1.6E-01 | U |
| Fluorene | | | 2.6E-02 | J | 2.0E-02 | U | 8.0E-02 | U | 1.2E-01 | U | 1.6E-01 | U |
| Indeno(1,2,3-cd)pyrene | 0.1 | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U | 1.2E-01 | U | 1.6E-01 | U |
| Naphthalene | | | 1.5E-01 | | 2.0E-02 | U | 4.3E-02 | J | 1.2E-01 | U | 1.6E-01 | U |
| Phenanthrene | | | 8.3E-02 | J | 2.0E-02 | U | 8.5E-02 | J | 1.2E-01 | U | 1.6E-01 | U |
| Pyrene | | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U | 1.2E-01 | U | 1.6E-01 | U |
| Pentachlorophenol | | | | | | | | | | | | |
| **Total PAH** | | | **1.1E+00** | | **ND** | | **5.6E-01** | | **2.3E-01** | | **ND** | **U** |
| **BaP-TE** | | | **1.4E-01** | | **4.6E-02** | | **1.8E-01** | | **2.8E-01** | | **3.7E-01** | **U** |
| **Dioxins (ug/kg)** | mamm | avian | | | | | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 0.01 | 0.01 | 1.1E-02 | | 1.1E-01 | | 2.1E-02 | | 1.9E-02 | | 1.4E-02 | |
| 1,2,3,4,6,7,8-HpCDF | 0.01 | 0.01 | 3.2E-03 | J | 1.6E-02 | | 4.5E-03 | | 5.4E-03 | | 3.6E-03 | |
| 1,2,3,4,7,8,9-HpCDF | 0.01 | 0.01 | 1.5E-04 | U | 7.8E-05 | U | 7.0E-05 | U | 2.5E-04 | J | 1.7E-04 | U |
| 1,2,3,4,7,8-HxCDD | 0.1 | 0.1 | 2.9E-04 | J | 1.1E-03 | J | 4.4E-04 | J | 5.0E-04 | J | 3.6E-04 | J |
| 1,2,3,4,7,8-HxCDF | 0.1 | 0.1 | 4.3E-04 | J | 2.2E-03 | J | 8.7E-04 | J | 7.0E-04 | J | 4.9E-04 | J |
| 1,2,3,6,7,8-HxCDD | 0.1 | 0.1 | 1.0E-03 | J | 7.4E-03 | | 1.8E-03 | J | 1.4E-03 | J | 1.2E-03 | J |
| 1,2,3,6,7,8-HxCDF | 0.1 | 0.1 | 2.4E-04 | J | 6.3E-04 | J | 4.6E-04 | J | 3.7E-04 | J | 3.1E-04 | J |
| 1,2,3,7,8,9-HxCDD | 0.1 | 0.1 | 4.0E-04 | J | 1.0E-03 | J | 6.4E-04 | J | 7.9E-04 | J | 4.9E-04 | J |
| 1,2,3,7,8,9-HxCDF | 0.1 | 0.1 | 4.0E-05 | U | 4.4E-05 | U | 6.4E-05 | U | 7.9E-05 | U | 8.3E-05 | U |
| 1,2,3,7,8-PeCDD | 1 | 1 | 2.5E-04 | J | 3.7E-04 | J | 1.6E-04 | U | 3.1E-04 | J | 1.9E-04 | U |
| 1,2,3,7,8-PeCDF | 0.03 | 0.05 | 2.1E-04 | U | 7.2E-04 | J | 2.5E-04 | J | 2.5E-04 | J | 1.0E-04 | U |
| 2,3,4,6,7,8-HxCDF | 0.1 | 0.1 | 2.6E-04 | J | 8.5E-04 | J | 4.1E-04 | J | 4.1E-04 | J | 3.5E-04 | J |
| 2,3,4,7,8-PeCDF | 0.3 | 0.5 | 1.9E-04 | U | 6.8E-04 | J | 2.0E-04 | U | 3.3E-04 | J | 2.5E-04 | J |
| 2,3,7,8-TCDD | 1 | 1 | 1.4E-04 | U | 2.3E-04 | J | 9.8E-05 | U | 1.0E-04 | U | 5.0E-05 | U |
| 2,3,7,8-TCDF | 0.1 | 0.1 | 1.7E-04 | U | 9.8E-04 | | 2.5E-04 | J | 2.5E-04 | J | 1.1E-04 | U |
| OCDD | 0.0003 | 0.0001 | 5.6E-02 | | 5.8E-01 | | 1.0E-01 | | 8.7E-02 | | 7.0E-02 | B |
| OCDF | 0.0003 | 0.0001 | 3.3E-03 | J | 1.1E-03 | J | 6.0E-03 | | 4.6E-03 | J | 3.6E-03 | J |
| **2,3,7,8-TCDD TEQ (mamm)** | | | **9.0E-04** | | **3.7E-03** | | **1.1E-03** | | **1.2E-03** | | **NA** | |
| **2,3,7,8-TCDD TEQ (avian)** | | | **9.3E-04** | | **3.7E-03** | | **1.1E-03** | | **1.3E-03** | | **NA** | |
| **Miscellaneous** | | | | | | | | | | | | |
| Percent Lipids (%) | | | 3.38 | | 1.67 | | 0.892 | | 1.02 | | 1.83 | |

Notes:
ND: individual PAHs were all Non-detect
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (1998) TEFs for mammals, assuming 1/2 the sample-specific estimated detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimated detection limit.

Penta/PAH data qualifiers:
U - Analyte not detected above reporting limit. Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 the estimated maximum possible concentration or
B- Analyte detected in Method Blank.
OCDD detected in FS-REF and FLY-REF blank at 3.47E-4 ug/kg.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Table 2-6**
**Sediment Data Summary Statistics**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | number analyzed | number detected | FOD | minimum detected | maximum detected | maximum sample ID | average* |
|---|---|---|---|---|---|---|---|
| **Analytes** | | | | | | | |
| **PAH and Penta (mg/kg)** | | | | | | | |
| Acenaphthene | 8 | 8 | 100% | 1.3E+00 | 9.3E+01 | SED-R5 | 2.4E+01 |
| Acenaphthylene | 8 | 8 | 100% | 1.2E-01 | 3.6E+00 | SED-R2 | 1.1E+00 |
| Anthracene | 8 | 8 | 100% | 2.6E+00 | 1.4E+02 | SED-R5 | 4.1E+01 |
| Benzo(a)anthracene | 8 | 8 | 100% | 2.4E+00 | 6.6E+01 | SED-R2 | 2.1E+01 |
| Benzo(a)pyrene | 8 | 8 | 100% | 9.4E-01 | 2.7E+01 | SED-R2 | 8.4E+00 |
| Benzo(b)fluoranthene | 8 | 8 | 100% | 1.6E+00 | 3.6E+01 | SED-R2 | 1.2E+01 |
| Benzo(ghi)perylene | 8 | 8 | 100% | 3.3E-01 | 1.0E+01 | SED-R2 | 3.3E+00 |
| Benzo(k)fluoranthene | 8 | 8 | 100% | 4.3E-01 | 1.6E+01 | SED-R2 | 4.6E+00 |
| Chrysene | 8 | 8 | 100% | 2.9E+00 | 6.0E+01 | SED-R2 & SED-R5 | 2.5E+01 |
| Dibenzo(a,h)anthracene | 8 | 8 | 100% | 9.8E-02 | 2.9E+00 | SED-R2 | 9.3E-01 |
| Fluoranthene | 8 | 8 | 100% | 1.1E+01 | 2.7E+02 | SED-R2 | 8.9E+01 |
| Fluorene | 8 | 8 | 100% | 1.4E+00 | 8.4E+01 | SED-R5 | 2.3E+01 |
| Indeno(1,2,3-cd)pyrene | 8 | 8 | 100% | 3.2E-01 | 9.6E+00 | SED-R2 | 3.1E+00 |
| Naphthalene | 8 | 8 | 100% | 2.9E-01 | 1.4E+02 | SED-R5 | 2.2E+01 |
| Phenanthrene | 8 | 8 | 100% | 7.0E+00 | 2.4E+02 | SED-R5 | 8.4E+01 |
| Pyrene | 8 | 8 | 100% | 7.9E+00 | 2.1E+02 | SED-R2 | 6.7E+01 |
| Pentachlorophenol | 8 | 0 | 0% | NA | NA | NA | 2.5E-01 |
| **Total PAH** | 8 | 8 | 100% | 4.6E+01 | 1.2E+03 | SED-R5 | 4.3E+02 |
| **BaP-TE** | 8 | 8 | 100% | 1.5E+00 | 4.1E+01 | SED-R2 | 1.3E+01 |
| **PCDDs/PCDFs (ug/kg)** | | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 8 | 8 | 100% | 1.1E-02 | 3.1E+00 | SED-R2 | 1.2E+00 |
| 1,2,3,4,6,7,8-HpCDF | 8 | 8 | 100% | 2.8E-03 | 7.9E-01 | SED-R2 | 3.1E-01 |
| 1,2,3,4,7,8,9-HpCDF | 8 | 7 | 88% | 3.9E-03 | 4.5E-02 | SED-R2 | 2.3E-02 |
| 1,2,3,4,7,8-HxCDD | 8 | 7 | 88% | 5.6E-04 | 1.4E-02 | SED-R2 | 3.6E-03 |
| 1,2,3,4,7,8-HxCDF | 8 | 7 | 88% | 4.1E-03 | 5.9E-02 | SED-R2 | 2.4E-02 |
| 1,2,3,6,7,8-HxCDD | 8 | 8 | 100% | 4.5E-04 | 8.6E-02 | SED-R2 | 3.3E-02 |
| 1,2,3,6,7,8-HxCDF | 8 | 7 | 88% | 1.6E-03 | 1.7E-02 | SED-R6 | 7.1E-03 |
| 1,2,3,7,8,9-HxCDD | 8 | 7 | 88% | 1.2E-03 | 1.2E-02 | SED-R2 | 5.7E-03 |
| 1,2,3,7,8,9-HxCDF | 8 | 7 | 88% | 9.9E-04 | 9.8E-03 | SED-R6 | 4.7E-03 |
| 1,2,3,7,8-PeCDD | 8 | 5 | 63% | 8.6E-04 | 1.6E-03 | SED-R2 | 7.5E-04 |
| 1,2,3,7,8-PeCDF | 8 | 7 | 88% | 3.8E-04 | 3.1E-03 | SED-R6 | 1.7E-03 |
| 2,3,4,6,7,8-HxCDF | 8 | 7 | 88% | 1.5E-03 | 1.5E-02 | SED-R2 | 7.4E-03 |
| 2,3,4,7,8-PeCDF | 8 | 7 | 88% | 7.0E-04 | 7.6E-03 | SED-R6 | 3.7E-03 |
| 2,3,7,8-TCDD | 8 | 2 | 25% | 2.9E-04 | 4.4E-04 | SED-R2 | 1.9E-04 |
| 2,3,7,8-TCDF | 8 | 7 | 88% | 1.3E-04 | 8.1E-04 | SED-R6 | 4.9E-04 |
| OCDD | 8 | 8 | 100% | 9.9E-02 | 3.4E+01 | SED-R2 | 1.3E+01 |
| OCDF | 8 | 8 | 100% | 1.6E-02 | 4.6E+00 | SED-R2 | 1.7E+00 |
| **2,3,7,8-TCDD TEQ (avian)** | 8 | 8 | 100% | 4.8E-04 | 6.9E-02 | SED-R2 | 2.8E-02 |
| **2,3,7,8-TCDD TEQ (mamm)** | 8 | 8 | 100% | 4.9E-04 | 7.6E-02 | SED-R2 | 3.0E-02 |

Notes:
FOD: Frequency if Detection
non detects are at half detection limit
*average calculated using 1/2 the reporting limit for non-detect results.
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (1998) TEFs for mammals, assuming 1/2 the sample-specific estimated detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimated detection limit.
NA: Not Applicable
Statistics do not include reference sample(s).

**Table 2-7**
**Soil Data Summary Statistics**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | number analyzed | number detected | FOD | minimum detected | maximum detected | maximum sample ID | average* |
|---|---|---|---|---|---|---|---|
| **Analytes** | | | | | | | |
| **Penta and PAHs (mg/kg)** | | | | | | | |
| Acenaphthene | 24 | 12 | 50% | 1.3E-02 | 1.6E-01 | T15 Comp | 1.6E-01 |
| Acenaphthylene | 24 | 20 | 83% | 1.7E-02 | 1.1E+00 | SOIL-T23 | 2.4E-01 |
| Anthracene | 24 | 20 | 83% | 2.1E-02 | 2.1E+00 | SOIL-T24 Comp | 3.7E-01 |
| Benzo(a)anthracene | 24 | 22 | 92% | 1.9E-02 | 6.6E-01 | SOIL-T23 | 1.5E-01 |
| Benzo(a)pyrene | 24 | 23 | 96% | 1.3E-02 | 2.1E+00 | SOIL-T24 Comp | 3.1E-01 |
| Benzo(b)fluoranthene | 24 | 23 | 96% | 2.2E-02 | 2.2E+00 | SOIL-T24 Comp | 3.8E-01 |
| Benzo(g,h,i)perylene | 24 | 23 | 96% | 1.5E-02 | 2.8E+00 | SOIL-T24 Comp | 6.0E-01 |
| Benzo(k)fluoranthene | 24 | 20 | 83% | 1.4E-02 | 8.4E-01 | SOIL-T24 Comp | 1.6E-01 |
| Chrysene | 24 | 23 | 96% | 1.8E-02 | 3.6E+00 | SOIL-T24 Comp | 4.7E-01 |
| Dibenzo(a,h)anthracene | 23 | 16 | 70% | 1.7E-02 | 4.8E-01 | SOIL-T24 Comp | 1.8E-01 |
| Fluoranthene | 24 | 22 | 92% | 1.1E-02 | 5.7E-01 | SOIL-T24 Comp | 1.5E-01 |
| Fluorene | 24 | 15 | 63% | 2.2E-02 | 1.8E-01 | T15 Comp | 1.4E-01 |
| Indeno(1,2,3-cd)Pyrene | 24 | 23 | 96% | 1.3E-02 | 2.4E+00 | SOIL-T24 Comp | 5.2E-01 |
| Naphthalene | 24 | 14 | 58% | 1.4E-02 | 6.5E-01 | SOIL-T24 Comp | 1.6E-01 |
| Phenanthrene | 24 | 20 | 83% | 1.4E-02 | 2.8E-01 | SOIL-T23 | 1.0E-01 |
| Pyrene | 24 | 22 | 92% | 2.5E-02 | 5.5E-01 | SOIL-T24 Comp | 1.4E-01 |
| Pentachlorophenol | 24 | 0 | 0% | NA | NA | NA | 1.4E+00 |
| **Total PAHs** | 23 | 23 | 100% | 1.2E-01 | 2.0E+01 | SOIL-T24 Comp | 3.6E+00 |
| **BaP-TE** | 23 | 23 | 100% | 2.2E-02 | 3.1E+00 | SOIL-T24 Comp | 5.2E-01 |
| **PCDDs/PCDFs (ug/kg)** | | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 24 | 24 | 100% | 9.9E-03 | 6.3E+00 | SOIL-T1 | 1.3E+00 |
| 1,2,3,4,6,7,8-HPCDF | 24 | 24 | 100% | 1.4E-03 | 2.3E+00 | SOIL-T1 | 3.7E-01 |
| 1,2,3,4,7,8,9-HPCDF | 24 | 23 | 96% | 3.1E-04 | 1.6E-01 | SOIL-T24 Comp | 3.4E-02 |
| 1,2,3,4,7,8-HxCDD | 24 | 23 | 96% | 1.7E-04 | 2.0E-02 | SOIL-T23 | 4.7E-03 |
| 1,2,3,4,7,8-HxCDF | 24 | 24 | 100% | 1.8E-04 | 1.8E-01 | SOIL-T24 Comp | 3.6E-02 |
| 1,2,3,6,7,8-HxCDD | 24 | 23 | 96% | 3.6E-04 | 2.1E-01 | SOIL-T1 | 4.0E-02 |
| 1,2,3,6,7,8-HxCDF | 24 | 24 | 100% | 1.9E-04 | 5.3E-02 | SOIL-T9 | 1.2E-02 |
| 1,2,3,7,8,9-HxCDD | 24 | 24 | 100% | 2.6E-04 | 3.5E-02 | SOIL-T23 | 8.6E-03 |
| 1,2,3,7,8,9-HxCDF | 24 | 23 | 96% | 1.4E-04 | 4.4E-02 | SOIL-T24 Comp | 9.0E-03 |
| 1,2,3,7,8-PeCDD | 24 | 23 | 96% | 1.7E-04 | 6.1E-03 | SOIL-T23 | 1.4E-03 |
| 1,2,3,7,8-PeCDF | 24 | 23 | 96% | 1.5E-04 | 1.4E-02 | SOIL-T23 | 3.0E-03 |
| 2,3,4,6,7,8-HxCDF | 24 | 24 | 100% | 1.5E-04 | 6.0E-02 | SOIL-T23 | 1.3E-02 |
| 2,3,4,7,8-PeCDF | 24 | 23 | 96% | 3.2E-04 | 3.4E-02 | SOIL-T9 | 6.9E-03 |
| 2,3,7,8-TCDD | 24 | 14 | 58% | 1.4E-04 | 9.8E-04 | SOIL-T23 | 2.5E-04 |
| 2,3,7,8-TCDF | 24 | 24 | 100% | 1.2E-04 | 3.5E-03 | SOIL-T9 | 6.6E-04 |
| OCDD | 24 | 24 | 100% | 8.2E-02 | 7.4E+01 | SOIL-T24 Comp | 1.5E+01 |
| OCDF | 24 | 24 | 100% | 3.6E-03 | 1.1E+01 | SOIL-T1 | 1.6E+00 |
| Total HpCDD | 24 | 24 | 100% | 3.0E-02 | 1.1E+01 | SOIL-T24 Comp | 2.5E+00 |
| Total HpCDF | 24 | 24 | 100% | 3.8E-03 | 1.1E+01 | SOIL-T1 | 1.9E+00 |
| Total HxCDD | 24 | 24 | 100% | 6.8E-03 | 8.1E-01 | SOIL-T24 Comp | 2.0E-01 |
| Total HxCDF | 24 | 24 | 100% | 2.8E-03 | 2.7E+00 | SOIL-T24 Comp | 6.3E-01 |
| Total PeCDD | 24 | 24 | 100% | 3.8E-03 | 4.9E-02 | SOIL-T23 | 1.5E-02 |
| Total PeCDF | 24 | 24 | 100% | 2.2E-03 | 4.8E-01 | SOIL-T9 | 9.5E-02 |
| Total TCDD | 24 | 24 | 100% | 3.6E-03 | 1.3E-02 | SOIL-T1 | 8.7E-03 |
| Total TCDF | 24 | 24 | 100% | 2.0E-03 | 1.3E-01 | SOIL-T9 | 2.4E-02 |
| 2,3,7,8-TCDD TEQ (mamm) | 24 | 24 | 100% | 4.2E-04 | 1.7E-01 | SOIL-T24 Comp | 3.8E-02 |
| 2,3,7,8-TCDD TEQ (avian) | 24 | 24 | 100% | 4.2E-04 | 1.6E-01 | SOIL-T23 | 3.6E-02 |
| **Miscellaneous** | | | | | | | |
| Percent Solids (%) | 24 | 24 | 100% | 47.7 | 72.3 | SOIL-T19 | 59.2 |
| Total Organic Carbon (mg/kg) | 24 | 24 | 100% | 15100 | 97800 | SOIL-T20 | 34600 |

Notes:
FOD: Frequency if Detection
non detects are at half detection limit
*average calculated using 1/2 the reporting limit for non-detect results.
NA: Not Applicable
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (1998) TEFs for mammals, assuming 1/2 the sample-specific estimated detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimated detection limit.
Statistics do not include reference sample(s).

**Table 2-8**
**Surface Water Summary Statistics**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Analytes | number analyzed | number detected | FOD | minimum detected | maximum detected | maximum sample ID | average* |
|---|---|---|---|---|---|---|---|
| **PAH and Penta (ug/L)** | | | | | | | |
| Acenaphthene | 9 | 0 | 0% | NA | NA | NA | 1.5E+00 |
| Acenaphthylene | 9 | 0 | 0% | NA | NA | NA | 1.5E+00 |
| Anthracene | 9 | 1 | 11% | 1.6E-01 | 1.6E-01 | SW-06-06/13/1996 | 8.8E-01 |
| Benzo(a)anthracene | 9 | 0 | 0% | NA | NA | NA | 8.4E-01 |
| Benzo(a)pyrene | 9 | 2 | 22% | 4.0E-02 | 1.0E-01 | SW-06-06/13/1996 | 8.5E-01 |
| Benzo(b)fluoranthene | 9 | 5 | 56% | 3.3E-02 | 2.7E-01 | W2 8/9/1999 | 6.3E-01 |
| Benzo(g,h,i)perylene | 9 | 0 | 0% | NA | NA | NA | 8.5E-01 |
| Benzo(k)fluoranthene | 9 | 2 | 22% | 4.2E-02 | 6.6E-02 | SW-06-06/13/1996 | 8.5E-01 |
| Chrysene | 9 | 0 | 0% | NA | NA | NA | 8.9E-01 |
| Dibenzo(a,h)anthracene | 9 | 0 | 0% | NA | NA | NA | 8.4E-01 |
| Fluoranthene | 9 | 1 | 11% | 2.3E-01 | 2.3E-01 | SW-09-06/12/1996 | 9.1E-01 |
| Fluorene | 9 | 0 | 0% | NA | NA | NA | 9.0E-01 |
| Indeno(1,2,3-cd)pyrene | 9 | 1 | 11% | 6.6E-02 | 6.6E-02 | SW-06-06/13/1996 | 8.6E-01 |
| Naphthalene | 9 | 0 | 0% | NA | NA | NA | 1.5E+00 |
| Pentachlorophenol | 9 | 2 | 22% | 7.5E-02 | 4.1E-01 | W1 8/9/1999 | 2.5E-01 |
| Phenanthrene | 9 | 0 | 0% | NA | NA | NA | 1.0E+00 |
| Pyrene | 9 | 0 | 0% | NA | NA | NA | 9.0E-01 |
| **Total PAHs** | 5 | 5 | 100% | 4.4E-02 | 6.5E-01 | SW-06-06/13/1996 | 2.7E-01 |
| **BAP-TE** | 9 | 9 | 100% | 3.3E-02 | 5.8E+00 | SW-08-06/12/1996 | 1.9E+00 |

Notes:
FOD: Frequency of Detection
non detects are at half detection limit
*average calculated using 1/2 the reporting limit for non-detect results.
NA: Not Applicable
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.

**Table 2-9**
**Fish Data Summary Statistics**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Analytes | number analyzed | number detected | FOD | minimum detected | maximum detected | maximum sample ID | average* |
|---|---|---|---|---|---|---|---|
| **PAH and Penta (ug/L)** | | | | | | | |
| Acenaphthene | 6 | 6 | 100% | 4.0E-02 | 5.8E+00 | FS-R5 | 1.6E+00 |
| Acenaphthylene | 6 | 2 | 33% | 1.6E-02 | 8.5E-02 | FS-R5 | 5.3E-02 |
| Anthracene | 6 | 6 | 100% | 2.9E-02 | 1.0E+00 | FS-R5 | 2.7E-01 |
| Benzo(a)anthracene | 6 | 5 | 83% | 2.5E-02 | 2.0E-01 | FS-R5 | 9.2E-02 |
| Benzo(a)pyrene | 6 | 2 | 33% | 8.1E-02 | 1.1E-01 | FS-R5 | 6.8E-02 |
| Benzo(b)fluoranthene | 6 | 3 | 50% | 1.4E-02 | 2.1E-01 | FS-R5 | 1.0E-01 |
| Benzo(ghi)perylene | 6 | 2 | 33% | 3.3E-02 | 8.0E-02 | FS-R5 | 5.5E-02 |
| Benzo(k)fluoranthene | 6 | 1 | 17% | 6.4E-02 | 6.4E-02 | FS-R5 | 5.3E-02 |
| Chrysene | 6 | 5 | 83% | 1.9E-02 | 2.1E-01 | FS-R5 | 8.1E-02 |
| Dibenzo(a,h)anthracene | 6 | 0 | 0% | NA | NA | NA | 5.8E-02 |
| Fluoranthene | 6 | 6 | 100% | 7.9E-02 | 3.4E+00 | FS-R5 | 1.0E+00 |
| Fluorene | 6 | 6 | 100% | 2.1E-02 | 3.7E+00 | FS-R5 | 9.6E-01 |
| Indeno(1,2,3-cd)pyrene | 6 | 0 | 0% | NA | NA | NA | 5.8E-02 |
| Naphthalene | 6 | 5 | 83% | 2.1E-02 | 2.3E+00 | FS-R5 | 7.3E-01 |
| Phenanthrene | 6 | 6 | 100% | 7.6E-02 | 6.8E+00 | FS-R5 | 1.7E+00 |
| Pyrene | 6 | 6 | 100% | 9.8E-02 | 1.6E+00 | FS-R5 | 5.5E-01 |
| **Total PAH** | 6 | 6 | 100% | 3.9E-01 | 2.6E+01 | FS-R5 | 7.2E+00 |
| **BaP-te** | 6 | 6 | 100% | 4.6E-02 | 2.6E-01 | FS-R5 | 1.5E-01 |
| **Dioxins (ug/kg)** | | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 6 | 6 | 100% | 3.5E-03 | 1.2E-02 | FS-R6 | 7.5E-03 |
| 1,2,3,4,6,7,8-HpCDF | 6 | 5 | 83% | 9.5E-04 | 3.5E-03 | FS-R6 | 1.9E-03 |
| 1,2,3,4,7,8,9-HpCDF | 6 | 2 | 33% | 3.7E-04 | 4.2E-04 | FS-R5 & FS-R6 | 2.0E-04 |
| 1,2,3,4,7,8-HxCDD | 6 | 3 | 50% | 2.7E-04 | 3.8E-04 | FS-R6 | 2.5E-04 |
| 1,2,3,4,7,8-HxCDF | 6 | 6 | 100% | 5.0E-04 | 1.6E-03 | FS-R6 | 9.8E-04 |
| 1,2,3,6,7,8-HxCDD | 6 | 6 | 100% | 7.4E-04 | 2.1E-03 | FS-R6 | 1.4E-03 |
| 1,2,3,6,7,8-HxCDF | 6 | 5 | 83% | 2.0E-04 | 1.1E-03 | FS-R6 | 4.4E-04 |
| 1,2,3,7,8,9-HxCDD | 6 | 3 | 50% | 3.1E-04 | 4.5E-04 | FS-R5 & FS-R6 | 2.6E-04 |
| 1,2,3,7,8,9-HxCDF | 6 | 0 | 0% | NA | NA | NA | 6.3E-05 |
| 1,2,3,7,8-PeCDD | 6 | 2 | 33% | 3.8E-04 | 4.8E-04 | FS-R6 | 2.2E-04 |
| 1,2,3,7,8-PeCDF | 6 | 5 | 83% | 2.1E-04 | 5.0E-04 | FS-R5 & FS-R6 | 3.2E-04 |
| 2,3,4,6,7,8-HxCDF | 6 | 4 | 67% | 1.8E-04 | 4.6E-04 | FS-R6 | 2.3E-04 |
| 2,3,4,7,8-PeCDF | 6 | 5 | 83% | 2.5E-04 | 9.9E-04 | FS-R6 | 5.9E-04 |
| 2,3,7,8-TCDD | 6 | 2 | 33% | 1.9E-04 | 2.0E-04 | FS-R5 & FS-R6 | 1.1E-04 |
| 2,3,7,8-TCDF | 6 | 3 | 50% | 3.1E-04 | 3.8E-04 | FS-R6 | 2.1E-04 |
| OCDD | 6 | 6 | 100% | 2.3E-02 | 1.1E-01 | FS-R5 | 5.4E-02 |
| OCDF | 6 | 6 | 100% | 2.2E-03 | 1.1E-02 | FS-R5 | 5.1E-03 |
| **2,3,7,8-TCDD TEQ (mamm)** | 6 | 6 | 100% | 4.6E-04 | 1.8E-03 | FS-R6 | 1.0E-03 |
| **2,3,7,8-TCDD TEQ (avian)** | 6 | 6 | 100% | 4.8E-04 | 2.0E-03 | FS-R6 | 1.1E-03 |
| Percent Lipids | 6 | 6 | 100% | 1.16 | 3.14 | FS-R6 | 1.77 |

Notes:
FOD: Frequency of Detection
non detects are at half detection limit
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
Statistics do not include reference sample(s).
*average calculated using 1/2 the reporting limit for non-detect results.
NA: Not Applicable
Statistics do not include reference sample(s).

**Table 2-10**
**Insect Data Summary Statistics**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Analytes | number analyzed | number detected | FOD | minimum detected | maximum detected | maximum sample ID | average |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| **PAH and Penta (mg/kg)** | | | | | | | |
| Acenaphthene | 4 | 1 | 25% | 3.0E-02 | 3.0E-02 | FLY-1 | 6.3E-02 |
| Anthracene | 4 | 0 | 0% | NA | NA | NA | 7.0E-02 |
| Fluoranthene | 4 | 3 | 75% | 2.2E-01 | 4.3E-01 | FLY-3 | 2.3E-01 |
| Fluorene | 4 | 1 | 25% | 2.6E-02 | 2.6E-02 | FLY-1 | 6.2E-02 |
| Indeno(1,2,3-cd)pyrene | 4 | 0 | 0% | NA | NA | NA | 7.0E-02 |
| Naphthalene | 4 | 2 | 50% | 4.3E-02 | 1.5E-01 | FLY-1 | 8.3E-02 |
| Benzo(a)anthracene | 4 | 0 | 0% | NA | NA | NA | 7.0E-02 |
| Benzo(b)fluoranthene | 4 | 1 | 25% | 5.3E-02 | 5.3E-02 | FLY-1 | 6.8E-02 |
| Benzo(k)fluoranthene | 4 | 0 | 0% | NA | NA | NA | 7.0E-02 |
| Benzo(ghi)perylene | 4 | 0 | 0% | NA | NA | NA | 7.4E-02 |
| Benzo(a)pyrene | 4 | 0 | 0% | NA | NA | NA | 7.0E-02 |
| Phenanthrene | 4 | 2 | 50% | 8.3E-02 | 8.5E-02 | FLY-3 | 7.7E-02 |
| Pyrene | 4 | 0 | 0% | NA | NA | NA | 7.0E-02 |
| Dibenzo(a,h)anthracene | 4 | 0 | 0% | NA | NA | NA | 7.0E-02 |
| Acenaphthylene | 4 | 1 | 25% | 5.4E-01 | 5.4E-01 | FLY-1 | 1.9E-01 |
| Chrysene | 4 | 0 | 0% | NA | NA | NA | 7.0E-02 |
| | | | | | | | |
| Pentachlorophenol | 0 | 0 | 0% | NA | NA | NA | |
| | | | | | | | |
| **Total PAH** | 3 | 3 | 100% | 2.3E-01 | 1.1E+00 | FLY-4 | 6.3E-01 |
| **BaP-te** | 4 | 4 | 100% | 1.4E-01 | 1.4E-01 | FLY-1 | 1.6E-01 |
| **Dioxins (ug/kg)** | | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 4 | 4 | 100% | 1.1E-02 | 1.1E-01 | FLY-2 | 4.1E-02 |
| 1,2,3,4,6,7,8-HpCDF | 4 | 4 | 100% | 3.2E-03 | 1.6E-02 | FLY-2 | 7.4E-03 |
| 1,2,3,4,7,8,9-HpCDF | 4 | 1 | 25% | 2.5E-04 | 2.5E-04 | FLY-4 | 1.4E-04 |
| 1,2,3,4,7,8-HxCDD | 4 | 4 | 100% | 2.9E-04 | 1.1E-03 | FLY-2 | 5.7E-04 |
| 1,2,3,4,7,8-HxCDF | 4 | 4 | 100% | 4.3E-04 | 2.2E-03 | FLY-2 | 1.0E-03 |
| 1,2,3,6,7,8-HxCDD | 4 | 4 | 100% | 1.0E-03 | 7.4E-03 | FLY-2 | 2.9E-03 |
| 1,2,3,6,7,8-HxCDF | 4 | 4 | 100% | 2.4E-04 | 6.3E-04 | FLY-2 | 4.2E-04 |
| 1,2,3,7,8,9-HxCDD | 4 | 4 | 100% | 4.0E-04 | 1.0E-03 | FLY-2 | 7.2E-04 |
| 1,2,3,7,8,9-HxCDF | 4 | 0 | 0% | NA | NA | NA | 5.7E-05 |
| 1,2,3,7,8-PeCDD | 4 | 3 | 75% | 2.5E-04 | 3.7E-04 | FLY-2 | 2.7E-04 |
| 1,2,3,7,8-PeCDF | 4 | 3 | 75% | 2.5E-04 | 7.2E-04 | FLY-2 | 3.6E-04 |
| 2,3,4,6,7,8-HxCDF | 4 | 4 | 100% | 2.6E-04 | 8.5E-04 | FLY-2 | 4.8E-04 |
| 2,3,4,7,8-PeCDF | 4 | 2 | 50% | 3.3E-04 | 6.8E-04 | FLY-2 | 3.5E-04 |
| 2,3,7,8-TCDD | 4 | 1 | 25% | 2.3E-04 | 2.3E-04 | FLY-2 | 1.4E-04 |
| 2,3,7,8-TCDF | 4 | 3 | 75% | 2.5E-04 | 9.8E-04 | FLY-2 | 4.1E-04 |
| OCDD | 4 | 4 | 100% | 5.6E-02 | 5.8E-01 | FLY-2 | 2.0E-01 |
| OCDF | 4 | 4 | 100% | 1.1E-03 | 6.0E-03 | FLY-3 | 3.7E-03 |
| | | | | | | | |
| **2,3,7,8-TCDD TEQ (mamm)** | 4 | 4 | 100% | 9.0E-04 | 3.7E-03 | FLY-2 | 1.7E-03 |
| **2,3,7,8-TCDD TEQ (avian)** | 4 | 4 | 100% | 9.3E-04 | 3.7E-03 | FLY-2 | 1.8E-03 |
| | | | | | | | |
| Percent Lipids | 4 | 4 | 100% | 0.892 | 3.38 | | 1.7405 |

Notes:
FOD: Frequency of Detection
non detects are at half detection limit
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
*average calculated using 1/2 the reporting limit for non-detect results.
NA: Not Applicable
Statistics do not include reference sample(s).

**Table 2-11**
**List of Samples Representative of Exposure Area 1**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Media | Sample ID | Sample Date | Sample Depth |
|---|---|---|---|
| **Sediment** | See Table 2-12* | | |
| **Soil** | SOIL-T23 | 6/7/2005 | 0 - 0.5 |
| | SOIL-T24 | 6/6/2005 | 0 - 0.5 |
| | SOIL-T24 & Duplicate | 6/6/2005 | 0 - 0.5 |
| **Surface Water** | W1 | 8/9/1999 | NA |
| **Fish** | See Table 2-12* | | |
| **Insects** | FLY-4 | 7/14/2005 | NA |

Notes:
NA:Not applicable
*No samples collected in Exposure Area 1 within this medium

**Table 2-12**
**List of Samples Representative of Exposure Area 2**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Media | Sample ID | Sample Date | Sample Depth |
|---|---|---|---|
| **Sediment** | SED-R4 | 7/12/2005 | 0-3" |
| | SED-R5 | 7/13/2005 | 0-3" |
| | SED-R6 | 7/13/2005 | 0-3" |
| **Soil** | SOIL-T1 | 6/7/2005 | 0-6" |
| | SOIL-T10 | 6/7/2005 | 0-6" |
| | SOIL-T11 | 6/7/2005 | 0-6" |
| | SOIL-T12 | 6/7/2005 | 0-6" |
| | SOIL-T13 | 6/7/2005 | 0-6" |
| | SOIL-T14 | 6/6/2005 | 0-6" |
| | SOIL-T16 | 6/7/2005 | 0-6" |
| | SOIL-T17 | 6/7/2005 | 0-6" |
| | SOIL-T18 | 6/7/2005 | 0-6" |
| | SOIL-T19 | 6/6/2005 | 0-6" |
| | SOIL-T2 | 6/7/2005 | 0-6" |
| | SOIL-T20 | 6/6/2005 | 0-6" |
| | SOIL-T3 | 6/7/2005 | 0-6" |
| | SOIL-T4 | 6/7/2005 | 0-6" |
| | SOIL-T5 | 6/7/2005 | 0-6" |
| | SOIL-T6 | 6/7/2005 | 0-6" |
| | SOIL-T7 | 6/7/2005 | 0-6" |
| | SOIL-T8 | 6/7/2005 | 0-6" |
| | SOIL-T9 | 6/7/2005 | 0-6" |
| | T15 & Duplicate | 6/7/2005 | 0-6" |
| **Surface Water** | SW-06 | 6/13/1996 | NA |
| | SW-07 | 6/10/1996 | NA |
| | SW-08 | 6/12/1996 | NA |
| | SW-09 | 6/12/1996 | NA |
| | W2 | 8/9/1999 | NA |
| **Fish** | FS-R4 | 7/14/2005 | NA |
| | FS-R5 | 7/14/2005 | NA |
| | FS-R6 | 7/13/2005 | NA |
| **Insects** | FLY-1 | 7/15/2005 | NA |
| | FLY-2 | 6/7/2005 | NA |
| | FLY-3 | 7/14/2005 | NA |

Notes:
NA: Not Applicable

**Table 2-13**
**List of Samples Representative of Exposure Area 3**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Media | Sample ID | Sample Date | Sample Depth |
|---|---|---|---|
| **Sediment** | SED-R1 and Duplicate | 6/8/2005 | 0-3" |
| | SED-R1 | 7/12/2005 | 0-3" |
| | SED-R2 | 6/8/2005 | 0-3" |
| | SED-R2 | 7/12/2005 | 0-3" |
| | SED-R3 | 7/12/2005 | 0-3" |
| **Soil** | See Table 2-12* | | |
| **Surface Water** | SW-10 | 6/11/1996 | NA |
| | SW-11 | 6/11/1996 | NA |
| | W3 | 8/9/1999 | NA |
| **Fish** | FS-R1 | 7/14/2005 | NA |
| | FS-R2 | 7/14/2005 | NA |
| | FS-R3 | 7/14/2005 | NA |
| **Insects** | See Table 2-12* | | |

Notes:
NA:Not applicable
*No samples collected in Exposure Area 3 within this medium

**Table 2-14**
**Summary of Toxicity Values for HHERA**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Constituent | Chronic Oral RfD | | Oral CSF | |
|---|---|---|---|---|
| | mg/kg-day | Source | 1/(mg/kg-day) | Source |
| *PAHs* | | | | |
| Acenaphthene | 6.0E-02 | IRIS | NA | |
| Acenaphthylene | 2.0E-02 | (a) | NA | |
| Anthracene | 3.0E-01 | IRIS | NA | |
| Benzo(a)anthracene | 2.0E-02 | (a) | 7.30E-01 | (b) |
| Benzo(a)pyrene | 2.0E-02 | (a) | 7.3 | |
| Benzo(b)fluoranthene | 2.0E-02 | (a) | 7.30E-01 | (b) |
| Benzo(g,h,i)perylene | 2.0E-02 | (a) | NA | |
| Benzo(k)fluoranthene | 2.0E-02 | (a) | 7.30E-02 | (b) |
| Chrysene | 2.0E-02 | (a) | 7.30E-03 | (b) |
| Dibenz(a,h)anthracene | 2.0E-02 | (a) | 7.3 | (b) |
| Fluoranthene | 4.0E-02 | IRIS | NA | |
| Fluorene | 4.0E-02 | IRIS | NA | |
| Indeno(1,2,3-cd)pyrene | 2.0E-02 | (a) | 7.30E-01 | (b) |
| Naphthalene | 2.0E-02 | IRIS | NA | |
| Phenanthrene | 2.0E-02 | (a) | NA | |
| Pyrene | 3.0E-02 | IRIS | NA | |
| Pentachlorophenol | 3.0E-02 | IRIS | 1.20E-01 | IRIS |
| 2,3,7,8 - TCDD | NA | | 1.50E+05 | HEAST |

Sources:
IRIS: USEPA Integrated Risk Information System. On-Line Database. 2008 (USEPA, 2008)
HEAST: USEPA Health Effects Assessment Summary Tables. Fiscal Year 1997 (USEPA, 1997b)
Notes:
(a) Use naphthalene as a surrogate
(b) Potential carcinogenic risk evaluated as BAP-TE by applying CPF from USEPA (1993)
to the carcinogenic dose-response value for benzo(a)pyrene
NA: Not available

**Table 2-15**
**Human Health Toxic Equivalent Factors for PAH (BaP-TE)**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Constituent | CPF |
|---|---|
| Benzo(a)anthracene | 0.1 |
| Benzo(k)fluoranthene | 0.01 |
| Benzo(a)pyrene | 1 |
| Benzo(b)fluoranthene | 0.1 |
| Chrysene | 0.001 |
| Dibenzo(a,h)anthracene | 1 |
| Indeno(1,2,3-cd)pyrene | 0.1 |

Source: USEPA, 1993.

**Table 2-16**
**Toxic Equivalent Factors for Dioxin and Furan Congeners**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Constituent | WHO 2005 TEF |
|---|---|
| **Chlorinated Dibenzo-p-dioxins** | |
| 1,2,3,7,8-PeCDD | 1 |
| 1,2,3,4,7,8-HxCDD | 0.1 |
| 1,2,3,6,7,8-HxCDD | 0.1 |
| 1,2,3,7,8,9-HxCDD | 0.1 |
| 1,2,3,4,6,7,8-HpCDD | 0.01 |
| OCDD | 0.0003 |
| **Chlorinated Dibenzofurans** | |
| 2,3,7,8-TCDF | 0.1 |
| 1,2,3,7,8-PeCDF | 0.03 |
| 2,3,4,7,8-PeCDF | 0.3 |
| 1,2,3,4,7,8-HxCDF | 0.1 |
| 1,2,3,6,7,8-HxCDF | 0.1 |
| 1,2,3,7,8,9-HxCDF | 0.1 |
| 2,3,4,6,7,8-HxCDF | 0.1 |
| 1,2,3,4,6,7,8-HpCDF | 0.01 |
| 1,2,3,4,7,8,9-HpCDF | 0.01 |
| OCDF | 0.0003 |

Source: van den Berg et al., 2006.

**Table 2-17**
**AMEC-derived Absorption Adjustment Factors**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Constituent | Absorption Adjustment Factor (unitless) | | | |
|---|---|---|---|---|
| | Soil / Sediment | | Water | |
| | Oral | Dermal | Oral | Dermal |
| **PAHs (a)** | | | | |
| Acenaphthene | 1 | 0.1 | 1 | 1 |
| Acenaphthylene | 1 | 0.1 | 1 | 1 |
| Anthracene | 1 | 0.1 | 1 | 1 |
| Benzo(a)anthracene | 1 | 0.02 | 1 | 1 |
| Benzo(a)pyrene | 1 | 0.02 | 1 | 1 |
| Benzo(b)fluoranthene | 1 | 0.02 | 1 | 1 |
| Benzo(g,h,i)perylene | 1 | 0.1 | 1 | 1 |
| Benzo(k)fluoranthene | 1 | 0.02 | 1 | 1 |
| Chrysene | 1 | 0.02 | 1 | 1 |
| Dibenz(a,h)anthracene | 1 | 0.02 | 1 | 1 |
| Fluoranthene | 1 | 0.1 | 1 | 1 |
| Fluorene | 1 | 0.1 | 1 | 1 |
| Indeno(1,2,3-cd)pyrene | 1 | 0.02 | 1 | 1 |
| Naphthalene | 1 | 0.1 | 1 | 1 |
| Phenanthrene | 1 | 0.1 | 1 | 1 |
| Pyrene | 1 | 0.1 | 1 | 1 |
| Pentachlorophenol (b) | 1 | 0.03 | 1 | 1 |
| 2,3,7,8 - TCDD (c) | 1 | 0.04 | NA | NA |

Notes:
(a) See ARCADIS BBL (2007) for derivation of AAFs for PAHs
(b) See ARCADIS BBL (2007) for derivation of AAF for pentachlorophenol
(c) Value based on dermal absorption efficiency of 3% presented in USEPA (2002), adjusted by estimated oral absorption of 70%
NA: not applicable because not a COPC in this medium
USEPA AAF's are listed in Table 2-18

**Table 2-18**
**Absorption Adjustment Factors Requested by WDNR**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Constituent | Absorption Adjustment Factor (unitless) | | | |
|---|---|---|---|---|
| | Soil / Sediment | | Water | |
| | Oral | Dermal | Oral | Dermal |
| **PAHs** | | | | |
| Acenaphthene | 1 | 0.13 | 1 | 1 |
| Acenaphthylene | 1 | 0.13 | 1 | 1 |
| Anthracene | 1 | 0.13 | 1 | 1 |
| Benzo(a)anthracene | 1 | 0.13 | 1 | 1 |
| Benzo(a)pyrene | 1 | 0.13 | 1 | 1 |
| Benzo(b)fluoranthene | 1 | 0.13 | 1 | 1 |
| Benzo(g,h,i)perylene | 1 | 0.13 | 1 | 1 |
| Benzo(k)fluoranthene | 1 | 0.13 | 1 | 1 |
| Chrysene | 1 | 0.13 | 1 | 1 |
| Dibenz(a,h)anthracene | 1 | 0.13 | 1 | 1 |
| Fluoranthene | 1 | 0.13 | 1 | 1 |
| Fluorene | 1 | 0.13 | 1 | 1 |
| Indeno(1,2,3-cd)pyrene | 1 | 0.13 | 1 | 1 |
| Naphthalene | 1 | 0.13 | 1 | 1 |
| Phenanthrene | 1 | 0.13 | 1 | 1 |
| Pyrene | 1 | 0.13 | 1 | 1 |
| Pentachlorophenol | 1 | 0.25 | 1 | 1 |
| 2,3,7,8 - TCDD (a) | 1 | 0.04 | NA | NA |

Notes:
(a) Value based on dermal absorption efficiency of 3% presented in USEPA (2002), adjusted by estimated oral absorption of 70%
NA: not applicable because not a COPC in this medium

**Table 2-19**
**Dermal Permeability Constants**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Constituent | Dermal Permeability Constant (cm/hr) |
|---|---|
| **PAH** | |
| Acenaphthene | 4.0E-02 |
| Acenaphthylene | 4.0E-02 |
| Anthracene | 4.0E-02 |
| Benzo(a)anthracene | 2.0E-02 |
| Benzo(a)pyrene | 2.0E-02 |
| Benzo(b)fluoranthene | 2.0E-02 |
| Benzo(g,h,i)perylene | 4.0E-02 |
| Benzo(k)fluoranthene | 2.0E-02 |
| Chrysene | 2.0E-02 |
| Dibenz(a,h)anthracene | 2.0E-02 |
| Fluoranthene | 4.0E-02 |
| Fluorene | 4.0E-02 |
| Indeno(1,2,3-cd)pyrene | 2.0E-02 |
| Naphthalene | 4.0E-02 |
| Phenanthrene | 4.0E-02 |
| Pyrene | 4.0E-02 |
| Pentachlorophenol | 6.5E-01 |

Notes:
See Appendix E for derivation of dermal permeability constants

**Table 2-20**
**Summary of Human Health Potential Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Receptor | Parameter (units) | Floodplain Soil | Sediment | Surface Water |
|---|---|---|---|---|
| Recreational Visitor (12-18 year old teen) | Exposure time (hr/d) | 2 | 2 | 1 |
| | Exposure Frequency (d/y) (a) | 12 | 12 | 12 |
| | Exposure Duration (y) | 6 | 6 | 6 |
| | Body Weight (kg) | 56 | 56 | 56 |
| | Averaging Time - Lifetime (days) | 25550 | 25550 | 25550 |
| | Averaging Time - Chronic Noncancer (days) | 2190 | 2190 | 2190 |
| | Contact Rate (mg/d) or (mL/d) | 50 | 50 | 10 |
| | Fraction from Site (unitless) | 0.08 | 0.08 | NA |
| | Surface Area Exposed ($cm^2$/d) (b) | 2433 | 3133 | 3133 |
| | Soil-to-Skin Adherence Factor (mg/$cm^2$) | 0.14 | 0.18 | NA |
| Recreational Visitor (adult) | Exposure time (hr/d) | 2 | 2 | 1 |
| | Exposure Frequency (d/y) (a) | 12 | 12 | 12 |
| | Exposure Duration (y) | 24 | 24 | 24 |
| | Body Weight (kg) | 71.8 | 71.8 | 71.8 |
| | Averaging Time - Lifetime (days) | 25550 | 25550 | 25550 |
| | Averaging Time - Chronic Noncancer (days) | 8760 | 8760 | 8760 |
| | Contact Rate (mg/d) or (mL/d) | 50 | 50 | 10 |
| | Fraction from Site (unitless) | 0.08 | 0.08 | NA |
| | Surface Area Exposed ($cm^2$/d) (b) | 2518 | 3341 | 3341 |
| | Soil-to-Skin Adherence Factor (mg/$cm^2$) | 0.14 | 0.18 | NA |
| Hunter (12-18 year old teen) | Exposure time (hr/d) | 4 | 0.5 | 0.5 |
| | Exposure Frequency (d/y) (c) | 28 | 16 | 16 |
| | Exposure Duration (y) | 6 | 6 | 6 |
| | Body Weight (kg) | 56 | 56 | 56 |
| | Averaging Time - Lifetime (days) | 25550 | 25550 | 25550 |
| | Averaging Time - Chronic Noncancer (days) | 2190 | 2190 | 2190 |
| | Contact Rate (mg/d) or (mL/d) | 50 | 50 | 10 |
| | Fraction from Site (unitless) | 0.17 | 0.02 | NA |
| | Surface Area Exposed ($cm^2$/d) (d) | 2433 | 928 | 928 |
| | Soil-to-Skin Adherence Factor (mg/$cm^2$) | 0.14 | 0.2 | NA |
| Hunter (adult) | Exposure time (hr/d) | 4 | 0.5 | 0.5 |
| | Exposure Frequency (d/y) (c) | 28 | 16 | 16 |
| | Exposure Duration (y) | 24 | 24 | 24 |
| | Body Weight (kg) | 71.8 | 71.8 | 71.8 |
| | Averaging Time - Lifetime (days) | 25550 | 25550 | 25550 |
| | Averaging Time - Chronic Noncancer (days) | 8760 | 8760 | 8760 |
| | Contact Rate (mg/d) or (mL/d) | 50 | 50 | 10 |
| | Fraction from Site (unitless) | 0.17 | 0.02 | NA |
| | Surface Area Exposed ($cm^2$/d) (d) | 2518 | 904 | 904 |
| | Soil-to-Skin Adherence Factor (mg/$cm^2$) | 0.14 | 0.2 | NA |

Notes:
(a) Corresponds to one visit per week for three months per year
(b) Corresponds to hands, forearms, and face for soil; and hands, forearms and feet for sediment and surface water
(c) Corresponds to one visit per week for seven months per year for soil, and one visit per week for four months per year for surface water and sediment
(d) Corresponds to hands, forearms, and face for soil; and hands for sediment and surface water
Body weight and Surface Area values presented for the teen receptor are based on values available for a 15-16 yr old
See text for an additional discussion of Exposure Assumptions
NA - not applicable

**Table 2-21**
**Summary of Human Health Potential Exposure Assumptions Requested by WDNR**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Receptor | Parameter (units) | Floodplain Soil | Sediment | Surface Water |
|---|---|---|---|---|
| Recreational Visitor (7-18 year old teen) | Exposure time (hr/d) | 2 | 2 | 2 |
| | Exposure Frequency (d/y) | 365 | 365 | 365 |
| | Exposure Duration (y) | 11 | 11 | 11 |
| | Body Weight (kg) | 48 | 48 | 48 |
| | Averaging Time - Lifetime (days) | 25550 | 25550 | 25550 |
| | Averaging Time - Chronic Noncancer (days) | 4015 | 4015 | 4015 |
| | Contact Rate (mg/d) or (mL/d) | 100 | 100 | 10 |
| | Fraction from Site (unitless) | 0.08 | 0.08 | NA |
| | Surface Area Exposed ($cm^2$/d) | 2433 | 3133 | 3133 |
| | Soil-to-Skin Adherence Factor (mg/$cm^2$) | 0.14 | 0.18 | NA |
| Recreational Visitor (adult) | Exposure time (hr/d) | 2 | 2 | 2 |
| | Exposure Frequency (d/y) | 120 | 120 | 120 |
| | Exposure Duration (y) | 24 | 24 | 24 |
| | Body Weight (kg) | 71.8 | 71.8 | 71.8 |
| | Averaging Time - Lifetime (days) | 25550 | 25550 | 25550 |
| | Averaging Time - Chronic Noncancer (days) | 8760 | 8760 | 8760 |
| | Contact Rate (mg/d) or (mL/d) | 50 | 50 | 10 |
| | Fraction from Site (unitless) | 0.08 | 0.08 | NA |
| | Surface Area Exposed ($cm^2$/d) | 2518 | 3341 | 3341 |
| | Soil-to-Skin Adherence Factor (mg/$cm^2$) | 0.14 | 0.18 | NA |
| Hunter (7-18 year old teen) | Exposure time (hr/d) | 4 | 0.5 | 0.5 |
| | Exposure Frequency (d/y) | 28 | 16 | 16 |
| | Exposure Duration (y) | 11 | 11 | 11 |
| | Body Weight (kg) | 48 | 48 | 48 |
| | Averaging Time - Lifetime (days) | 25550 | 25550 | 25550 |
| | Averaging Time - Chronic Noncancer (days) | 4015 | 4015 | 4015 |
| | Contact Rate (mg/d) or (mL/d) | 100 | 100 | 10 |
| | Fraction from Site (unitless) | 0.17 | 0.02 | NA |
| | Surface Area Exposed ($cm^2$/d) | 2433 | 928 | 928 |
| | Soil-to-Skin Adherence Factor (mg/$cm^2$) | 0.14 | 0.2 | NA |
| Hunter (adult) | Exposure time (hr/d) | 4 | 0.5 | 0.5 |
| | Exposure Frequency (d/y) | 28 | 16 | 16 |
| | Exposure Duration (y) | 24 | 24 | 24 |
| | Body Weight (kg) | 71.8 | 71.8 | 71.8 |
| | Averaging Time - Lifetime (days) | 25550 | 25550 | 25550 |
| | Averaging Time - Chronic Noncancer (days) | 8760 | 8760 | 8760 |
| | Contact Rate (mg/d) or (mL/d) | 50 | 50 | 10 |
| | Fraction from Site (unitless) | 0.17 | 0.02 | NA |
| | Surface Area Exposed ($cm^2$/d) | 2518 | 904 | 904 |
| | Soil-to-Skin Adherence Factor (mg/$cm^2$) | 0.14 | 0.2 | NA |
| Trapper (adult) | Exposure time (hr/d) | 2 | 2 | 2 |
| | Exposure Frequency (d/y) | 150 | 150 | 150 |
| | Exposure Duration (y) | 24 | 24 | 24 |
| | Body Weight (kg) | 71.8 | 71.8 | 71.8 |
| | Averaging Time - Lifetime (days) | 25550 | 25550 | 25550 |
| | Averaging Time - Chronic Noncancer (days) | 8760 | 8760 | 8760 |
| | Contact Rate (mg/d) or (mL/d) | 50 | 50 | 10 |
| | Fraction from Site (unitless) | 0.08 | 0.08 | NA |
| | Surface Area Exposed (cm2/d) | 2518 | 3341 | 3341 |
| | Soil-to-Skin Adherence Factor (mg/cm2) | 0.14 | 0.18 | NA |

Notes:
See text for a discussion of Exposure Assumptions
NA - not applicable

**Table 2-22**
**Human Health Exposure Point Concentrations**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | Area 1 | | | Area 2 | | | Area 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Soil** | **Sediment** | **Surface Water*** | **Soil** | **Sediment** | **Surface Water** | **Soil** | **Sediment** | **Surface Water** |
| **PAH and Penta (mg/kg or mg/L)** | | | | | | | | | |
| Acenaphthene | 7.12E-02 | 9.30E+01 | 0.00E+00 | 1.61E-01 | 9.30E+01 | 1.00E-03 | 1.61E-01 | 3.18E+01 | 1.00E-03 |
| Anthracene | 3.00E+00 | 1.40E+02 | 0.00E+00 | 3.35E-01 | 1.40E+02 | 1.34E-04 | 3.35E-01 | 6.39E+01 | 5.00E-05 |
| Fluoranthene | 7.43E-01 | 1.80E+02 | 0.00E+00 | 1.53E-01 | 1.80E+02 | 1.99E-04 | 1.53E-01 | 1.89E+02 | 1.00E-04 |
| Fluorene | 2.41E-01 | 8.40E+01 | 0.00E+00 | 1.72E-01 | 8.40E+01 | 1.00E-04 | 1.72E-01 | 3.32E+01 | 1.00E-04 |
| Indeno(1,2,3-cd)pyrene | 2.57E+00 | 5.50E+00 | 0.00E+00 | 5.41E-01 | 5.50E+00 | 5.73E-05 | 5.41E-01 | 6.80E+00 | 3.00E-05 |
| Naphthalene | 1.02E-01 | 1.40E+02 | 0.00E+00 | 1.60E-01 | 1.40E+02 | 1.00E-03 | 1.60E-01 | 2.20E+00 | 1.00E-03 |
| Benzo(a)anthracene | 6.95E-01 | 4.30E+01 | 0.00E+00 | 1.45E-01 | 4.30E+01 | 1.00E-05 | 1.45E-01 | 4.57E+01 | 1.00E-05 |
| Benzo(b)fluoranthene | 3.59E+00 | 1.90E+01 | 0.00E+00 | 3.63E-01 | 1.90E+01 | 2.36E-04 | 3.63E-01 | 2.55E+01 | 4.40E-05 |
| Benzo(k)fluoranthene | 1.43E+00 | 7.20E+00 | 0.00E+00 | 1.47E-01 | 7.20E+00 | 5.97E-05 | 1.47E-01 | 1.09E+01 | 1.00E-05 |
| Benzo(g,h,i)perylene | 2.80E+00 | 6.00E+00 | 0.00E+00 | 6.09E-01 | 6.00E+00 | 3.00E-05 | 6.09E-01 | 7.17E+00 | 3.00E-05 |
| Benzo(a)pyrene | 3.66E+00 | 1.40E+01 | 0.00E+00 | 2.85E-01 | 1.40E+01 | 8.32E-05 | 2.85E-01 | 1.90E+01 | 1.00E-05 |
| Phenanthrene | 4.01E-01 | 2.40E+02 | 0.00E+00 | 1.34E-01 | 2.40E+02 | 3.00E-04 | 1.34E-01 | 1.45E+02 | 3.00E-04 |
| Pyrene | 7.27E-01 | 1.30E+02 | 0.00E+00 | 1.54E-01 | 1.30E+02 | 1.00E-04 | 1.54E-01 | 1.46E+02 | 1.00E-04 |
| Dibenzo(a,h)anthracene | 5.32E-01 | 1.60E+00 | 0.00E+00 | 1.87E-01 | 1.60E+00 | 1.50E-05 | 1.87E-01 | 2.05E+00 | 1.50E-05 |
| Acenaphthylene | 1.76E+00 | 2.00E+00 | 0.00E+00 | 2.26E-01 | 2.00E+00 | 1.00E-03 | 2.26E-01 | 2.46E+00 | 1.00E-03 |
| Chrysene | 4.29E+00 | 6.00E+01 | 0.00E+00 | 3.34E-01 | 6.00E+01 | 8.00E-05 | 3.34E-01 | 4.91E+01 | 8.00E-05 |
| Pentachlorophenol | 2.80E+00 | 5.00E-01 | 4.10E-04 | 1.43E+00 | 5.00E-01 | 2.50E-04 | 1.43E+00 | 5.00E-01 | 2.50E-04 |
| Total PAHs | 2.59E+01 | 1.17E+03 | ND | 3.30E+00 | 1.17E+03 | 5.87E-04 | 3.30E+00 | 7.68E+02 | 1.75E-04 |
| BaP-TE | 4.90E+00 | 2.25E+01 | 5.78E-03 | 4.93E-01 | 2.25E+01 | 3.26E-03 | 4.93E-01 | 2.90E+01 | 3.36E-05 |
| | | | | | | | | | |
| **2,3,7,8-TCDD TEQ (avian)** | 1.68E-04 | 4.26E-05 | NA | 4.12E-05 | 4.26E-05 | NA | 4.12E-05 | 5.22E-05 | NA |
| **2,3,7,8-TCDD TEQ (mamm)** | 1.80E-04 | 4.60E-05 | NA | 4.35E-05 | 4.60E-05 | NA | 4.35E-05 | 5.69E-05 | NA |

Notes:

EPC's are equal to the lesser of the 95% UCL and the maximum detected sample. See text for an additional discussion

*Only one surface water sample was collected within Exposure Area 1. The results were non-detect, but the detection limit was elevated. Therefore, a concentration of zero was assumed for individual PAHs in surface water in Area 1.

ND: all PAHs were non-detect

NA: Not Analyzed

**Table 2-23**
**Summary of Potential Human Health Risk Results**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | | Soil Component | | Sediment Component | | Surface Water Component | | Cumulative Risks | |
|---|---|---|---|---|---|---|---|---|---|
| **Exposure Area** | **Receptor** | **Noncancer** | **Cancer** | **Noncancer** | **Cancer** | **Noncancer** | **Cancer** | **Noncancer** | **Cancer** |
| Area 1 | Recreational Visitor (15-16) | 3.9E-06 | 1.6E-08 | 1.9E-04 | 4.4E-08 | 1.6E-05 | 5.9E-08 | 2.1E-04 | 1.2E-07 |
| Area 1 | Recreational Visitor (adult) | 3.1E-06 | 5.0E-08 | 1.5E-04 | 1.4E-07 | 1.4E-05 | 4.9E-08 | 1.7E-04 | 2.4E-07 |
| Area 1 | Hunter (15-16) | 7.8E-06 | 3.2E-08 | 4.3E-05 | 1.3E-08 | 3.3E-06 | 1.2E-08 | 5.4E-05 | 5.6E-08 |
| Area 1 | Hunter (adult) | 6.1E-06 | 9.9E-08 | 3.3E-05 | 4.0E-08 | 2.5E-06 | 9.1E-09 | 4.2E-05 | 1.5E-07 |
| Area 2 | Recreational Visitor (15-16) | 7.2E-07 | 2.8E-09 | 1.9E-04 | 4.4E-08 | 2.3E-05 | 7.6E-08 | 2.1E-04 | 1.2E-07 |
| Area 2 | Recreational Visitor (adult) | 5.7E-07 | 8.8E-09 | 1.5E-04 | 1.4E-07 | 1.9E-05 | 6.3E-08 | 1.7E-04 | 2.1E-07 |
| Area 2 | Hunter (15-16) | 1.4E-06 | 5.6E-09 | 4.3E-05 | 1.3E-08 | 5.7E-06 | 2.2E-08 | 5.0E-05 | 4.0E-08 |
| Area 2 | Hunter (adult) | 1.1E-06 | 1.8E-08 | 3.3E-05 | 4.0E-08 | 4.3E-06 | 1.7E-08 | 3.9E-05 | 7.4E-08 |
| Area 3 | Recreational Visitor (15-16) | 7.2E-07 | 2.8E-09 | 1.2E-04 | 5.7E-08 | 2.2E-05 | 4.6E-08 | 1.5E-04 | 1.1E-07 |
| Area 3 | Recreational Visitor (adult) | 5.7E-07 | 8.8E-09 | 9.9E-05 | 1.8E-07 | 1.8E-05 | 3.8E-08 | 1.2E-04 | 2.3E-07 |
| Area 3 | Hunter (15-16) | 1.4E-06 | 5.6E-09 | 2.8E-05 | 1.7E-08 | 5.3E-06 | 1.1E-08 | 3.5E-05 | 3.3E-08 |
| Area 3 | Hunter (adult) | 1.1E-06 | 1.8E-08 | 2.2E-05 | 5.2E-08 | 4.1E-06 | 8.2E-09 | 2.7E-05 | 7.7E-08 |

Notes
Results are based on AMEC exposure assumptions and AMEC-derived AAF's as described in the text
Results based on WDNR assumptions are presented in Table 2-24

**Table 2-24**
**Summary of Potential Human Health Risk Results based on WDNR Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | | Soil Component | | Sediment Component | | Surface Water Component | | Cumulative Risks | |
|---|---|---|---|---|---|---|---|---|---|
| **Exposure Area** | **Receptor** | **Noncancer** | **Cancer** | **Noncancer** | **Cancer** | **Noncancer** | **Cancer** | **Noncancer** | **Cancer** |
| Area 1 | Trapper (adult) | 5.9E-05 | 8.5E-07 | 2.4E-03 | 3.8E-06 | 1.7E-04 | 6.1E-07 | 2.7E-03 | 5.2E-06 |
| Area 1 | Recreational Visitor (7-18) | 1.3E-04 | 9.3E-07 | 4.9E-03 | 3.4E-06 | 5.8E-04 | 2.1E-06 | 5.6E-03 | 6.5E-06 |
| Area 1 | Recreational Visitor (adult) | 5.9E-05 | 8.5E-07 | 2.4E-03 | 3.8E-06 | 1.4E-04 | 4.9E-07 | 2.6E-03 | 5.1E-06 |
| Area 1 | Hunter (7-18) | 2.6E-04 | 1.9E-06 | 8.8E-04 | 6.0E-07 | 3.9E-06 | 1.4E-08 | 1.1E-03 | 2.5E-06 |
| Area 1 | Hunter (adult) | 1.2E-04 | 1.7E-06 | 3.5E-04 | 5.3E-07 | 2.5E-06 | 9.1E-09 | 4.7E-04 | 2.2E-06 |
| Area 2 | Trapper (adult) | 1.1E-05 | 1.4E-07 | 2.4E-03 | 3.8E-06 | 2.3E-04 | 7.9E-07 | 2.7E-03 | 4.7E-06 |
| Area 2 | Recreational Visitor (7-18) | 2.4E-05 | 1.5E-07 | 4.1E-03 | 2.8E-06 | 8.0E-04 | 2.7E-06 | 4.9E-03 | 5.7E-06 |
| Area 2 | Recreational Visitor (adult) | 1.1E-05 | 1.4E-07 | 2.1E-03 | 3.2E-06 | 1.9E-04 | 6.3E-07 | 2.3E-03 | 4.0E-06 |
| Area 2 | Hunter (7-18) | 4.8E-05 | 3.1E-07 | 1.0E-03 | 7.1E-07 | 6.6E-06 | 2.5E-08 | 1.1E-03 | 1.0E-06 |
| Area 2 | Hunter (adult) | 2.2E-05 | 2.8E-07 | 4.6E-04 | 7.0E-07 | 4.3E-06 | 1.7E-08 | 4.8E-04 | 9.9E-07 |
| Area 3 | Trapper (adult) | 1.1E-05 | 1.4E-07 | 1.7E-03 | 4.8E-06 | 2.2E-04 | 4.8E-07 | 1.9E-03 | 5.5E-06 |
| Area 3 | Recreational Visitor (7-18) | 2.4E-05 | 1.5E-07 | 2.8E-03 | 3.6E-06 | 7.6E-04 | 1.6E-06 | 3.6E-03 | 5.4E-06 |
| Area 3 | Recreational Visitor (adult) | 1.1E-05 | 1.4E-07 | 1.4E-03 | 4.2E-06 | 1.8E-04 | 3.8E-07 | 1.6E-03 | 4.7E-06 |
| Area 3 | Hunter (7-18) | 4.8E-05 | 3.1E-07 | 6.9E-04 | 9.1E-07 | 6.2E-06 | 1.3E-08 | 7.5E-04 | 1.2E-06 |
| Area 3 | Hunter (adult) | 2.2E-05 | 2.8E-07 | 3.1E-04 | 9.0E-07 | 4.1E-06 | 8.2E-09 | 3.3E-04 | 1.2E-06 |

Notes
Results are based on WDNR exposure assumptions and EPA-derived AAF's as described in the text
Results based on AMEC assumptions are presented in Table 2-23

**Table 3-1**
**Toxic Equivalent Factors for PCDDs/PCDFs**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| **Constituent** | **WHO 2005 TEF (Mammalian)** | **WHO 1998 TEF (Avian)** |
|---|---|---|
| *Chlorinated Dibenzo-p-dioxins* | | |
| 1,2,3,7,8-PeCDD | 1 | 1 |
| 1,2,3,4,7,8-HxCDD | 0.1 | 0.1 |
| 1,2,3,6,7,8-HxCDD | 0.1 | 0.1 |
| 1,2,3,7,8,9-HxCDD | 0.1 | 0.1 |
| 1,2,3,4,6,7,8-HpCDD | 0.01 | 0.01 |
| OCDD | 0.0003 | 0.0001 |
| *Chlorinated Dibenzofurans* | | |
| 2,3,7,8-TCDF | 0.1 | 0.1 |
| 1,2,3,7,8-PeCDF | 0.03 | 0.05 |
| 2,3,4,7,8-PeCDF | 0.3 | 0.5 |
| 1,2,3,4,7,8-HxCDF | 0.1 | 0.1 |
| 1,2,3,6,7,8-HxCDF | 0.1 | 0.1 |
| 1,2,3,7,8,9-HxCDF | 0.1 | 0.1 |
| 2,3,4,6,7,8-HxCDF | 0.1 | 0.1 |
| 1,2,3,4,6,7,8-HpCDF | 0.01 | 0.01 |
| 1,2,3,4,7,8,9-HpCDF | 0.01 | 0.01 |
| OCDF | 0.0003 | 0.0001 |

Source: van den Berg et al., 2006 and van den Berg et al., 1998

**Table 3-2**
**Exposure Parameters**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Parameter | Mink | | Belted Kingfisher | | American Robin | |
|---|---|---|---|---|---|---|
| | Value | Source | Value | Source | Value | Source |
| **Body Weight (kg)** | 1.0195 | USEPA (1993) | 0.147333333 | USEPA (1993) | 0.079 | USEPA (1993) |
| **Total Dietary Intake (kg/d)** | 0.22429 | USEPA (1993) | 0.07367 | USEPA (1993) | 0.095195 | USEPA (1993) |
| **Fish Ingestion Rate (kg/d)** | 0.1682 | Assumed 75% of diet | 0.0368 | Assumed 50% of diet | NR | |
| **Flying Insect Invert Ingestion Rate (kg/d):** | NR | | 0.03683 | Assumed 50% of diet | NR | |
| **Benthic Macroinvert Ingestion Rate (kg/d)** | 0.05607 | Assumed 25% of diet | NR | | NR | |
| **Sediment Ingestion Rate (kg/day)** | 0 | Sediment in prey species accounted for in analytical results of site fish | 0 | Sediment in prey species accounted for in analytical results of site fish | NR | |
| **Water ingestion rate (L/day)** | 0.079 | USEPA (1993) | 0.11 | USEPA (1993) | 0.01106 | USEPA (1993) |
| **Vegetation Ingestion Rate (kg/d):** | NR | | NR | | 0.047121525 | EPA (1993) mean of values for all seasons for percent fruit in diet in central US is 49.5%. (wet wt.) |
| **Soil Ingestion Rate (kg/day)** | NR | | NR | | 0.0011297 | Beyer et al, (1994) as cited in USEPA (1999), uses 10% soil in diet from range of values. |
| **Earthworm Ingestion Rate (kg/d)** | NR | | NR | | 0.048073475 | Total dietary intake minus vegetation. (wet wt.) |
| **Soil Dry wt./wet wt. CF** | NR | | NR | | 0.60 | Soils comprised of 60% solids. |
| **Veg Dry wt./wet wt. CF** | NR | | NR | | 0.2 | Vegetation assumed to be 80% water (USEPA 1993). |
| **Fish Dry wt./wet wt. CF** | 1 | | 1 | Fish data is wet wt. | NR | |
| **Sediment Dry wt./wet wt. CF** | 0.65 | Assuming 65.4% solids; arithmetic mean of sediments analyzed in 2005 event. | 0.65 | Assuming 65.4% solids; arithmetic mean of sediments analyzed in 2005 event. | NR | |
| **Invert Dry wt./wet wt. CF** | 1 | | 1 | insect data is wet wt. | NR | |
| **Home range (ha)** | 266 | USEPA (1993) | 1.16 | USEPA (1993) | 0.25 | USEPA (1993) |
| **Area Use Factor: upstream (US) and downstream (DS)** | 1 | Based on a home range and available habitat | 1 | Length of stream reach US = 2550 ft = 0.8 km (not of shoreline though). | 1 | Home range assumed to be smaller than exposure area. |
| **SUF: US and DS** | 1 | Potentially present year-round. | 0.5 | Assumed to be present 6 of 12 months. | 0.5 | Assumed to be present 6 of 12 months. |

Notes:
NR - not relevant

**Table 3-2**
**Exposure Parameters**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Parameter | Tree Swallow | | Little Brown Bat | | Meadow Vole | |
|---|---|---|---|---|---|---|
| | Value | Source | Value | Source | Value | Source |
| **Body Weight (kg)** | 0.02 | Robertson et al, 1992 | 0.009 | Nagy 2001 | 0.022 | USEPA (1993) |
| **Total Dietary Intake (kg/d)** | 0.03520 | Nagy 2001 FMI | 0.00511 | g FMI/d = 4.85 (grams body mass)^0.652; Nagy 2001 | 0.012 | Nagy (2001) dry wt. |
| **Fish Ingestion Rate (kg/d)** | NR | | NR | | NR | |
| **Flying Insect Invert Ingestion Rate (kg/d):** | 0.03520 | Assumed 100% of diet | 0.00511 | Assumed 100% of diet | NR | |
| **Benthic Macroinvert Ingestion Rate (kg/d)** | NR | | NR | | NR | |
| **Sediment Ingestion Rate (kg/day)** | NR | | NR | | NR | |
| **Water ingestion rate (L/day)** | 0.004 | USEPA (1993) | 0.0014 | USEPA (1993) | 0.0047 | USEPA (1993) |
| **Vegetation Ingestion Rate (kg/d):** | NR | | NR | | 0.012 | Assumed to be 100% of diet |
| **Soil Ingestion Rate (kg/day)** | NR | | NR | | 0.0003 | Beyer et al. (1994) |
| **Earthworm Ingestion Rate (kg/d)** | NR | | NR | | NR | |
| **Soil Dry wt./wet wt. CF** | NR | | NR | | 0.60 | Soils comprised of 60% solids. |
| **Veg Dry wt./wet wt. CF** | NR | | NR | | 0.200 | Vegetation assumed to be 80% water (USEPA 1993). |
| **Fish Dry wt./wet wt. CF** | NR | | NR | | NR | |
| **Sediment Dry wt./wet wt. CF** | NR | | NR | | NR | |
| **Invert Dry wt./wet wt. CF** | NR | | 1 | | NR | |
| **Home range (ha)** | 7.8 | http://animaldiversity.ummz.umich.edu/site/accounts/information/Tachycineta_bicolor.html | 10 | Saunders 1988 | 0.02 | USEPA (1993) |
| **Area Use Factor: upstream (US) and downstream (DS)** | 1 | Home range assumed to be smaller than exposure area. | 1 | Based on a home range and available habitat | 1 | Home range assumed to be smaller than exposure area. |
| **SUF: US and DS** | 0.5 | Assumed to be present 6 of 12 months. | 0.5 | Assumed to be present 6 of 12 months. | 1 | Potentially present year-round. |

Notes:
NR - not relevant

**Table 3-3**
**Biotransfer Factors**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Constituent | Earthworm BTFs | | Vegetation BTFs | |
|---|---|---|---|---|
| Acenaphthene | 8.0E-02 | (a) | 4.5E-02 | (a) |
| Acenaphthylene | 8.0E-02 | (a) | 4.5E-02 | (a) |
| Anthracene | 8.0E-02 | (a) | 4.5E-02 | (a) |
| Benzo(a)anthracene | 3.0E-02 | (b) | 2.0E-02 | (b) |
| Benzo(a)pyrene | 7.0E-02 | (b) | 1.1E-02 | (b) |
| Benzo(b)fluoranthene | 7.0E-02 | (b) | 1.0E-02 | (b) |
| Benzo(ghi)perylene | 8.0E-02 | (a) | 4.5E-02 | (a) |
| Benzo(k)fluoranthene | 8.0E-02 | (b) | 1.0E-02 | (b) |
| Chrysene | 4.0E-02 | (b) | 1.9E-02 | (b) |
| Dibenzo(a,h)anthracene | 7.0E-02 | (b) | 6.4E-03 | (b) |
| Fluoranthene | 8.0E-02 | (a) | 4.5E-02 | (a) |
| Fluorene | 8.0E-02 | (a) | 4.5E-02 | (a) |
| Indeno(1,2,3-cd)pyrene | 8.0E-02 | (b) | 3.9E-03 | (b) |
| Naphthalene | 8.0E-02 | (a) | 4.5E-02 | (a) |
| Phenanthrene | 8.0E-02 | (a) | 4.5E-02 | (a) |
| Pyrene | 8.0E-02 | (a) | 4.5E-02 | (a) |
| Pentachlorophenol | 1 | (c) | 4.5E-02 | (b) |
| 2,3,7,8-TCDD TEQ (avian) | 4.4E-01 | (d) | 5.6E-03 | (b) |
| 2,3,7,8-TCDD TEQ (mamm) | 4.4E-01 | (d) | 5.6E-03 | (b) |

Notes:
(a) USEPA (1999). Value for largest BTF in PAH class.
(b) USEPA (1999)
(c) Default of 1.
(d) Dioxin insect BTF from Meyn, Ossi, Maurice Zeeman, Michael J Wise, and Susan E. Keane. 1997. Terrestrial Wildlife Risk Assessment for TCDD in Land-Applied Pulp and Paper Mill Sludge. Environmental Toxicology and Chemistry, Vol 16, No. 9, pp 1789-1801.

**Table 3-4**
**Summary of Exposure Point Concentration Calculations for the BERA**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | Intake from water | Intake from Insects | Intake from Benthic Invertebrates | Intake from fish | Intake from soil | Intake from plants | Intake from earthworms |
|---|---|---|---|---|---|---|---|
| **Bat** | Average of samples | Average of samples | | | | | |
| **Kingfisher** | Average of samples | | Maximum fish sample | Average of samples | | | |
| **Mink** | Average of samples | | Maximum fish sample | Average of samples | | | |
| **Robin** | Average of samples | | | | Average of samples | Average of calculated values (BTF applied to soil samples) | Average of calculated values (BTF applied to soil samples) |
| **Swallow** | Average of samples | Average of samples | | | | | |
| **Vole** | Average of samples | | | | Average of samples | Average of calculated values (BTF applied to soil samples) | |

## Table 3-5
## Exposure Point Concentrations for each Media: Exposure Area 1
## Beazer East, Inc.
## Off-Site Portion of Koppers Inc. Facility
## Superior, WI

| | Bat - Area 1 | | Kingfisher - Area 1 | | | Mink - Area 1 | | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Surface Water (max)*** | **Insects (max)*** | **Surface Water (max)*** | **Benthic Invertebrates (max fish)** | **Fish (avg)** | **Surface Water (max)*** | **Benthic Invertebrates (max fish)** | **Fish (avg)** |
| **PAH and Penta (mg/kg or mg/L)** | | | | | | | | |
| Acenaphthene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 5.80E+00 | 2.90E+00 | 0.00E+00 | 5.80E+00 | 2.90E+00 |
| Anthracene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.00E+00 | 4.67E-01 | 0.00E+00 | 1.00E+00 | 4.67E-01 |
| Fluoranthene | 0.00E+00 | 2.30E-01 | 0.00E+00 | 3.40E+00 | 1.63E+00 | 0.00E+00 | 3.40E+00 | 1.63E+00 |
| Fluorene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.70E+00 | 1.80E+00 | 0.00E+00 | 3.70E+00 | 1.80E+00 |
| Indeno(1,2,3-cd)pyrene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 9.50E-02 | 8.17E-02 | 0.00E+00 | 9.50E-02 | 8.17E-02 |
| Naphthalene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 2.30E+00 | 1.29E+00 | 0.00E+00 | 2.30E+00 | 1.29E+00 |
| Benzo(a)anthracene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 2.00E-01 | 1.12E-01 | 0.00E+00 | 2.00E-01 | 1.12E-01 |
| Benzo(b)fluoranthene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 2.10E-01 | 1.20E-01 | 0.00E+00 | 2.10E-01 | 1.20E-01 |
| Benzo(k)fluoranthene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 6.40E-02 | 7.13E-02 | 0.00E+00 | 6.40E-02 | 7.13E-02 |
| Benzo(g,h,i)perylene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 8.00E-02 | 7.67E-02 | 0.00E+00 | 8.00E-02 | 7.67E-02 |
| Benzo(a)pyrene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.10E-01 | 8.67E-02 | 0.00E+00 | 1.10E-01 | 8.67E-02 |
| Phenanthrene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 6.80E+00 | 3.12E+00 | 0.00E+00 | 6.80E+00 | 3.12E+00 |
| Pyrene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.60E+00 | 9.10E-01 | 0.00E+00 | 1.60E+00 | 9.10E-01 |
| Dibenzo(a,h)anthracene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 9.50E-02 | 8.17E-02 | 0.00E+00 | 9.50E-02 | 8.17E-02 |
| Acenaphthylene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 8.50E-02 | 7.83E-02 | 0.00E+00 | 8.50E-02 | 7.83E-02 |
| Chrysene | 0.00E+00 | 1.20E-01 | 0.00E+00 | 2.10E-01 | 1.21E-01 | 0.00E+00 | 2.10E-01 | 1.21E-01 |
| Pentachlorophenol | 4.10E-07 | 0.00E+00 | 4.10E-07 | 0.00E+00 | 0.00E+00 | 4.10E-07 | 0.00E+00 | 0.00E+00 |
| Total PAHs | | 2.30E-01 | | 2.56E+01 | 1.25E+01 | | 2.56E+01 | 1.25E+01 |
| BaP-te | | 2.77E-01 | | 2.56E-01 | 2.01E-01 | | 2.56E-01 | 2.01E-01 |
| **Dioxins (ug/kg)** | | | | | | | | |
| 2,3,7,8-TCDD | | 1.04E-04 | | 1.96E-04 | 1.61E-04 | | 1.96E-04 | 1.61E-04 |
| 1,2,3,7,8-PeCDD | | 3.13E-04 | | 4.80E-04 | 3.45E-04 | | 4.80E-04 | 3.45E-04 |
| 1,2,3,4,7,8-HxCDD | | 4.97E-04 | | 3.81E-04 | 3.25E-04 | | 3.81E-04 | 3.25E-04 |
| 1,2,3,6,7,8-HxCDD | | 1.42E-03 | | 2.14E-03 | 1.88E-03 | | 2.14E-03 | 1.88E-03 |
| 1,2,3,7,8,9-HxCDD | | 7.94E-04 | | 4.49E-04 | 3.77E-04 | | 4.49E-04 | 3.77E-04 |
| 1,2,3,4,6,7,8-HpCDD | | 1.89E-02 | | 1.16E-02 | 9.23E-03 | | 1.16E-02 | 9.23E-03 |
| OCDD | | 8.67E-02 | | 1.08E-01 | 7.14E-02 | | 1.08E-01 | 7.14E-02 |
| 2,3,7,8-TCDF | | 2.52E-04 | | 3.78E-04 | 3.48E-04 | | 3.78E-04 | 3.48E-04 |
| 1,2,3,7,8-PeCDF | | 2.46E-04 | | 5.04E-04 | 4.46E-04 | | 5.04E-04 | 4.46E-04 |
| 2,3,4,7,8-PeCDF | | 3.33E-04 | | 9.91E-04 | 8.80E-04 | | 9.91E-04 | 8.80E-04 |
| 1,2,3,4,7,8-HxCDF | | 7.00E-04 | | 1.62E-03 | 1.28E-03 | | 1.62E-03 | 1.28E-03 |
| 1,2,3,6,7,8-HxCDF | | 3.69E-04 | | 1.06E-03 | 6.17E-04 | | 1.06E-03 | 6.17E-04 |
| 2,3,4,6,7,8-HxCDF | | 4.13E-04 | | 4.61E-04 | 3.05E-04 | | 4.61E-04 | 3.05E-04 |
| 1,2,3,7,8,9-HxCDF | | 7.90E-05 | | 7.95E-05 | 6.49E-05 | | 7.95E-05 | 6.49E-05 |
| 1,2,3,4,6,7,8-HpCDF | | 5.43E-03 | | 3.47E-03 | 2.71E-03 | | 3.47E-03 | 2.71E-03 |
| 1,2,3,4,7,8,9-HpCDF | | 2.47E-04 | | 4.20E-04 | 2.93E-04 | | 4.20E-04 | 2.93E-04 |
| OCDF | | 4.55E-03 | | 1.09E-02 | 6.89E-03 | | 1.09E-02 | 6.89E-03 |
| **2,3,7,8-TCDD TEQ (avian)** | | | | 2.02E-03 | 1.62E-03 | | | |
| **2,3,7,8-TCDD TEQ (mamm)** | | 1.25E-03 | | | | | 1.83E-03 | 1.45E-03 |

Notes:

*One surface water sample was analyzed for PAHs in Area 1. The laboratory report indicated non-detect results with elevated detection limits for all reported PAHs (5 ug/L). As such, concentrations of zero were assumed for the individual PAHs in Area 1.

Sediment and Fish EPCs were calculated based on samples collected within Exposure Area 2 (see text for additional discussion)

Table 3-5
Exposure Point Concentrations for each Media: Exposure Area 1
Beazer East, Inc.
Off-Site Portion of Koppers Inc. Facility
Superior, WI

| Robin - Area 1 | | | | Swallow - Area 1 | | Vole - Area 1 | | |
|---|---|---|---|---|---|---|---|---|
| Surface Water (max)* | Soil (avg) | Vegetables (avg of soil and BTF) | Earthworms (avg of soil and BTF | Surface Water (max)* | Insects (max)* | Surface Water (max)* | Soil (avg) | Vegetables (avg of soil and BTF) |
| 0.00E+00 | 6.45E-02 | 2.90E-03 | 5.16E-03 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 6.45E-02 | 2.90E-03 |
| 0.00E+00 | 1.78E+00 | 7.99E-02 | 1.42E-01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.78E+00 | 7.99E-02 |
| 0.00E+00 | 5.20E-01 | 2.34E-02 | 4.16E-02 | 0.00E+00 | 2.30E-01 | 0.00E+00 | 5.20E-01 | 2.34E-02 |
| 0.00E+00 | 1.63E-01 | 7.31E-03 | 1.30E-02 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.63E-01 | 7.31E-03 |
| 0.00E+00 | 2.35E+00 | 9.17E-03 | 1.88E-01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 2.35E+00 | 9.17E-03 |
| 0.00E+00 | 9.55E-02 | 4.30E-03 | 7.64E-03 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 9.55E-02 | 4.30E-03 |
| 0.00E+00 | 6.50E-01 | 1.31E-02 | 1.95E-02 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 6.50E-01 | 1.31E-02 |
| 0.00E+00 | 1.80E+00 | 1.82E-02 | 1.26E-01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.80E+00 | 1.82E-02 |
| 0.00E+00 | 6.63E-01 | 6.69E-03 | 5.30E-02 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 6.63E-01 | 6.69E-03 |
| 0.00E+00 | 2.80E+00 | 1.26E-01 | 2.24E-01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 2.80E+00 | 1.26E-01 |
| 0.00E+00 | 1.65E+00 | 1.83E-02 | 1.16E-01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.65E+00 | 1.83E-02 |
| 0.00E+00 | 2.45E-01 | 1.10E-02 | 1.96E-02 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 2.45E-01 | 1.10E-02 |
| 0.00E+00 | 4.93E-01 | 2.22E-02 | 3.94E-02 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 4.93E-01 | 2.22E-02 |
| 0.00E+00 | 4.65E-01 | 2.98E-03 | 3.26E-02 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 4.65E-01 | 2.98E-03 |
| 0.00E+00 | 9.10E-01 | 4.10E-02 | 7.28E-02 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 9.10E-01 | 4.10E-02 |
| 0.00E+00 | 3.40E+00 | 6.36E-02 | 1.36E-01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E+00 | 6.36E-02 |
| 4.10E-07 | 2.08E+00 | 9.32E-02 | 2.08E+00 | 4.10E-07 | | 4.10E-07 | 2.08E+00 | 9.32E-02 |
| | 1.81E+01 | | | | 2.30E-01 | | 1.81E+01 | |
| | 2.61E+00 | | | | 2.77E-01 | | 2.61E+00 | |
| | 9.31E-04 | | | | 1.04E-04 | | 9.31E-04 | |
| | 5.67E-03 | | | | 3.13E-04 | | 5.67E-03 | |
| | 1.89E-02 | | | | 4.97E-04 | | 1.89E-02 | |
| | 1.57E-01 | | | | 1.42E-03 | | 1.57E-01 | |
| | 3.38E-02 | | | | 7.94E-04 | | 3.38E-02 | |
| | 5.22E+00 | | | | 1.89E-02 | | 5.22E+00 | |
| | 7.17E+01 | | | | 8.67E-02 | | 7.17E+01 | |
| | 1.99E-03 | | | | 2.52E-04 | | 1.99E-03 | |
| | 1.36E-02 | | | | 2.46E-04 | | 1.36E-02 | |
| | 3.13E-02 | | | | 3.33E-04 | | 3.13E-02 | |
| | 1.78E-01 | | | | 7.00E-04 | | 1.78E-01 | |
| | 4.72E-02 | | | | 3.69E-04 | | 4.72E-02 | |
| | 6.03E-02 | | | | 4.13E-04 | | 6.03E-02 | |
| | 4.40E-02 | | | | 7.90E-05 | | 4.40E-02 | |
| | 1.45E+00 | | | | 5.43E-03 | | 1.45E+00 | |
| | 1.52E-01 | | | | 2.47E-04 | | 1.52E-01 | |
| | 5.88E+00 | | | | 4.55E-03 | | 5.88E+00 | |
| | 1.53E-01 | 8.56E-07 | 6.73E-05 | | 1.30E-03 | | | |
| | | | | | | | 1.62E-01 | 9.07E-07 |

Notes:
*One surface water sample was analyzed for PAHs in Area 1. The laboratory report indicated non-detect results with elevated detection limits for all reported PAHs (5 ug/L). As such, concentrations of zero were assumed for the individual PAHs in Area 1.
Sediment and Fish EPCs were calculated based on samples collected within Exposure Area 2 (see text for additional discussion)

## Table 3-6
## Exposure Point Concentrations for each Media: Exposure Area 2
## Beazer East, Inc.
## Off-Site Portion of Koppers Inc. Facility
## Superior, WI

| | Bat - Area 2 | | Kingfisher - Area 2 | | | Mink - Area 2 | | |
|---|---|---|---|---|---|---|---|---|
| Parameter | Surface Water (avg) | Insects (avg) | Surface Water (avg) | Benthic Invertebrates (max fish) | Fish (avg) | Surface Water (avg) | Benthic Invertebrates (max fish) | Fish (avg) |
| **PAH and Penta (mg/kg or mg/L)** | | | | | | | | |
| Acenaphthene | 1.00E-06 | 4.33E-02 | 1.00E-06 | 5.80E+00 | 2.90E+00 | 1.00E-06 | 5.80E+00 | 2.90E+00 |
| Anthracene | 7.75E-08 | 5.33E-02 | 7.75E-08 | 1.00E+00 | 4.67E-01 | 7.75E-08 | 1.00E+00 | 4.67E-01 |
| Fluoranthene | 1.33E-07 | 2.23E-01 | 1.33E-07 | 3.40E+00 | 1.63E+00 | 1.33E-07 | 3.40E+00 | 1.63E+00 |
| Fluorene | 1.00E-07 | 4.20E-02 | 1.00E-07 | 3.70E+00 | 1.80E+00 | 1.00E-07 | 3.70E+00 | 1.80E+00 |
| Indeno(1,2,3-cd)pyrene | 3.90E-08 | 5.33E-02 | 3.90E-08 | 9.50E-02 | 8.17E-02 | 3.90E-08 | 9.50E-02 | 8.17E-02 |
| Naphthalene | 1.00E-06 | 7.10E-02 | 1.00E-06 | 2.30E+00 | 1.29E+00 | 1.00E-06 | 2.30E+00 | 1.29E+00 |
| Benzo(a)anthracene | 1.00E-08 | 5.33E-02 | 1.00E-08 | 2.00E-01 | 1.12E-01 | 1.00E-08 | 2.00E-01 | 1.12E-01 |
| Benzo(b)fluoranthene | 1.27E-07 | 5.10E-02 | 1.27E-07 | 2.10E-01 | 1.20E-01 | 1.27E-07 | 2.10E-01 | 1.20E-01 |
| Benzo(k)fluoranthene | 3.20E-08 | 5.33E-02 | 3.20E-08 | 6.40E-02 | 7.13E-02 | 3.20E-08 | 6.40E-02 | 7.13E-02 |
| Benzo(g,h,i)perylene | 3.00E-08 | 5.83E-02 | 3.00E-08 | 8.00E-02 | 7.67E-02 | 3.00E-08 | 8.00E-02 | 7.67E-02 |
| Benzo(a)pyrene | 4.00E-08 | 5.33E-02 | 4.00E-08 | 1.10E-01 | 8.67E-02 | 4.00E-08 | 1.10E-01 | 8.67E-02 |
| Phenanthrene | 3.00E-07 | 6.27E-02 | 3.00E-07 | 6.80E+00 | 3.12E+00 | 3.00E-07 | 6.80E+00 | 3.12E+00 |
| Pyrene | 1.00E-07 | 5.33E-02 | 1.00E-07 | 1.60E+00 | 9.10E-01 | 1.00E-07 | 1.60E+00 | 9.10E-01 |
| Dibenzo(a,h)anthracene | 1.50E-08 | 5.33E-02 | 1.50E-08 | 9.50E-02 | 8.17E-02 | 1.50E-08 | 9.50E-02 | 8.17E-02 |
| Acenaphthylene | 1.00E-06 | 2.13E-01 | 1.00E-06 | 8.50E-02 | 7.83E-02 | 1.00E-06 | 8.50E-02 | 7.83E-02 |
| Chrysene | 7.75E-08 | 5.33E-02 | 7.75E-08 | 2.10E-01 | 1.21E-01 | 7.75E-08 | 2.10E-01 | 1.21E-01 |
| Pentachlorophenol | 2.15E-07 | 0.00E+00 | 2.15E-07 | 0.00E+00 | 0.00E+00 | 2.15E-07 | 0.00E+00 | 0.00E+00 |
| Total PAH | 3.32E-07 | 8.30E-01 | 3.32E-07 | 2.56E+01 | 1.25E+01 | 3.32E-07 | 2.56E+01 | 1.25E+01 |
| BaP-te | | 1.23E-01 | | 2.56E-01 | 2.01E-01 | | 2.56E-01 | 2.01E-01 |
| **Dioxins (ug/kg)** | | | | | | | | |
| 2,3,7,8-TCDD | | 1.56E-04 | | 1.96E-04 | 1.61E-04 | | 1.96E-04 | 1.61E-04 |
| 1,2,3,7,8-PeCDD | | 2.60E-04 | | 4.80E-04 | 3.45E-04 | | 4.80E-04 | 3.45E-04 |
| 1,2,3,4,7,8-HxCDD | | 5.96E-04 | | 3.81E-04 | 3.25E-04 | | 3.81E-04 | 3.25E-04 |
| 1,2,3,6,7,8-HxCDD | | 3.38E-03 | | 2.14E-03 | 1.88E-03 | | 2.14E-03 | 1.88E-03 |
| 1,2,3,7,8,9-HxCDD | | 6.95E-04 | | 4.49E-04 | 3.77E-04 | | 4.49E-04 | 3.77E-04 |
| 1,2,3,4,6,7,8-HpCDD | | 4.84E-02 | | 1.16E-02 | 9.23E-03 | | 1.16E-02 | 9.23E-03 |
| OCDD | | 2.44E-01 | | 1.08E-01 | 7.14E-02 | | 1.08E-01 | 7.14E-02 |
| 2,3,7,8-TCDF | | 4.66E-04 | | 3.78E-04 | 3.48E-04 | | 3.78E-04 | 3.48E-04 |
| 1,2,3,7,8-PeCDF | | 3.93E-04 | | 5.04E-04 | 4.46E-04 | | 5.04E-04 | 4.46E-04 |
| 2,3,4,7,8-PeCDF | | 3.56E-04 | | 9.91E-04 | 8.80E-04 | | 9.91E-04 | 8.80E-04 |
| 1,2,3,4,7,8-HxCDF | | 1.16E-03 | | 1.62E-03 | 1.28E-03 | | 1.62E-03 | 1.28E-03 |
| 1,2,3,6,7,8-HxCDF | | 4.43E-04 | | 1.06E-03 | 6.17E-04 | | 1.06E-03 | 6.17E-04 |
| 2,3,4,6,7,8-HxCDF | | 5.06E-04 | | 4.61E-04 | 3.05E-04 | | 4.61E-04 | 3.05E-04 |
| 1,2,3,7,8,9-HxCDF | | 4.96E-05 | | 7.95E-05 | 6.49E-05 | | 7.95E-05 | 6.49E-05 |
| 1,2,3,4,6,7,8-HpCDF | | 8.05E-03 | | 3.47E-03 | 2.71E-03 | | 3.47E-03 | 2.71E-03 |
| 1,2,3,4,7,8,9-HpCDF | | 9.77E-05 | | 4.20E-04 | 2.93E-04 | | 4.20E-04 | 2.93E-04 |
| OCDF | | 3.45E-03 | | 1.09E-02 | 6.89E-03 | | 1.09E-02 | 6.89E-03 |
| **2,3,7,8-TCDD TEQ (avian)** | | | | 2.02E-03 | 1.62E-03 | | | |
| **2,3,7,8-TCDD TEQ (mamm)** | | 1.90E-03 | | | | | 1.83E-03 | 1.45E-03 |

## Table 3-6
## Exposure Point Concentrations for each Media: Exposure Area 2
## Beazer East, Inc.
## Off-Site Portion of Koppers Inc. Facility
## Superior, WI

| Robin - Area 2 | | | | Swallow - Area 2 | | Vole - Area 2 | | |
|---|---|---|---|---|---|---|---|---|
| Surface Water (avg) | Soil (avg) | Vegetables (avg of soil and BTF) | Earthworms (avg of soil and BTF | Surface Water (avg) | Insects (avg) | Surface Water (avg) | Soil (avg) | Vegetables (avg of soil and BTF) |
| 1.00E-06 | 1.55E-01 | 6.97E-03 | 1.24E-02 | 1.00E-06 | 4.33E-02 | 1.00E-06 | 1.55E-01 | 6.97E-03 |
| 7.75E-08 | 2.47E-01 | 1.11E-02 | 1.98E-02 | 7.75E-08 | 5.33E-02 | 7.75E-08 | 2.47E-01 | 1.11E-02 |
| 1.33E-07 | 1.22E-01 | 5.47E-03 | 9.73E-03 | 1.33E-07 | 2.23E-01 | 1.33E-07 | 1.22E-01 | 5.47E-03 |
| 1.00E-07 | 1.29E-01 | 5.81E-03 | 1.03E-02 | 1.00E-07 | 4.20E-02 | 1.00E-07 | 1.29E-01 | 5.81E-03 |
| 3.90E-08 | 3.82E-01 | 1.49E-03 | 3.06E-02 | 3.90E-08 | 5.33E-02 | 3.90E-08 | 3.82E-01 | 1.49E-03 |
| 1.00E-06 | 1.33E-01 | 5.99E-03 | 1.06E-02 | 1.00E-06 | 7.10E-02 | 1.00E-06 | 1.33E-01 | 5.99E-03 |
| 1.00E-08 | 1.12E-01 | 2.27E-03 | 3.37E-03 | 1.00E-08 | 5.33E-02 | 1.00E-08 | 1.12E-01 | 2.27E-03 |
| 1.27E-07 | 2.70E-01 | 2.73E-03 | 1.89E-02 | 1.27E-07 | 5.10E-02 | 1.27E-07 | 2.70E-01 | 2.73E-03 |
| 3.20E-08 | 1.10E-01 | 1.11E-03 | 8.82E-03 | 3.20E-08 | 5.33E-02 | 3.20E-08 | 1.10E-01 | 1.11E-03 |
| 3.00E-08 | 4.37E-01 | 1.97E-02 | 3.50E-02 | 3.00E-08 | 5.83E-02 | 3.00E-08 | 4.37E-01 | 1.97E-02 |
| 4.00E-08 | 2.09E-01 | 2.32E-03 | 1.46E-02 | 4.00E-08 | 5.33E-02 | 4.00E-08 | 2.09E-01 | 2.32E-03 |
| 3.00E-07 | 9.61E-02 | 4.32E-03 | 7.69E-03 | 3.00E-07 | 6.27E-02 | 3.00E-07 | 9.61E-02 | 4.32E-03 |
| 1.00E-07 | 1.20E-01 | 5.40E-03 | 9.59E-03 | 1.00E-07 | 5.33E-02 | 1.00E-07 | 1.20E-01 | 5.40E-03 |
| 1.50E-08 | 1.46E-01 | 9.32E-04 | 1.02E-02 | 1.50E-08 | 5.33E-02 | 1.50E-08 | 1.46E-01 | 9.32E-04 |
| 1.00E-06 | 1.70E-01 | 7.65E-03 | 1.36E-02 | 1.00E-06 | 2.13E-01 | 1.00E-06 | 1.70E-01 | 7.65E-03 |
| 7.75E-08 | 2.24E-01 | 4.19E-03 | 8.96E-03 | 7.75E-08 | 5.33E-02 | 7.75E-08 | 2.24E-01 | 4.19E-03 |
| 2.15E-07 | 1.38E+00 | 6.18E-02 | 1.38E+00 | 2.15E-07 | 0.00E+00 | 2.15E-07 | 1.38E+00 | 6.18E-02 |
| 3.32E-07 | 0.00E+00 | | | 3.32E-07 | 8.30E-01 | 3.32E-07 | 0.00E+00 | |
| | 3.53E-01 | | | | 1.23E-01 | | 3.53E-01 | |
| | 2.03E-04 | | | | 1.56E-04 | | 2.03E-04 | |
| | 1.07E-03 | | | | 2.60E-04 | | 1.07E-03 | |
| | 3.76E-03 | | | | 5.96E-04 | | 3.76E-03 | |
| | 3.25E-02 | | | | 3.38E-03 | | 3.25E-02 | |
| | 6.94E-03 | | | | 6.95E-04 | | 6.94E-03 | |
| | 1.01E+00 | | | | 4.84E-02 | | 1.01E+00 | |
| | 1.08E+01 | | | | 2.44E-01 | | 1.08E+01 | |
| | 5.78E-04 | | | | 4.66E-04 | | 5.78E-04 | |
| | 2.24E-03 | | | | 3.93E-04 | | 2.24E-03 | |
| | 5.19E-03 | | | | 3.56E-04 | | 5.19E-03 | |
| | 2.48E-02 | | | | 1.16E-03 | | 2.48E-02 | |
| | 9.95E-03 | | | | 4.43E-04 | | 9.95E-03 | |
| | 9.90E-03 | | | | 5.06E-04 | | 9.90E-03 | |
| | 6.43E-03 | | | | 4.96E-05 | | 6.43E-03 | |
| | 3.04E-01 | | | | 8.05E-03 | | 3.04E-01 | |
| | 2.51E-02 | | | | 9.77E-05 | | 2.51E-02 | |
| | 1.38E+00 | | | | 3.45E-03 | | 1.38E+00 | |
| | 2.81E-02 | 1.57E-07 | 1.24E-05 | | 1.93E-03 | | | |
| | | | | | | | 2.95E-02 | 1.65E-07 |

**Table 3-7**
**Exposure Point Concentrations for each Media: Exposure Area 3**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | Bat - Area 3 | | Kingfisher - Area 3 | | | Mink - Area 3 | | |
|---|---|---|---|---|---|---|---|---|
| Parameter | Surface Water (avg) | Insects (avg) | Surface Water (avg) | Benthic Invertebrates (max fish) | Fish (avg) | Surface Water (avg) | Benthic Invertebrates (max fish) | Fish (avg) |
| **PAH and Penta (mg/kg or mg/L)** | | | | | | | | |
| Acenaphthene | 1.00E-06 | 4.33E-02 | 1.00E-06 | 5.80E+00 | 2.90E+00 | 1.00E-06 | 5.80E+00 | 2.90E+00 |
| Anthracene | 5.00E-08 | 5.33E-02 | 5.00E-08 | 1.00E+00 | 4.67E-01 | 5.00E-08 | 1.00E+00 | 4.67E-01 |
| Fluoranthene | 1.00E-07 | 2.23E-01 | 1.00E-07 | 3.40E+00 | 1.63E+00 | 1.00E-07 | 3.40E+00 | 1.63E+00 |
| Fluorene | 1.00E-07 | 4.20E-02 | 1.00E-07 | 3.70E+00 | 1.80E+00 | 1.00E-07 | 3.70E+00 | 1.80E+00 |
| Indeno(1,2,3-cd)pyrene | 2.75E-08 | 5.33E-02 | 2.75E-08 | 9.50E-02 | 8.17E-02 | 2.75E-08 | 9.50E-02 | 8.17E-02 |
| Naphthalene | 1.00E-06 | 7.10E-02 | 1.00E-06 | 2.30E+00 | 1.29E+00 | 1.00E-06 | 2.30E+00 | 1.29E+00 |
| Benzo(a)anthracene | 1.00E-08 | 5.33E-02 | 1.00E-08 | 2.00E-01 | 1.12E-01 | 1.00E-08 | 2.00E-01 | 1.12E-01 |
| Benzo(b)fluoranthene | 2.70E-08 | 5.10E-02 | 2.70E-08 | 2.10E-01 | 1.20E-01 | 2.70E-08 | 2.10E-01 | 1.20E-01 |
| Benzo(k)fluoranthene | 1.00E-08 | 5.33E-02 | 1.00E-08 | 6.40E-02 | 7.13E-02 | 1.00E-08 | 6.40E-02 | 7.13E-02 |
| Benzo(g,h,i)perylene | 2.75E-08 | 5.83E-02 | 2.75E-08 | 8.00E-02 | 7.67E-02 | 2.75E-08 | 8.00E-02 | 7.67E-02 |
| Benzo(a)pyrene | 1.00E-08 | 5.33E-02 | 1.00E-08 | 1.10E-01 | 8.67E-02 | 1.00E-08 | 1.10E-01 | 8.67E-02 |
| Phenanthrene | 2.75E-07 | 6.27E-02 | 2.75E-07 | 6.80E+00 | 3.12E+00 | 2.75E-07 | 6.80E+00 | 3.12E+00 |
| Pyrene | 1.00E-07 | 5.33E-02 | 1.00E-07 | 1.60E+00 | 9.10E-01 | 1.00E-07 | 1.60E+00 | 9.10E-01 |
| Dibenzo(a,h)anthracene | 1.50E-08 | 5.33E-02 | 1.50E-08 | 9.50E-02 | 8.17E-02 | 1.50E-08 | 9.50E-02 | 8.17E-02 |
| Acenaphthylene | 1.00E-06 | 2.13E-01 | 1.00E-06 | 8.50E-02 | 7.83E-02 | 1.00E-06 | 8.50E-02 | 7.83E-02 |
| Chrysene | 7.75E-08 | 5.33E-02 | 7.75E-08 | 2.10E-01 | 1.21E-01 | 7.75E-08 | 2.10E-01 | 1.21E-01 |
| Pentachlorophenol | 2.50E-07 | 0.00E+00 | 2.50E-07 | 0.00E+00 | 0.00E+00 | 2.50E-07 | 0.00E+00 | 0.00E+00 |
| Total PAH | 4.40E-08 | 8.30E-01 | 4.40E-08 | 2.56E+01 | 1.25E+01 | 4.40E-08 | 2.56E+01 | 1.25E+01 |
| BaP-te | | 1.23E-01 | | 2.56E-01 | 2.01E-01 | | 2.56E-01 | 2.01E-01 |
| **Dioxins (ug/kg)** | | | | | | | | |
| 2,3,7,8-TCDD | | 1.56E-04 | | 1.96E-04 | 1.61E-04 | | 1.96E-04 | 1.61E-04 |
| 1,2,3,7,8-PeCDD | | 2.60E-04 | | 4.80E-04 | 3.45E-04 | | 4.80E-04 | 3.45E-04 |
| 1,2,3,4,7,8-HxCDD | | 5.96E-04 | | 3.81E-04 | 3.25E-04 | | 3.81E-04 | 3.25E-04 |
| 1,2,3,6,7,8-HxCDD | | 3.38E-03 | | 2.14E-03 | 1.88E-03 | | 2.14E-03 | 1.88E-03 |
| 1,2,3,7,8,9-HxCDD | | 6.95E-04 | | 4.49E-04 | 3.77E-04 | | 4.49E-04 | 3.77E-04 |
| 1,2,3,4,6,7,8-HpCDD | | 4.84E-02 | | 1.16E-02 | 9.23E-03 | | 1.16E-02 | 9.23E-03 |
| OCDD | | 2.44E-01 | | 1.08E-01 | 7.14E-02 | | 1.08E-01 | 7.14E-02 |
| 2,3,7,8-TCDF | | 4.66E-04 | | 3.78E-04 | 3.48E-04 | | 3.78E-04 | 3.48E-04 |
| 1,2,3,7,8-PeCDF | | 3.93E-04 | | 5.04E-04 | 4.46E-04 | | 5.04E-04 | 4.46E-04 |
| 2,3,4,7,8-PeCDF | | 3.56E-04 | | 9.91E-04 | 8.80E-04 | | 9.91E-04 | 8.80E-04 |
| 1,2,3,4,7,8-HxCDF | | 1.16E-03 | | 1.62E-03 | 1.28E-03 | | 1.62E-03 | 1.28E-03 |
| 1,2,3,6,7,8-HxCDF | | 4.43E-04 | | 1.06E-03 | 6.17E-04 | | 1.06E-03 | 6.17E-04 |
| 2,3,4,6,7,8-HxCDF | | 5.06E-04 | | 4.61E-04 | 3.05E-04 | | 4.61E-04 | 3.05E-04 |
| 1,2,3,7,8,9-HxCDF | | 4.96E-05 | | 7.95E-05 | 6.49E-05 | | 7.95E-05 | 6.49E-05 |
| 1,2,3,4,6,7,8-HpCDF | | 8.05E-03 | | 3.47E-03 | 2.71E-03 | | 3.47E-03 | 2.71E-03 |
| 1,2,3,4,7,8,9-HpCDF | | 9.77E-05 | | 4.20E-04 | 2.93E-04 | | 4.20E-04 | 2.93E-04 |
| OCDF | | 3.45E-03 | | 1.09E-02 | 6.89E-03 | | 1.09E-02 | 6.89E-03 |
| **2,3,7,8-TCDD TEQ (avian)** | | | | 2.02E-03 | 1.62E-03 | | | |
| **2,3,7,8-TCDD TEQ (mamm)** | | 1.90E-03 | | | | | 1.83E-03 | 1.45E-03 |

Notes:
Floodplain Soil and Insect EPCs were calculated based on samples collected within Exposure Area 2 (see text for additional discussion)

## Table 3-7
## Exposure Point Concentrations for each Media: Exposure Area 3
## Beazer East, Inc.
## Off-Site Portion of Koppers Inc. Facility
## Superior, WI

| Robin - Area 3 | | | | Swallow - Area 3 | | Vole - Area 3 | | |
|---|---|---|---|---|---|---|---|---|
| Surface Water (avg) | Soil (avg) | Vegetables (avg of soil and BTF) | Earthworms (avg of soil and BTF | Surface Water (avg) | Insects (avg) | Surface Water (avg) | Soil (avg) | Vegetables (avg of soil and BTF) |
| 1.00E-06 | 1.55E-01 | 6.97E-03 | 1.24E-02 | 1.00E-06 | 4.33E-02 | 1.00E-06 | 1.55E-01 | 6.97E-03 |
| 5.00E-08 | 2.47E-01 | 1.11E-02 | 1.98E-02 | 5.00E-08 | 5.33E-02 | 5.00E-08 | 2.47E-01 | 1.11E-02 |
| 1.00E-07 | 1.22E-01 | 5.47E-03 | 9.73E-03 | 1.00E-07 | 2.23E-01 | 1.00E-07 | 1.22E-01 | 5.47E-03 |
| 1.00E-07 | 1.29E-01 | 5.81E-03 | 1.03E-02 | 1.00E-07 | 4.20E-02 | 1.00E-07 | 1.29E-01 | 5.81E-03 |
| 2.75E-08 | 3.82E-01 | 1.49E-03 | 3.06E-02 | 2.75E-08 | 5.33E-02 | 2.75E-08 | 3.82E-01 | 1.49E-03 |
| 1.00E-06 | 1.33E-01 | 5.99E-03 | 1.06E-02 | 1.00E-06 | 7.10E-02 | 1.00E-06 | 1.33E-01 | 5.99E-03 |
| 1.00E-08 | 1.12E-01 | 2.27E-03 | 3.37E-03 | 1.00E-08 | 5.33E-02 | 1.00E-08 | 1.12E-01 | 2.27E-03 |
| 2.70E-08 | 2.70E-01 | 2.73E-03 | 1.89E-02 | 2.70E-08 | 5.10E-02 | 2.70E-08 | 2.70E-01 | 2.73E-03 |
| 1.00E-08 | 1.10E-01 | 1.11E-03 | 8.82E-03 | 1.00E-08 | 5.33E-02 | 1.00E-08 | 1.10E-01 | 1.11E-03 |
| 2.75E-08 | 4.37E-01 | 1.97E-02 | 3.50E-02 | 2.75E-08 | 5.83E-02 | 2.75E-08 | 4.37E-01 | 1.97E-02 |
| 1.00E-08 | 2.09E-01 | 2.32E-03 | 1.46E-02 | 1.00E-08 | 5.33E-02 | 1.00E-08 | 2.09E-01 | 2.32E-03 |
| 2.75E-07 | 9.61E-02 | 4.32E-03 | 7.69E-03 | 2.75E-07 | 6.27E-02 | 2.75E-07 | 9.61E-02 | 4.32E-03 |
| 1.00E-07 | 1.20E-01 | 5.40E-03 | 9.59E-03 | 1.00E-07 | 5.33E-02 | 1.00E-07 | 1.20E-01 | 5.40E-03 |
| 1.50E-08 | 1.46E-01 | 9.32E-04 | 1.02E-02 | 1.50E-08 | 5.33E-02 | 1.50E-08 | 1.46E-01 | 9.32E-04 |
| 1.00E-06 | 1.70E-01 | 7.65E-03 | 1.36E-02 | 1.00E-06 | 2.13E-01 | 1.00E-06 | 1.70E-01 | 7.65E-03 |
| 7.75E-08 | 2.24E-01 | 4.19E-03 | 8.96E-03 | 7.75E-08 | 5.33E-02 | 7.75E-08 | 2.24E-01 | 4.19E-03 |
| 2.50E-07 | 1.38E+00 | 6.18E-02 | 1.38E+00 | 2.50E-07 | 0.00E+00 | 2.50E-07 | 1.38E+00 | 6.18E-02 |
| 4.40E-08 | 0.00E+00 | | | 4.40E-08 | 8.30E-01 | 4.40E-08 | 0.00E+00 | |
| | 3.53E-01 | | | | 1.23E-01 | | 3.53E-01 | |
| | 2.03E-04 | | | | 1.56E-04 | | 2.03E-04 | |
| | 1.07E-03 | | | | 2.60E-04 | | 1.07E-03 | |
| | 3.76E-03 | | | | 5.96E-04 | | 3.76E-03 | |
| | 3.25E-02 | | | | 3.38E-03 | | 3.25E-02 | |
| | 6.94E-03 | | | | 6.95E-04 | | 6.94E-03 | |
| | 1.01E+00 | | | | 4.84E-02 | | 1.01E+00 | |
| | 1.08E+01 | | | | 2.44E-01 | | 1.08E+01 | |
| | 5.78E-04 | | | | 4.66E-04 | | 5.78E-04 | |
| | 2.24E-03 | | | | 3.93E-04 | | 2.24E-03 | |
| | 5.19E-03 | | | | 3.56E-04 | | 5.19E-03 | |
| | 2.48E-02 | | | | 1.16E-03 | | 2.48E-02 | |
| | 9.95E-03 | | | | 4.43E-04 | | 9.95E-03 | |
| | 9.90E-03 | | | | 5.06E-04 | | 9.90E-03 | |
| | 6.43E-03 | | | | 4.96E-05 | | 6.43E-03 | |
| | 3.04E-01 | | | | 8.05E-03 | | 3.04E-01 | |
| | 2.51E-02 | | | | 9.77E-05 | | 2.51E-02 | |
| | 1.38E+00 | | | | 3.45E-03 | | 1.38E+00 | |
| | 2.81E-02 | 1.57E-07 | 1.24E-05 | | 1.93E-03 | | | |
| | | | | | | | 2.95E-05 | 1.65E-07 |

Notes:
Floodplain Soil and Insect EPCs were calculated based on samples collected within Exposure Area 2 (see text for additional discussion)

**Table 3-8**
**Avian Toxicity Reference Values (NOAEL)**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

**NOAEL-based TRVs**

| Constituent | Test Species Common Name | Endpoint | Study Type | Effect to Test Organism | Toxicity Value (mg/kg-day) | $LD_{50}$ to NOAEL UF | Subchronic to Chronic UF | Avian NOAEL-Equiv TRV (mg/kg-day) | Toxicity Value Surrogate | Initial Compilation Source |
|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) | Ring-Necked Pheasant | NOAEL | sub-chronic | reproduction | 1.00E-05 | | 10 | 1.40E-05 | | Nosek et al. 1992 |
| Acenaphthene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 100 | | 1.01E+00 | | Schafer et al. 1983 |
| Acenaphthylene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 100 | | 1.01E+00 | Acenaphthene | Schafer et al. 1983 |
| Anthracene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 111 | 100 | | 1.11E+00 | | Schafer et al. 1983 |
| Benzo(a)anthracene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 100 | | 1.01E+00 | fluorene | Schafer et al. 1983 |
| Benzo(a)pyrene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 100 | | 1.01E+00 | fluorene | Schafer et al. 1983 |
| Benzo(b)fluoranthene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 100 | | 1.01E+00 | fluorene | Schafer et al. 1983 |
| Benzo(ghi)perylene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 100 | | 1.01E+00 | fluorene | Schafer et al. 1983 |
| Benzo(k)fluoranthene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 100 | | 1.01E+00 | fluorene | Schafer et al. 1983 |
| Chrysene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 100 | | 1.01E+00 | fluorene | Schafer et al. 1983 |
| Dibenzo(ah)anthracene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 100 | | 1.01E+00 | fluorene | Schafer et al. 1983 |
| Fluoranthene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 100 | | 1.01E+00 | fluorene | Schafer et al. 1983 |
| Fluorene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 100 | | 1.01E+00 | | Schafer et al. 1983 |
| Indeno(1,2,3-cd)pyrene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 100 | | 1.01E+00 | fluorene | Schafer et al. 1983 |
| Naphthalene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 111 | 100 | | 1.11E+00 | anthracene | Schafer et al. 1983 |
| Pentachlorophenol | Northern Bobwhite | NOAEL | acute | mortality | 871 | | 10 | 8.71E+01 | | Hill and Camardese 1986, intake adjusted for BW of 14-day old quail |
| Phenanthrene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 113 | 100 | | 1.13E+00 | | Schafer et al. 1983 |
| Pyrene | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 111 | 100 | | 1.11E+00 | anthracene | Schafer et al. 1983 |

Notes:
mg - milligram
kg - kilogram
$LD_{50}$ - lethal dose for 50% of study population
LOAEL - lowest-observable-adverse-effect-level
NOAEL - no-observable-adverse-effect-level
TRV - toxicity reference value

**Table 3-9**
**Avian Toxicity Reference Values (LOAEL)**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

**LOAEL-Based TRVs**

| Constituent | TEF | Test Species Common Name | Endpoint | Study Type | Effect to Test Organism | Toxicity Value (mg/kg-day) | $LD_{50}$ to LOAEL UF | Subchronic to Chronic UF | LOAEL to NOAEL UF | Avian LOAEL-Equiv TRV (mg/kg-day) | Toxicity Value Surrogate | Initial Compilation Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) | 1 | Ring-Necked Pheasant | LOAEL | sub-chronic | reproduction | 1.00E-05 | | 10 | | 1.40E-04 | | Nosek et al. 1992 |
| Acenaphthene | 1 | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 10 | | | 1.01E+01 | | Schafer et al. 1983 |
| Acenaphthylene | 1 | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 10 | | | 1.01E+01 | Acenaphthene | Schafer et al. 1983 |
| Anthracene | 1 | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 111 | 10 | | | 1.11E+01 | | Schafer et al. 1983 |
| Benzo(a)anthracene | | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 10 | | | 1.01E+01 | fluorene | Schafer et al. 1983 |
| Benzo(a)pyrene | | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 10 | | | 1.01E+01 | fluorene | Schafer et al. 1983 |
| Benzo(b)fluoranthene | | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 10 | | | 1.01E+01 | fluorene | Schafer et al. 1983 |
| Benzo(ghi)perylene | | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 10 | | | 1.01E+01 | fluorene | Schafer et al. 1983 |
| Benzo(k)fluoranthene | | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 10 | | | 1.01E+01 | fluorene | Schafer et al. 1983 |
| Chrysene | | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 10 | | | 1.01E+01 | fluorene | Schafer et al. 1983 |
| Dibenzo(ah)anthracene | | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 10 | | | 1.01E+01 | fluorene | Schafer et al. 1983 |
| Fluoranthene | | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 10 | | | 1.01E+01 | fluorene | Schafer et al. 1983 |
| Fluorene | 1 | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 10 | | | 1.01E+01 | | Schafer et al. 1983 |
| Indeno(1,2,3-cd)pyrene | | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 101 | 10 | | | 1.01E+01 | fluorene | Schafer et al. 1983 |
| Naphthalene | | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 111 | 10 | | | 1.11E+01 | anthracene | Schafer et al. 1983 |
| Pentachlorophenol | 1 | | | | | | | | | NA | | |
| Phenanthrene | 1 | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 113 | 10 | | | 1.13E+01 | | Schafer et al. 1983 |
| Pyrene | | Red-Winged Blackbird | $LD_{50}$ | acute | mortality | 111 | 10 | | | 1.11E+01 | anthracene | Schafer et al. 1983 |

Notes:
mg - milligram
kg - kilogram
$LD_{50}$ - lethal dose for 50% of study population
LOAEL - lowest-observable-adverse-effect-level
NA - Not available
NOAEL - no-observable-adverse-effect-level
TRV - toxicity reference value

Table 3-10
Mammalian Toxicity Reference Values
Beazer East, Inc.
Off-Site Portion of Koppers Inc. Facility
Superior, WI

NOAEL-Based TRVs

| Chemical | Test Species Common Name | Test Species Body Weight (kg) | Endpoint | Study Type | Effect to Test Organism | Toxicity Value (mg/kg-day) | Subchronic to Chronic UF | Endpoint Adjusted TRV (mg/kg-day) | Piscivorous mammal Mink (mg/kg-day) | Herbivorous Mammal Meadow vole (mg/kg-day) | Arial Insectivorous Mammal Bat (mg/kg-day) | Toxicity Value Surrogate | Initial Compilation Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) | rat | 0.35 | NOAEL | chronic | growth, organ toxicity, blood chemistry | 0.000001 | | 0.000001 | 7.65E-07 | 1.81E-06 | 2.66E-06 | | Sample et al. 1996 |
| Acenaphthene | mouse | 0.03 | NOAEL | subchronic | growth, organ toxicity | 175 | 10 | 17.5 | 7.25E+00 | 1.71E+01 | 2.52E+01 | | IRIS |
| Acenaphthylene | mouse | 0.03 | NOAEL | subchronic | growth, organ toxicity | 175 | 10 | 17.5 | 7.25E+00 | 1.71E+01 | 2.52E+01 | Acenaphthene | IRIS |
| Anthracene | mouse | 0.03 | NOAEL | subchronic | reproduction (decreased pup growth) | 1000 | 10 | 100 | 4.14E+01 | 9.78E+01 | 1.44E+02 | | IRIS |
| Benzo(a)anthracene | mouse | 0.03 | LOAEL | chronic | reproduction | 1 | | 1 | 4.14E-01 | 9.78E-01 | 1.44E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Benzo(a)pyrene | mouse | 0.03 | LOAEL | chronic | reproduction | 1 | | 1 | 4.14E-01 | 9.78E-01 | 1.44E+00 | | Sample et al. 1996 |
| Benzo(b)fluoranthene | mouse | 0.03 | LOAEL | chronic | reproduction | 1 | | 1 | 4.14E-01 | 9.78E-01 | 1.44E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Benzo(ghi)perylene | mouse | 0.03 | LOAEL | chronic | reproduction | 1 | | 1 | 4.14E-01 | 9.78E-01 | 1.44E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Benzo(k)fluoranthene | mouse | 0.03 | LOAEL | chronic | reproduction | 1 | | 1 | 4.14E-01 | 9.78E-01 | 1.44E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Chrysene | mouse | 0.03 | LOAEL | chronic | reproduction | 1 | | 1 | 4.14E-01 | 9.78E-01 | 1.44E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Dibenzo(a,h)anthracene | mouse | 0.03 | LOAEL | chronic | reproduction | 1 | | 1 | 4.14E-01 | 9.78E-01 | 1.44E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Fluoranthene | mouse | 0.03 | NOAEL | subchronic | liver and kidney toxicity, hematology | 125 | 10 | 12.5 | 5.18E+00 | 1.22E+01 | 1.80E+01 | | IRIS |
| Fluorene | mouse | 0.03 | NOAEL | subchronic | hematology | 125 | 10 | 12.5 | 5.18E+00 | 1.22E+01 | 1.80E+01 | | IRIS |
| Indeno(1,2,3-cd)pyrene | mouse | 0.03 | LOAEL | chronic | reproduction | 1 | | 1 | 4.14E-01 | 9.78E-01 | 1.44E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Naphthalene | rat | 0.35 | NOAEL | chronic | reproduction | 50 | | 50 | 3.83E+01 | 9.04E+01 | 1.33E+02 | | EFA West 1998 |
| Pentachlorophenol | rat | 0.35 | NOAEL | chronic | liver and kidney toxicity | 3 | | 3 | 2.30E+00 | 5.42E+00 | 7.98E+00 | | IRIS |
| Phenanthrene | mouse | 0.03 | NOAEL | subchronic | kidney toxicity | 75 | 10 | 7.5 | 3.11E+00 | 7.33E+00 | 1.08E+01 | Pyrene | IRIS |
| Pyrene | mouse | 0.03 | NOAEL | subchronic | kidney toxicity | 75 | 10 | 7.5 | 3.11E+00 | 7.33E+00 | 1.08E+01 | | IRIS |

Notes:
mg - milligram
kg - kilogram
LOAEL - lowest-observable-adverse-effect-level
NOAEL - no-observable-adverse-effect-level
TRV - toxicity reference value

**Table 3-11**
**Mammalian Toxicity Reference Values**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

**LOAEL-Based TRVs**

| Chemical | TEF | Test Species Common Name | Test Species Body Weight (kg) | Endpoint | Study Type | Effect to Test Organism | Toxicity Value (mg/kg-day) | Subchronic to Chronic UF | LOAEL to NOAEL UF | deer mouse TRV | Endpoint Adjusted TRV (mg/kg-day) | Piscivorous mammal Mink (mg/kg-day) | Herbivorous Mammal Meadow vole (mg/kg-day) | Omnivorous Mammal Raccoon (mg/kg-day) | Arial Insectivorous Mammal Bat (mg/kg-day) | Carnivorous Mammal Red Fox (mg/kg-day) | Toxicity Value Surrogate | Initial Compilation Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) | 1 | rat | 0.35 | LOAEL | chronic | growth, organ toxicity, blood chemistry | 0.00001 | | | 2.05E-06 | 0.00001 | 7.65E-06 | 1.81E-05 | 4.96E-06 | 2.66E-05 | 5.27E-06 | | Sample et al. 1996 |
| Acenaphthene | 1 | mouse | 0.03 | LOAEL | subchronic | hepatotoxicity | 350 | 10 | | 1.94E+01 | 35 | 1.45E+01 | 3.42E+01 | 9.39E+00 | 5.04E+01 | 9.98E+00 | | IRIS |
| Acenaphthylene | 1 | mouse | 0.03 | LOAEL | subchronic | hepatotoxicity | 350 | 10 | | 1.94E+01 | 35 | 1.45E+01 | 3.42E+01 | 9.39E+00 | 5.04E+01 | 9.98E+00 | Acenaphthene | IRIS |
| Anthracene | 1 | | | | | | NA | | | | | | | | | | | |
| Benzo(a)anthracene | 1 | mouse | 0.03 | LOAEL | chronic | reproduction | 10 | | | 1.11E+00 | 10 | 4.14E+00 | 9.78E+00 | 2.68E+00 | 1.44E+01 | 2.85E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Benzo(a)pyrene | 1 | mouse | 0.03 | LOAEL | chronic | reproduction | 10 | | | 1.11E+00 | 10 | 4.14E+00 | 9.78E+00 | 2.68E+00 | 1.44E+01 | 2.85E+00 | | Sample et al. 1996 |
| Benzo(b)fluoranthene | 1 | mouse | 0.03 | LOAEL | chronic | reproduction | 10 | | | 1.11E+00 | 10 | 4.14E+00 | 9.78E+00 | 2.68E+00 | 1.44E+01 | 2.85E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Benzo(ghi)perylene | 1 | mouse | 0.03 | LOAEL | chronic | reproduction | 10 | | | 1.11E+00 | 10 | 4.14E+00 | 9.78E+00 | 2.68E+00 | 1.44E+01 | 2.85E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Benzo(k)fluoranthene | 1 | mouse | 0.03 | LOAEL | chronic | reproduction | 10 | | | 1.11E+00 | 10 | 4.14E+00 | 9.78E+00 | 2.68E+00 | 1.44E+01 | 2.85E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Chrysene | 1 | mouse | 0.03 | LOAEL | chronic | reproduction | 10 | | | 1.11E+00 | 10 | 4.14E+00 | 9.78E+00 | 2.68E+00 | 1.44E+01 | 2.85E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Dibenzo(a,h)anthracene | 1 | mouse | 0.03 | LOAEL | chronic | reproduction | 10 | | | 1.11E+00 | 10 | 4.14E+00 | 9.78E+00 | 2.68E+00 | 1.44E+01 | 2.85E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Fluoranthene | 1 | mouse | 0.03 | LOAEL | subchronic | liver and kidney toxicity, hematology | 250 | 10 | | 1.38E+01 | 25 | 1.04E+01 | 2.44E+01 | 6.71E+00 | 3.60E+01 | 7.13E+00 | | IRIS |
| Fluorene | 1 | mouse | 0.03 | LOAEL | subchronic | hematology | 250 | 10 | | 1.38E+01 | 25 | 1.04E+01 | 2.44E+01 | 6.71E+00 | 3.60E+01 | 7.13E+00 | | IRIS |
| Indeno(1,2,3-cd)pyrene | 1 | mouse | 0.03 | LOAEL | chronic | reproduction | 10 | | | 1.11E+00 | 10 | 4.14E+00 | 9.78E+00 | 2.68E+00 | 1.44E+01 | 2.85E+00 | Benzo(a)pyrene | Sample et al. 1996 |
| Naphthalene | 1 | rat | 0.35 | LOAEL | subchronic | body weight | 100 | 10 | | | 10 | 7.65E+00 | 1.81E+01 | 4.96E+00 | 2.66E+01 | | | IRIS |
| Pentachlorophenol | 1 | rat | 0.35 | LOAEL | chronic | liver and kidney toxicity | 10 | | | 6.14E+00 | 10 | 7.65E+00 | 1.81E+01 | 4.96E+00 | 2.66E+01 | 5.27E+00 | | IRIS |
| Phenanthrene | 1 | mouse | 0.03 | LOAEL | subchronic | kidney toxicity | 125 | 10 | | 8.30E+00 | 12.5 | 5.18E+00 | 1.22E+01 | 3.35E+00 | 1.80E+01 | 3.56E+00 | Pyrene | IRIS |
| Pyrene | 1 | mouse | 0.03 | LOAEL | subchronic | kidney toxicity | 125 | 10 | | 8.30E+00 | 12.5 | 5.18E+00 | 1.22E+01 | 3.35E+00 | 1.80E+01 | 3.56E+00 | | IRIS |

Notes:
mg - milligram
kg - kilogram
LOAEL - lowest-observable-adverse-effect-level
NOAEL - no-observable-adverse-effect-level
TRV - toxicity reference value

Table 3-12
Sediment PAH Concentrations Compared to WDNR CBSQGs
Beazer East, Inc.
Off-Site Portion of Koppers Inc. Facility
Superior, WI

| PAH | SQG Screening Criterion [a] (ug/kg dw at 1% TOC) | | | | Sediment Concentration (ug/kg @ 1% TOC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Upstream of Railroad Embankment | | | Downstream of Railroad Embankment | | | | | |
| | | | | | Sed R4 | SED R5 | SED R6 | Sed R1 | SED R1 Dup | SED R2 | SED R1 (07/05) | SED R2 (07/05) | SED R3 (07/05) |
| | TEC | MEC | PEC | source | 7/12/2005 0-3" | 7/13/2005 0-3" | 7/13/2005 0-3" | 6/8/2005 0-3" | 6/8/2005 0-3" | 6/8/2005 0-3" | 7/12/2005 0-3" | 7/12/2005 0-3" | 7/12/2005 0-3" |
| Acenaphthene | 6.7 | 48 | 89 | CCME (1999) | 10810.8 | 33695.7 | 4305.6 | 4875.3 | 3971.6 | 38888.9 | 1300.0 | 9027.8 | 4658.7 |
| Anthracene | 57.2 | 451 | 845 | CBSQG (2000a) | 2567.6 | 50724.6 | 3541.7 | 40166.2 | 51773.0 | 55555.6 | 2600.0 | 11805.6 | 19501.6 |
| Fluoranthene | 423 | 1327 | 2230 | CBSQG (2000a) | 14864.9 | 65217.4 | 12500.0 | 50692.5 | 37588.7 | 214285.7 | 11000.0 | 76388.9 | 11917.7 |
| Fluorene | 77.4 | 307 | 536 | CBSQG (2000a) | 8108.1 | 30434.8 | 3402.8 | 7479.2 | 9929.1 | 39682.5 | 1400.0 | 9027.8 | 6392.2 |
| Indeno(1,2,3-cd)pyrene | 200 | 1700 | 3200 | CBSQG (2000a) | 216.2 | 1992.8 | 763.9 | 2548.5 | 1773.0 | 7619.0 | 640.0 | 1875.0 | 357.5 |
| Naphthalene | 176 | 369 | 561 | CBSQG (2000a) | 18243.2 | 50724.6 | 3125.0 | 886.4 | 1134.8 | 1904.8 | 290.0 | 618.1 | 2275.2 |
| Benzo(a)anthracene | 108 | 579 | 1050 | CBSQG (2000a) | 2837.8 | 15579.7 | 3750.0 | 15789.5 | 10638.3 | 52381.0 | 2800.0 | 11805.6 | 2600.2 |
| Benzo(b)fluoranthene | 240 | 6820 | 13400 | Persaud *et al*. 1993 | 1554.1 | 6884.1 | 2986.1 | 9169.0 | 6453.9 | 28571.4 | 2300.0 | 7638.9 | 1733.5 |
| Benzo(k)fluoranthene | 240 | 6820 | 13400 | Persaud et al. 1993 | 479.7 | 2608.7 | 972.2 | 3241.0 | 2127.7 | 12698.4 | 780.0 | 3194.4 | 465.9 |
| Benzo(g,h,i)perylene | 170 | 1685 | 3200 | Persaud et al. 1993 | 223.0 | 2173.9 | 763.9 | 2825.5 | 1985.8 | 7936.5 | 710.0 | 1944.4 | 390.0 |
| Benzo(a)pyrene | 150 | 800 | 1450 | CBSQG (2000a) | 1013.5 | 5072.5 | 1805.6 | 6842.1 | 4751.8 | 21428.6 | 1600.0 | 5277.8 | 1018.4 |
| Phenanthrene | 204 | 687 | 1170 | CBSQG (2000a) | 25000.0 | 86956.5 | 10416.7 | 29916.9 | 29078.0 | 166666.7 | 7000.0 | 61111.1 | 18418.2 |
| Pyrene | 195 | 858 | 1520 | CBSQG (2000a) | 10135.1 | 47101.4 | 9722.2 | 39335.2 | 29787.2 | 166666.7 | 9000.0 | 56944.4 | 8559.0 |
| Dibenzo(a,h)anthracene | 33 | 84 | 135 | CBSQG (2000a) | 74.3 | 579.7 | ***222.2*** | 770.1 | 553.2 | ***2301.6*** | 190.0 | 562.5 | ***106.2*** |
| Acenaphthylene | 5.9 | 67 | 128 | CCME (1999) | 94.6 | 724.6 | ***243.1*** | 783.9 | 659.6 | ***2857.1*** | 200.0 | 659.7 | ***130.0*** |
| Chrysene | 166 | 728 | 1290 | CBSQG (2000a) | 2432.4 | 21739.1 | 4375.0 | 27146.8 | 12766.0 | 47619.0 | 3900.0 | 11805.6 | 3141.9 |

Notes:

PAH: Polycyclic Aromatic Hydrocarbon

Values in bold and italics were non detects and are shown at half of the detection limit.

Highlighted value indicates the observed concentration exceeds screening criterion.

(a) WDNR, 2003

Table 3-13
OC-Adjusted Sediment Total PAH Concentrations compared to Swartz (1999) benchmarks
Beazer East, Inc.
Off-Site Portion of Koppers Inc. Facility
Superior, WI

| PAH | Effects Concentration (a) (ug/kg OC) | | | OC-Adjusted Sediment Concentration (ug/kg OC)(b) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Upstream of Railroad | | | Downstream of Railroad Embankment | | | | | |
| | | | | Sed R4 | SED R5 | SED R6 | SED R1 | SED R1 Dup | SED R2 | SED R1 | SED R2 | SED R3 |
| | Threshold | Median | Extreme | 7/12/2005 0-3" | 7/13/2005 0-3" | 7/13/2005 0-3" | 6/8/2005 0-3" | 6/8/2005 0-3" | 6/8/2005 0-3" | 7/12/2005 0-3" | 7/12/2005 0-3" | 7/12/2005 0-3" |
| Total PAH* | 290,000 | 1,800,000 | 10,000,000 | 9,564,865 | 36,731,884 | 5,782,639 | 24,246,814 | 20,497,163 | 86,706,349 | 4,571,000 | 26,968,750 | 8,166,631 |

Notes:
PAH: Polycyclic Aromatic Hydrocarbon
OC: Organic Carbon
(a) Consensus sediment quality guidelines for PAH mixturtes (Swartz, 1999)
(b) OC-adjusted Sediment Concentration calculated as sediment PAH concentration divided by sample-specific fraction OC
fraction OC in sediment at Field Sample Location 1: 0.13
fraction OC in sediment at Background Sample Location 1: 0.046
fraction OC in sediment at Field Sample Location 2: 0.16
fraction OC in sediment at Background Sample Location 2: 0.21
fraction OC in sediment at Field Sample Location 3: 0.27
fraction OC in sediment at Background Sample Location 3: 0.036
Highlighted value indicates the observed concentration exceeds threshold screening criterion
*sum includes 13 PAHs included in Swartz, 1999

Table 3-14
Sediment PAH Toxicity Unit Calculations
Beazer East, Inc.
Off-Site Portion of Koppers Inc. Facility
Superior, WI

| PAH | TU [a] | | | | | | | | | FCV (ug/kg OC) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Upstream of Railroad Embankment | | | Downstream of Railroad Embankment | | | | | | |
| | Sed R4<br>7/12/2005<br>0-3" | SED R5<br>7/13/2005<br>0-3" | SED R6<br>7/13/2005<br>0-3" | SED R1<br>6/8/2005<br>0-3" | SED R1 Dup<br>6/8/2005<br>0-3" | SED R2<br>6/8/2005<br>0-3" | SED R1<br>7/12/2005<br>0-3" | SED R2<br>7/12/2005<br>0-3" | SED R3<br>7/12/2005<br>0-3" | |
| Acenaphthene | 2E+00 | 7E+00 | 9E-01 | 1E+00 | 8E-01 | 8E+00 | 3E-01 | 2E+00 | 9E-01 | 491000 |
| Anthracene | 4E-01 | 9E+00 | 6E-01 | 7E+00 | 9E+00 | 9E+00 | 4E-01 | 2E+00 | 3E+00 | 594000 |
| Fluoranthene | 2E+00 | 9E+00 | 2E+00 | 7E+00 | 5E+00 | 3E+01 | 2E+00 | 1E+01 | 2E+00 | 707000 |
| Fluorene | 2E+00 | 6E+00 | 6E-01 | 1E+00 | 2E+00 | 7E+00 | 3E-01 | 2E+00 | 1E+00 | 538000 |
| Indeno(1,2,3-cd)pyrene | 2E-02 | 2E-01 | 7E-02 | 2E-01 | 2E-01 | 7E-01 | 6E-02 | 2E-01 | 3E-02 | 1115000 |
| Naphthalene | 5E+00 | 1E+01 | 8E-01 | 2E-01 | 3E-01 | 5E-01 | 8E-02 | 2E-01 | 6E-01 | 385000 |
| Benzo(a)anthracene | 3E-01 | 2E+00 | 4E-01 | 2E+00 | 1E+00 | 6E+00 | 3E-01 | 1E+00 | 3E-01 | 841000 |
| Benzo(b)fluoranthene | 2E-01 | 7E-01 | 3E-01 | 9E-01 | 7E-01 | 3E+00 | 2E-01 | 8E-01 | 2E-01 | 979000 |
| Benzo(k)fluoranthene | 5E-02 | 3E-01 | 1E-01 | 3E-01 | 2E-01 | 1E+00 | 8E-02 | 3E-01 | 5E-02 | 981000 |
| Benzo(g,h,i)perylene | 2E-02 | 2E-01 | 7E-02 | 3E-01 | 2E-01 | 7E-01 | 6E-02 | 2E-01 | 4E-02 | 1095000 |
| Benzo(a)pyrene | 1E-01 | 5E-01 | 2E-01 | 7E-01 | 5E-01 | 2E+00 | 2E-01 | 5E-01 | 1E-01 | 965000 |
| Phenanthrene | 4E+00 | 1E+01 | 2E+00 | 5E+00 | 5E+00 | 3E+01 | 1E+00 | 1E+01 | 3E+00 | 596000 |
| Pyrene | 1E+00 | 7E+00 | 1E+00 | 6E+00 | 4E+00 | 2E+01 | 1E+00 | 8E+00 | 1E+00 | 697000 |
| Dibenzo(a,h)anthracene | 7E-03 | 5E-02 | 2E-02 | 7E-02 | 5E-02 | 2E-01 | 2E-02 | 5E-02 | 9E-03 | 1123000 |
| Acenaphthylene | 2E-02 | 2E-01 | 5E-02 | 2E-01 | 1E-01 | 6E-01 | 4E-02 | 1E-01 | 3E-02 | 452000 |
| Chrysene | 3E-01 | 3E+00 | 5E-01 | 3E+00 | 2E+00 | 6E+00 | 5E-01 | 1E+00 | 4E-01 | 844000 |
| *sum-TU* [b] | 2E+01 | 7E+01 | 1E+01 | 4E+01 | 3E+01 | 1E+02 | 7E+00 | 4E+01 | 1E+01 | |

Notes:
PAH: Polycyclic Aromatic Hydrocarbon
TU: Toxic Unit
(a) TU calculated as: OC-adjusted sediment PAH concentration divided by FCV
(b) sum-TU calculated as: (sum of 16 individual PAH TUs for a given sample location)

Table 3-15
Summary Table of Ecological Risk: Superior Off-site (NOAEL based TRV's)
Beazer East, Inc.
Off-Site Portion of Koppers Inc. Facility
Superior, WI

## Area 1

| Bat | | | | | |
|---|---|---|---|---|---|
| | TQ-water | TQ-inverts | Total TQ | | |
| PAHs | NA | 2.0E-01 | 2.0E-01 | | |
| Pentachlorophenol | 4.1E-06 | NA | 4.1E-06 | | |
| TCDD-TEQ | NA | 1.3E-01 | 1.3E-01 | | |

| Kingfisher | | | | | |
|---|---|---|---|---|---|
| | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ | |
| PAHs | NA | **3.0E+00** | **1.5E+00** | **4.6E+00** | |
| Pentachlorophenol | 1.8E-06 | NA | NA | 1.8E-06 | |
| TCDD-TEQ | NA | 1.8E-02 | 1.4E-02 | 3.2E-02 | |

| Mink | | | | | |
|---|---|---|---|---|---|
| | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ | |
| PAHs | NA | 4.1E-01 | 7.0E-01 | **1.1E+00** | |
| Pentachlorophenol | 1.4E-05 | NA | NA | 1.4E-05 | |
| TCDD-TEQ | NA | 1.3E-01 | 3.1E-01 | 4.4E-01 | |

| Robin | | | | | |
|---|---|---|---|---|---|
| | HQ Soil | HQ Water | HQ veg | HQ-earth | Total HQ |
| PAHs | 1.3E-01 | NA | 2.6E-02 | 3.7E-01 | 5.2E-01 |
| Pentachlorophenol | 1.7E-04 | 3.3E-07 | 6.4E-05 | 7.2E-03 | 7.5E-03 |
| TCDD-TEQ | 7.8E-02 | NA | 3.6E-03 | **1.5E+00** | **1.5E+00** |

| Swallow | | | | | |
|---|---|---|---|---|---|
| | TQ-Water | TQ-Insects | Total TQ | | |
| PAHs | NA | **1.7E+00** | **1.7E+00** | | |
| Pentachlorophenol | 5.2E-07 | 0.0E+00 | 5.2E-07 | | |
| TCDD-TEQ | NA | 8.2E-02 | 8.2E-02 | | |

| Vole | | | | | |
|---|---|---|---|---|---|
| | TQ-Soil | TQ-Veg. | TQ-Water | Total TQ | |
| PAHs | 1.8E-01 | 2.8E-02 | NA | 2.0E-01 | |
| Pentachlorophenol | 4.7E-03 | 1.8E-03 | 1.6E-05 | 6.5E-03 | |
| TCDD-TEQ | **1.1E+00** | 5.1E-02 | NA | **1.2E+00** | |

## Area 2

| Bat | | | | | |
|---|---|---|---|---|---|
| | TQ-water | TQ-inverts | total TQ | | |
| PAHs | 3.1E-05 | 9.5E-02 | 9.5E-02 | | |
| Pentachlorophenol | 2.1E-06 | NA | 2.1E-06 | | |
| TCDD-TEQ | NA | 2.0E-01 | 2.0E-01 | | |

| Kingfisher | | | | | |
|---|---|---|---|---|---|
| | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ | |
| PAHs | 1.5E-03 | **3.0E+00** | **1.5E+00** | **4.6E+00** | |
| Pentachlorophenol | 9.2E-07 | NA | NA | 9.2E-07 | |
| TCDD-TEQ | NA | 1.8E-02 | 1.4E-02 | 3.2E-02 | |

| Mink | | | | | |
|---|---|---|---|---|---|
| | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ | |
| PAHs | 1.1E-04 | 4.1E-01 | 7.0E-01 | **1.1E+00** | |
| Pentachlorophenol | 7.3E-06 | NA | NA | 7.3E-06 | |
| TCDD-TEQ | NA | 1.3E-01 | 3.1E-01 | 4.4E-01 | |

| Robin | | | | | |
|---|---|---|---|---|---|
| | HQ Soil | HQ Water | HQ veg | HQ-earth | Total HQ |
| PAHs | 2.1E-02 | 2.7E-04 | 5.0E-03 | 6.6E-02 | 9.3E-02 |
| Pentachlorophenol | 1.1E-04 | 1.7E-07 | 4.2E-05 | 4.8E-03 | 5.0E-03 |
| TCDD-TEQ | 1.4E-02 | NA | 6.7E-04 | 2.7E-01 | 2.8E-01 |

| Swallow | | | | | |
|---|---|---|---|---|---|
| | TQ-Water | TQ-Insects | Total TQ | | |
| PAHs | 4.3E-04 | 1.0E+00 | 1.0E+00 | | |
| Pentachlorophenol | 2.7E-07 | NA | 2.7E-07 | | |
| TCDD-TEQ | NA | 1.2E-01 | 1.2E-01 | | |

| Vole | | | | | |
|---|---|---|---|---|---|
| | TQ-Soil | TQ-Veg. | TQ-Water | Total TQ | |
| PAHs | 2.5E-02 | 4.0E-03 | 1.2E-04 | 2.9E-02 | |
| Pentachlorophenol | 3.1E-03 | 1.2E-03 | 8.3E-06 | 4.3E-03 | |
| TCDD-TEQ | 2.0E-01 | 9.4E-03 | NA | 2.1E-01 | |

## Area 3

| Bat | | | | | |
|---|---|---|---|---|---|
| | TQ-water | TQ-inverts | total TQ | | |
| PAHs | 7.8E-05 | 9.5E-02 | 9.5E-02 | | |
| Pentachlorophenol | 8.9E-06 | NA | 8.9E-06 | | |
| TCDD-TEQ | NA | 2.0E-01 | 2.0E-01 | | |

| Kingfisher | | | | | |
|---|---|---|---|---|---|
| | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ | |
| PAHs | 1.4E-03 | 5.0E-01 | 2.4E-01 | 7.4E-01 | |
| Pentachlorophenol | 1.1E-06 | NA | NA | 1.1E-06 | |
| TCDD-TEQ | NA | 8.0E-03 | 5.8E-03 | 1.4E-02 | |

| Mink | | | | | |
|---|---|---|---|---|---|
| | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ | |
| PAHs | 7.4E-05 | 1.3E-01 | 2.0E-01 | 3.3E-01 | |
| Pentachlorophenol | 8.4E-06 | NA | NA | 8.4E-06 | |
| TCDD-TEQ | NA | 5.7E-02 | 1.3E-01 | 1.9E-01 | |

| Robin | | | | | |
|---|---|---|---|---|---|
| | HQ Soil | HQ Water | HQ veg | HQ-earth | Total HQ |
| PAHs | 2.1E-02 | 2.6E-04 | 5.0E-03 | 6.6E-02 | 9.3E-02 |
| Pentachlorophenol | 1.1E-04 | 2.0E-07 | 4.2E-05 | 4.8E-03 | 5.0E-03 |
| TCDD-TEQ | 1.4E-02 | NA | 6.7E-04 | 2.7E-01 | 2.8E-01 |

| Swallow | | | | | |
|---|---|---|---|---|---|
| | TQ-Water | TQ-Insects | Total TQ | | |
| PAHs | 4.0E-04 | 1.0E+00 | 1.0E+00 | | |
| Pentachlorophenol | 3.2E-07 | NA | 3.2E-07 | | |
| TCDD-TEQ | NA | 1.2E-01 | 1.2E-01 | | |

| Vole | | | | | |
|---|---|---|---|---|---|
| | TQ-Soil | TQ-Veg. | TQ-Water | Total TQ | |
| PAHs | 2.5E-02 | 4.0E-03 | 8.5E-05 | 2.9E-02 | |
| Pentachlorophenol | 3.1E-03 | 1.2E-03 | 9.7E-06 | 4.3E-03 | |
| TCDD-TEQ | 2.0E-01 | 9.4E-03 | NA | 2.1E-01 | |

Notes:
Area definitions:
1. Immediately adjacent to outfall intersection with creek
2. Upstream of embankment, not including area 1
3. Downstream of embankment.
Bolded values are greater than 1
NA indicated Not Applicable (no detects or no data available)
PAH's, Dioxins and Pentachlorophenol all assumed to be COPCs (1/2 detection limit for NDs): NOAEL

Table 3-16
Summary Table of Ecological Risk: Superior Off-site (LOAEL based TRV's)
Beazer East, Inc.
Off-Site Portion of Koppers Inc. Facility
Superior, WI

## Area 1

**Bat**

| | TQ-water | TQ-inverts | Total TQ | | |
|---|---|---|---|---|---|
| PAHs | NA | 2.8E-02 | 2.8E-02 | | |
| Pentachlorophenol | 1.2E-06 | NA | 1.2E-06 | | |
| Dioxin | NA | 1.3E-02 | 1.3E-02 | | |

**Kingfisher**

| | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ | |
|---|---|---|---|---|---|
| PAHs | 0.0E+00 | **3.0E-01** | **1.5E-01** | **4.6E-01** | |
| Pentachlorophenol | na | na | na | na | |
| Dioxin | NA | 1.8E-03 | 1.4E-03 | 3.2E-03 | |

**Mink**

| | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ | |
|---|---|---|---|---|---|
| PAHs | 0.0E+00 | 8.9E-02 | 1.4E-01 | **2.3E-01** | |
| Pentachlorophenol | 1.8E-06 | NA | NA | 1.8E-06 | |
| Dioxin | NA | 1.3E-02 | 3.1E-02 | 4.4E-02 | |

**Robin**

| | HQ Soil | HQ Water | HQ plant | HQ-earth | Total HQ |
|---|---|---|---|---|---|
| PAHs | 1.3E-02 | NA | 2.6E-03 | 3.7E-02 | 5.2E-02 |
| Pentachlorophenol | na | na | na | na | na |
| Dioxin | 7.8E-03 | NA | 3.6E-04 | **1.5E-01** | **1.5E-01** |

**Swallow**

| | TQ-Water | TQ-Insects | Total TQ | | |
|---|---|---|---|---|---|
| PAHs | NA | **1.7E-01** | **1.7E-01** | | |
| Pentachlorophenol | na | na | na | | |
| Dioxin | NA | 8.2E-03 | 8.2E-03 | | |

**Vole**

| | TQ-Soil | TQ-plant. | TQ-Water | Total TQ | |
|---|---|---|---|---|---|
| PAHs | 1.9E-02 | 3.3E-03 | 0.0E+00 | 2.2E-02 | |
| Pentachlorophenol | 1.4E-03 | 5.3E-04 | 4.8E-06 | 1.9E-03 | |
| Dioxin | **1.1E-01** | 5.1E-03 | NA | **1.2E-01** | |

## Area 2

**Bat**

| | TQ-water | TQ-inverts | total TQ | | |
|---|---|---|---|---|---|
| PAHs | 1.0E-05 | 1.5E-02 | 1.5E-02 | | |
| Pentachlorophenol | 6.4E-07 | NA | 6.4E-07 | | |
| Dioxin | NA | 2.0E-02 | 2.0E-02 | | |

**Kingfisher**

| | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ | |
|---|---|---|---|---|---|
| PAHs | 1.5E-04 | **3.0E-01** | **1.5E-01** | **4.6E-01** | |
| Pentachlorophenol | na | na | na | na | |
| Dioxin | NA | 1.8E-03 | 1.4E-03 | 3.2E-03 | |

**Mink**

| | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ | |
|---|---|---|---|---|---|
| PAHs | 2.1E-05 | 8.9E-02 | 1.4E-01 | **2.3E-01** | |
| Pentachlorophenol | 9.2E-07 | NA | NA | 9.2E-07 | |
| Dioxin | NA | 1.3E-02 | 3.1E-02 | 4.4E-02 | |

**Robin**

| | HQ Soil | HQ Water | HQ plant | HQ-earth | Total HQ |
|---|---|---|---|---|---|
| PAHs | 2.1E-03 | 2.7E-05 | 5.0E-04 | 6.6E-03 | 9.3E-03 |
| Pentachlorophenol | na | na | na | na | 0.0E+00 |
| Dioxin | 1.4E-03 | NA | 6.7E-05 | 2.7E-02 | 2.8E-02 |

**Swallow**

| | TQ-Water | TQ-Insects | Total TQ | | |
|---|---|---|---|---|---|
| PAHs | 4.3E-05 | 1.0E-01 | 1.0E-01 | | |
| Pentachlorophenol | na | na | 0.0E+00 | | |
| Dioxin | NA | 1.2E-02 | 1.2E-02 | | |

**Vole**

| | TQ-Soil | TQ-plant. | TQ-Water | Total TQ | |
|---|---|---|---|---|---|
| PAHs | 2.9E-03 | 5.7E-04 | 4.1E-05 | 3.5E-03 | |
| Pentachlorophenol | 9.4E-04 | 3.5E-04 | 2.5E-06 | 1.3E-03 | |
| Dioxin | 2.0E-02 | 9.3E-04 | NA | 2.1E-02 | |

## Area 3

**Bat**

| | TQ-water | TQ-inverts | total TQ | | |
|---|---|---|---|---|---|
| PAHs | 3.3E-05 | 1.5E-02 | 1.5E-02 | | |
| Pentachlorophenol | 2.7E-06 | NA | 2.7E-06 | | |
| Dioxin | NA | 2.0E-02 | 2.0E-02 | | |

**Kingfisher**

| | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ | |
|---|---|---|---|---|---|
| PAHs | 1.4E-04 | 5.0E-02 | 2.4E-02 | 7.4E-02 | |
| Pentachlorophenol | na | na | na | na | |
| Dioxin | NA | 8.0E-04 | 5.8E-04 | 1.4E-03 | |

**Mink**

| | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ | |
|---|---|---|---|---|---|
| PAHs | 2.0E-05 | 1.5E-02 | 2.2E-02 | 3.7E-02 | |
| Pentachlorophenol | 1.1E-06 | NA | NA | 1.1E-06 | |
| Dioxin | NA | 5.8E-03 | 1.3E-02 | 1.9E-02 | |

**Robin**

| | HQ Soil | HQ Water | HQ plant | HQ-earth | Total HQ |
|---|---|---|---|---|---|
| PAHs | 2.1E-03 | 2.6E-05 | 5.0E-04 | 6.6E-03 | 9.3E-03 |
| Pentachlorophenol | na | na | na | na | na |
| Dioxin | 1.4E-03 | NA | 6.7E-05 | 2.7E-02 | 2.8E-02 |

**Swallow**

| | TQ-Water | TQ-Insects | Total TQ | | |
|---|---|---|---|---|---|
| PAHs | 4.0E-05 | 1.0E-01 | 1.0E-01 | | |
| Pentachlorophenol | na | na | na | | |
| Dioxin | NA | 1.2E-02 | 1.2E-02 | | |

**Vole**

| | TQ-Soil | TQ-plant. | TQ-Water | Total TQ | |
|---|---|---|---|---|---|
| PAHs | 2.9E-03 | 5.7E-04 | 3.6E-05 | 3.5E-03 | |
| Pentachlorophenol | 9.4E-04 | 3.5E-04 | 2.9E-06 | 1.3E-03 | |
| Dioxin | 2.0E-02 | 9.3E-04 | NA | 2.1E-02 | |

Notes:
Area definitions:
1. Immediately adjacent to outfall intersection with creek
2. Upstream of embankment (not including area 1)
3. Downstream of embankment.
NA indicated Not Applicable (no detects or no data available)
PAH's, Dioxins and Pentachlorophenol all assumed to be COPCs (1/2 detection limit for NDs): LOAEL

**Table 3-17**
**Summary of Lipid Normalized Fish Tissue Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers INC. Facility**
**Superior, WI**

| pg TCDD-EQ / g Fish Tissue | | | | | | |
|---|---|---|---|---|---|---|
| Reference | FS-R6 | FS-R5 | FS-R4 | FS-R3 | FS-R2 | FS-R1 |
| 0.34 | 2 | 1.5 | 1.3 | 0.89 | 0.48 | 0.56 |
| % Lipids | | | | | | |
| 6.16 | 3.14 | 1.61 | 1.77 | 1.16 | 1.38 | 1.56 |
| Lipid Normalized pg TCDD-EQ / g Lipid in Fish | | | | | | |
| 5.52 | 63.7 | 93.2 | 73.5 | 76.7 | 34.8 | 35.9 |
| | Mean | 76.8 | | Mean | 49.1 | |
| | Std. Dev. | 15.0 | | Std. Dev. | 23.9 | |

| Benchmark Value (pg TCDD-EQ / g lipid) | | | |
|---|---|---|---|
| Protection Level (%) | LCL | Mean | UCL |
| Geometric mean of NOER and LOER | | | |
| 99 | 15 | 57 | 201 |
| 97.5 | 40 | 151 | 510 |
| 95 | 88 | 321 | 1050 |
| 90 | 199 | 699 | 2220 |
| LR50 | | | |
| 99 | 0.3 | 58 | 382 |
| 97.5 | 2.5 | 169 | 802 |
| 95 | 11.7 | 386 | 1430 |
| 90 | 58.3 | 909 | 2640 |

Notes:
Benchmark Value table taken from Steevens, 2005.
Lipid Normalized figure for FS-R2 was incorrect in Attachment 4 to Tom Janish's March 20, 2006 comments on 2/2006 off-property investigation
For compounds that were not detected, 1/2 of the reported detection limit was used in the calculation of the TCDD-TEQ.
LCL-Lower Confidence Limit
UCL-Upper Confidence Limit
LR50-Lethal Response for 50% of test subjects

# Appendix A

## Summary of Analytical Data by Exposure Area

**Summary of Area 2 Sediment Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| **Sample ID**<br>**Sample Date**<br>**Sample Depth** | | | SED-R4<br>7/12/2005<br>0-3" | | SED-R5<br>7/13/2005<br>0-3" | | SED-R6<br>7/13/2005<br>0-3" | |
|---|---|---|---|---|---|---|---|---|
| | **TEFs** | | | | | | | |
| **PAH and Penta (mg/kg)** | | | | | | | | |
| Acenaphthene | | | 1.6E+01 | D | 9.3E+01 | D | 6.2E+00 | D |
| Acenaphthylene | | | 1.4E-01 | | 2.0E+00 | | 3.5E-01 | |
| Anthracene | | | 3.8E+00 | D | 1.4E+02 | D | 5.1E+00 | D |
| Benzo(a)anthracene | 0.1 | | 4.2E+00 | D | 4.3E+01 | D | 5.4E+00 | D |
| Benzo(a)pyrene | 1 | | 1.5E+00 | D | 1.4E+01 | | 2.6E+00 | |
| Benzo(b)fluoranthene | 0.1 | | 2.3E+00 | D | 1.9E+01 | | 4.3E+00 | D |
| Benzo(ghi)perylene | | | 3.3E-01 | | 6.0E+00 | | 1.1E+00 | |
| Benzo(k)fluoranthene | 0.01 | | 7.1E-01 | | 7.2E+00 | | 1.4E+00 | |
| Chrysene | 0.001 | | 3.6E+00 | D | 6.0E+01 | D | 6.3E+00 | D |
| Dibenzo(a,h)anthracene | 1 | | 1.1E-01 | | 1.6E+00 | | 3.2E-01 | |
| Fluoranthene | | | 2.2E+01 | D | 1.8E+02 | D | 1.8E+01 | D |
| Fluorene | | | 1.2E+01 | D | 8.4E+01 | D | 4.9E+00 | D |
| Indeno(1,2,3-cd)pyrene | 0.1 | | 3.2E-01 | | 5.5E+00 | | 1.1E+00 | |
| Naphthalene | | | 2.7E+01 | D | 1.4E+02 | D | 4.5E+00 | D |
| Phenanthrene | | | 3.7E+01 | D | 2.4E+02 | D | 1.5E+01 | D |
| Pyrene | | | 1.5E+01 | D | 1.3E+02 | D | 1.4E+01 | D |
| Pentachlorophenol | | | 2.5E-02 | U | 5.0E-01 | U | 8.0E-02 | U |
| **Total PAH** | | | 1.5E+02 | | 1.2E+03 | | 9.1E+01 | |
| **BaP-TE** | | | 2.3E+00 | | 2.2E+01 | | 4.0E+00 | |
| **Dioxins (ug/kg)** | mamm | avian | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 0.01 | 0.01 | 1.1E-02 | | 1.8E+00 | | 1.0E+00 | |
| 1,2,3,4,6,7,8-HpCDF | 0.01 | 0.01 | 2.8E-03 | J,B | 4.9E-01 | B | 2.9E-01 | B |
| 1,2,3,4,7,8,9-HpCDF | 0.01 | 0.01 | 2.1E-04 | U | 3.8E-02 | | 3.2E-02 | |
| 1,2,3,4,7,8-HxCDD | 0.1 | 0.1 | 1.2E-04 | U | 4.0E-03 | J | 3.1E-03 | J |
| 1,2,3,4,7,8-HxCDF | 0.1 | 0.1 | 6.9E-05 | U | 3.5E-02 | | 4.3E-02 | |
| 1,2,3,6,7,8-HxCDD | 0.1 | 0.1 | 4.5E-04 | J | 5.1E-02 | | 2.9E-02 | |
| 1,2,3,6,7,8-HxCDF | 0.1 | 0.1 | 6.4E-05 | U | 9.6E-03 | D | 1.7E-02 | D |
| 1,2,3,7,8,9-HxCDD | 0.1 | 0.1 | 1.1E-04 | U | 1.0E-02 | | 6.1E-03 | |
| 1,2,3,7,8,9-HxCDF | 0.1 | 0.1 | 1.2E-04 | U | 7.0E-03 | | 9.8E-03 | |
| 1,2,3,7,8-PeCDD | 1 | 1 | 8.0E-05 | U | 1.1E-03 | J | 8.6E-04 | J |
| 1,2,3,7,8-PeCDF | 0.03 | 0.05 | 1.2E-04 | U | 2.0E-03 | J | 3.1E-03 | J |
| 2,3,4,6,7,8-HxCDF | 0.1 | 0.1 | 7.3E-05 | U | 1.2E-02 | | 1.3E-02 | |
| 2,3,4,7,8-PeCDF | 0.3 | 0.5 | 9.9E-05 | U | 5.6E-03 | | 7.6E-03 | |
| 2,3,7,8-TCDD | 1 | 1 | 9.0E-05 | U | 1.3E-04 | U | 2.9E-04 | J |
| 2,3,7,8-TCDF | 0.1 | 0.1 | 4.9E-05 | U | 4.9E-04 | J | 8.1E-04 | J |
| OCDD | 0.0003 | 0.0001 | 9.9E-02 | | 2.0E+01 | | 1.3E+01 | |
| OCDF | 0.0003 | 0.0001 | 1.6E-02 | | 2.7E+00 | | 1.2E+00 | |
| **2,3,7,8-TCDD TEQ (avian)** | | | 4.8E-04 | | 4.3E-02 | | 3.2E-02 | |
| **2,3,7,8-TCDD TEQ (mamm)** | | | 4.9E-04 | | 4.6E-02 | | 3.3E-02 | |
| **Miscellaneous** | | | | | | | | |
| Total Organic Carbon (mg/kg) | | | 14800 | | 27600 | | 14400 | |
| Percent Solids | | | 68 | | 64 | | 63 | |

Notes:
non detects are at half detection limit
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (2006) TEFs for mammals, assuming 1/2 the sample-specific estimate detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimate detection limit.
*"SED-R1 & Dup" incorporates the results from both SED-R1 and SED-DUP. The listed value is one of the following: 1) the average of detected values,2) the lower detection limits if both values were non-detect,

Penta/PAH data qualifiers:
U - Analyte Not detected above reporting limit. Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 the estimated maximum possible concentration or 1/2 the sample-specific estimated detection limit)
B- Analyte detected in Method Blank.
1,2,3,4,6,7,6,8-HpCDF detected in Blank at 4.9E-2 ug/kg in June sampling and 9.6E-5 ug/kg in July.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Summary of Area 3 Sediment Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| **Sample ID**<br>**Sample Date**<br>**Sample Depth** | | | SED-R1 & Dup*<br>6/8/2008<br>0-3" | | SED-R2<br>6/8/2005<br>0-3" | | SED-R1<br>7/12/2005<br>0-3" | | SED-R2<br>7/12/2005<br>0-3" | | SED-R3<br>7/12/2005<br>0-3" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **TEFs** | | | | | | | | | | | |
| **PAH and Penta (mg/kg)** | | | | | | | | | | | | |
| Acenaphthene | | | 8.8E+00 | | 4.9E+01 | D | 1.3E+00 | | 1.3E+01 | | 4.3E+00 | D |
| Acenaphthylene | | | 1.4E+00 | | 3.6E+00 | | 2.0E-01 | | 9.5E-01 | | 1.2E-01 | |
| Anthracene | | | 7.3E+01 | D | 7.0E+01 | D | 2.6E+00 | | 1.7E+01 | | 1.8E+01 | D |
| Benzo(a)anthracene | 0.1 | | 2.9E+01 | D | 6.6E+01 | D | 2.8E+00 | | 1.7E+01 | | 2.4E+00 | D |
| Benzo(a)pyrene | 1 | | 1.2E+01 | | 2.7E+01 | D | 1.6E+00 | | 7.6E+00 | | 9.4E-01 | |
| Benzo(b)fluoranthene | 0.1 | | 1.7E+01 | D | 3.6E+01 | D | 2.3E+00 | | 1.1E+01 | | 1.6E+00 | D |
| Benzo(ghi)perylene | | | 5.1E+00 | | 1.0E+01 | | 7.1E-01 | | 2.8E+00 | | 3.6E-01 | |
| Benzo(k)fluoranthene | 0.01 | | 5.9E+00 | | 1.6E+01 | | 7.8E-01 | | 4.6E+00 | | 4.3E-01 | |
| Chrysene | 0.001 | | 4.9E+01 | D | 6.0E+01 | D | 3.9E+00 | D | 1.7E+01 | | 2.9E+00 | D |
| Dibenzo(a,h)anthracene | 1 | | 1.4E+00 | | 2.9E+00 | | 1.9E-01 | | 8.1E-01 | | 9.8E-02 | |
| Fluoranthene | | | 9.2E+01 | D | 2.7E+02 | D | 1.1E+01 | D | 1.1E+02 | D | 1.1E+01 | D |
| Fluorene | | | 1.4E+01 | D | 5.0E+01 | D | 1.4E+00 | | 1.3E+01 | | 5.9E+00 | D |
| Indeno(1,2,3-cd)pyrene | 0.1 | | 4.6E+00 | | 9.6E+00 | | 6.4E-01 | | 2.7E+00 | | 3.3E-01 | |
| Naphthalene | | | 1.6E+00 | | 2.4E+00 | | 2.9E-01 | | 8.9E-01 | | 2.1E+00 | D |
| Phenanthrene | | | 5.4E+01 | D | 2.1E+02 | D | 7.0E+00 | D | 8.8E+01 | D | 1.7E+01 | D |
| Pyrene | | | 7.1E+01 | D | 2.1E+02 | D | 9.0E+00 | D | 8.2E+01 | D | 7.9E+00 | D |
| Pentachlorophenol | | | 2.8E-01 | U | 5.0E-01 | U | 7.5E-02 | U | 5.0E-01 | U | 2.4E-02 | U |
| **Total PAH** | | | 4.4E+02 | | 1.1E+03 | | 4.6E+01 | | 3.9E+02 | | 7.5E+01 | |
| **BaP-TE** | | | 1.9E+01 | | 4.1E+01 | | 2.4E+00 | | 1.2E+01 | | 1.5E+00 | |
| **Dioxins (ug/kg)** | mamm | avian | | | | | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 0.01 | 0.01 | 1.6E+00 | | 3.1E+00 | | 2.3E-01 | | 1.4E+00 | | 2.1E-01 | |
| 1,2,3,4,6,7,8-HpCDF | 0.01 | 0.01 | 4.4E-01 | | 7.9E-01 | B | 6.1E-02 | | 3.9E-01 | | 5.0E-02 | B |
| 1,2,3,4,7,8,9-HpCDF | 0.01 | 0.01 | 3.1E-02 | | 4.5E-02 | | 5.8E-03 | | 2.5E-02 | | 3.9E-03 | |
| 1,2,3,4,7,8-HxCDD | 0.1 | 0.1 | 3.4E-03 | J | 1.4E-02 | | 9.8E-04 | J | 2.9E-03 | J | 5.6E-04 | J |
| 1,2,3,4,7,8-HxCDF | 0.1 | 0.1 | 2.1E-02 | J | 5.9E-02 | | 7.0E-03 | | 2.2E-02 | | 4.1E-03 | |
| 1,2,3,6,7,8-HxCDD | 0.1 | 0.1 | 4.5E-02 | | 8.6E-02 | | 7.6E-03 | | 3.8E-02 | | 5.5E-03 | |
| 1,2,3,6,7,8-HxCDF | 0.1 | 0.1 | 5.6E-03 | J | 1.3E-02 | D | 2.8E-03 | J | 7.0E-03 | D | 1.6E-03 | J,D |
| 1,2,3,7,8,9-HxCDD | 0.1 | 0.1 | 7.3E-03 | J | 1.2E-02 | | 1.7E-03 | J | 7.1E-03 | | 1.2E-03 | J |
| 1,2,3,7,8,9-HxCDF | 0.1 | 0.1 | 4.5E-03 | J | 9.1E-03 | | 2.0E-03 | J | 3.9E-03 | J | 9.9E-04 | J |
| 1,2,3,7,8-PeCDD | 1 | 1 | 1.3E-03 | J | 1.6E-03 | J | 1.7E-04 | U | 8.7E-04 | J | 5.7E-05 | U |
| 1,2,3,7,8-PeCDF | 0.03 | 0.05 | 2.1E-03 | J | 2.9E-03 | | 9.7E-04 | J | 1.8E-03 | J | 3.8E-04 | J |
| 2,3,4,6,7,8-HxCDF | 0.1 | 0.1 | 8.0E-03 | J | 1.5E-02 | | 2.8E-03 | J | 7.4E-03 | | 1.5E-03 | J |
| 2,3,4,7,8-PeCDF | 0.3 | 0.5 | 3.4E-03 | J | 6.9E-03 | | 1.7E-03 | J | 3.5E-03 | J | 7.0E-04 | J |
| 2,3,7,8-TCDD | 1 | 1 | 2.0E-04 | U | 4.4E-04 | J | 1.3E-04 | U | 1.6E-04 | U | 6.0E-05 | U |
| 2,3,7,8-TCDF | 0.1 | 0.1 | 4.6E-04 | J | 6.3E-04 | | 5.8E-04 | J | 7.9E-04 | J | 1.3E-04 | J |
| OCDD | 0.0003 | 0.0001 | 1.7E+01 | | 3.4E+01 | | 2.8E+00 | | 1.7E+01 | | 2.3E+00 | |
| OCDF | 0.0003 | 0.0001 | 2.5E+00 | | 4.6E+00 | | 2.7E-01 | | 2.2E+00 | | 2.7E-01 | |
| **2,3,7,8-TCDD TEQ (avian)** | | | 3.6E-02 | | 6.9E-02 | | 7.0E-03 | | 3.2E-02 | | 4.9E-03 | |
| **2,3,7,8-TCDD TEQ (mamm)** | | | 3.9E-02 | | 7.6E-02 | | 7.2E-03 | | 3.5E-02 | | 5.3E-03 | |
| **Miscellaneous** | | | | | | | | | | | | |
| Total Organic Carbon (mg/kg) | | | 16050 | | 12600 | | 10000 | | 14400 | | 9230 | |
| Percent Solids | | | 62 | | 66 | | 68 | | 67 | | 69 | |

Notes:
non detects are at half detection limit
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (2006) TEFs for mammals, assuming 1/2 the sample-specific estimate detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimate detection limit.
*"SED-R1 & Dup" incorporates the results from both SED-R1 and SED-DUP. The listed value is one of the following: 1) the average of detected values,2) the lower detection limits if both values were non-detect,

Penta/PAH data qualifiers:
U - Analyte Not detected above reporting limit.
Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 the estimated maximum possible concentration or 1/2 the sample-specific estimated detection limit)
B- Analyte detected in Method Blank.
1,2,3,4,6,7,6,8-HpCDF detected in Blank at 4.9E-2 ug/kg in June sampling and 9.6E-5 ug/kg in July.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Summary of Area 1 Representative Soil Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Sample ID / Sample Date / Sample Depth | | | SOIL-T24 & Duplicate* 0 - 0.5 06/06/05 | | SOIL-T23 0 - 0.5 06/07/05 | |
|---|---|---|---|---|---|---|
| **Penta and PAHs (mg/kg)** | TEFs | | | | | |
| Acenaphthene | | | 6.3E-02 | J | 6.6E-02 | J |
| Acenaphthylene | | | 1.1E+00 | | 7.2E-01 | |
| Anthracene | | | 2.1E+00 | | 1.5E+00 | |
| Benzo(a)anthracene | 1.0E-01 | | 6.4E-01 | J | 6.6E-01 | |
| Benzo(a)pyrene | 1.0E+00 | | 2.1E+00 | | 1.2E+00 | |
| Benzo(b)fluoranthene | 1.0E-01 | | 2.2E+00 | | 1.4E+00 | |
| Benzo(g,h,i)perylene | | | 2.8E+00 | | 2.8E+00 | |
| Benzo(k)fluoranthene | 1.0E-02 | | 8.4E-01 | J | 4.9E-01 | J |
| Chrysene | 1.0E-03 | | 3.6E+00 | | 3.2E+00 | |
| Dibenzo(a,h)anthracene | 1.0E+00 | | 4.8E-01 | J | 4.5E-01 | J |
| Fluoranthene | | | 5.7E-01 | J | 4.7E-01 | J |
| Fluorene | | | 1.5E-01 | J | 1.8E-01 | J |
| Indeno(1,2,3-cd)Pyrene | 1.0E-01 | | 2.4E+00 | | 2.3E+00 | |
| Naphthalene | | | 6.5E-01 | J | 9.4E-02 | J |
| Phenanthrene | | | 2.1E-01 | J | 2.8E-01 | J |
| Pyrene | | | 5.5E-01 | J | 4.4E-01 | J |
| Pentachlorphenol | | | 2.8E+00 | U | 1.4E+00 | U |
| **Total PAHs** | | | 2.0E+01 | J | 1.6E+01 | J |
| **BaP-TE** | | | 3.1E+00 | | 2.1E+00 | |
| **PCDDs/PCDFs (ug/kg)** | **avian** | **mamm** | | | | |
| 1,2,3,4,6,7,8-HpCDD | 1.0E-02 | 1.0E-02 | 5.4E+00 | | 5.0E+00 | |
| 1,2,3,4,6,7,8-HPCDF | 1.0E-02 | 1.0E-02 | 1.5E+00 | | 1.4E+00 | B |
| 1,2,3,4,7,8,9-HPCDF | 1.0E-02 | 1.0E-02 | 1.6E-01 | | 1.4E-01 | |
| 1,2,3,4,7,8-HxCDD | 1.0E-01 | 1.0E-01 | 1.8E-02 | | 2.0E-02 | |
| 1,2,3,4,7,8-HxCDF | 1.0E-01 | 1.0E-01 | 1.8E-01 | | 1.7E-01 | B |
| 1,2,3,6,7,8-HxCDD | 1.0E-01 | 1.0E-01 | 1.6E-01 | | 1.5E-01 | |
| 1,2,3,6,7,8-HxCDF | 1.0E-01 | 1.0E-01 | 5.0E-02 | D | 4.4E-02 | BD |
| 1,2,3,7,8,9-HxCDD | 1.0E-01 | 1.0E-01 | 3.2E-02 | | 3.5E-02 | |
| 1,2,3,7,8,9-HxCDF | 1.0E-01 | 1.0E-01 | 4.4E-02 | | 4.4E-02 | |
| 1,2,3,7,8-PeCDD | 1.0E+00 | 1.0E+00 | 5.2E-03 | | 6.1E-03 | |
| 1,2,3,7,8-PeCDF | 5.0E-02 | 3.0E-02 | 1.3E-02 | | 1.4E-02 | |
| 2,3,4,6,7,8-HxCDF | 1.0E-01 | 1.0E-01 | 6.0E-02 | | 6.0E-02 | |
| 2,3,4,7,8-PeCDF | 5.0E-01 | 3.0E-01 | 3.1E-02 | | 3.1E-02 | |
| 2,3,7,8-TCDD | 1.0E+00 | 1.0E+00 | 8.8E-04 | | 9.8E-04 | |
| 2,3,7,8-TCDF | 1.0E-01 | 1.0E-01 | 2.0E-03 | | 2.0E-03 | |
| OCDD | 1.0E-04 | 3.0E-04 | 7.4E+01 | * | 6.9E+01 | * |
| OCDF | 1.0E-04 | 3.0E-04 | 6.4E+00 | | 5.3E+00 | |
| Total HpCDD | | | 1.1E+01 | | 1.0E+01 | |
| Total HpCDF | | | 7.8E+00 | | 6.8E+00 | B |
| Total HxCDD | | | 8.1E-01 | | 7.9E-01 | |
| Total HxCDF | | | 2.7E+00 | BD | 2.4E+00 | BD |
| Total PeCDD | | | 4.4E-02 | | 4.9E-02 | |
| Total PeCDF | | | 3.5E-01 | D | 3.3E-01 | D |
| **Total TCDD** | | | 1.2E-02 | | 1.3E-02 | |
| **Total TCDF** | | | 6.4E-02 | D | 5.3E-02 | D |
| **2,3,7,8-TCDD TEQ (mamm)** | | | 1.7E-01 | | 1.6E-01 | |
| **2,3,7,8-TCDD TEQ (avian)** | | | 1.6E-01 | | 1.5E-01 | |
| **Miscellaneous** | | | | | | |
| Percent Solids (%) | | | 56.25 | | 59.9 | |
| Total Organic Carbon (mg/kg) | | | 3.6E+04 | | 3.8E+04 | |

Notes:
non detects are at half detection limit
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (1998) TEFs for mammals, assuming 1/2 the sample-specific estimate detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimate detection limit.
*These samples were incorporated the results from both duplicate sampling locations. The listed value is one of the
Penta/PAH data qualifiers:
U - Analyte Not detected above reporting limit.
Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.
PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 the estimated maximum possible concentration or 1/2 the sample-specific estimated detection limit)
B- Analyte detected in Method Blank.
1,2,3,4,6,7,6,8-HpCDF detected in Blank at 4.9E-2 ug/kg in June sampling and 9.6E-5 ug/kg in July.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Summary of Area 2 Representative Floodplain Soil Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Sample ID | | | SOIL-T1 | SOIL-T2 | SOIL-T3 | SOIL-T4 | SOIL-T5 | SOIL-T6 | SOIL-T7 | SOIL-T8 | SOIL-T9 | SOIL-T10 | SOIL-T11 | SOIL-T12 | SOIL-T13 | Soil-T15 & Duplicate* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date | | | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 |
| Sample Depth | | | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 | 06/07/05 |
| **Penta and PAHs (mg/kg)** | TEFs | | | | | | | | | | | | | | | |
| Acenaphthene | | | 3.6E-02 J | 1.6E-02 J | 1.8E-02 J | 1.6E-02 J | 2.5E-01 U | 1.6E-02 J | 2.7E-01 U | 2.5E-01 U | 2.7E-01 U | 3.0E-01 U | 3.2E-02 J | 2.5E-01 U | 3.2E-01 U | 1.6E-01 J |
| Acenaphthylene | | | 6.0E-01 J | 1.9E-01 J | 1.3E-01 J | 9.8E-02 J | 2.5E-01 U | 1.3E-01 J | 7.0E-02 J | 7.3E-02 J | 8.8E-02 J | 7.7E-02 J | 4.8E-01 J | 1.7E-02 J | 6.5E-02 J | 2.0E-01 J |
| Anthracene | | | 9.6E-01 | 3.1E-01 J | 1.8E-01 J | 1.3E-01 J | 2.5E-01 U | 1.4E-01 J | 8.0E-02 J | 1.0E-01 J | 1.2E-01 J | 9.7E-02 J | 6.8E-01 | 2.1E-02 J | 1.1E-01 J | 4.4E-01 J |
| Benzo(a)anthracene | 1.0E-01 | | 2.2E-01 J | 7.9E-02 J | 7.4E-02 J | 6.6E-02 J | 2.5E-01 U | 5.9E-02 J | 2.5E-02 J | 9.8E-02 J | 5.2E-02 J | 3.9E-02 J | 1.8E-01 J | 2.1E-02 J | 4.7E-02 J | 1.1E-01 J |
| Benzo(a)pyrene | 1.0E+00 | | 7.2E-01 | 1.4E-01 J | 1.7E-01 J | 1.1E-01 J | 1.3E-02 J | 1.8E-01 J | 9.3E-02 J | 2.1E-01 J | 5.5E-02 J | 7.4E-02 J | 6.0E-01 | 2.3E-02 J | 5.3E-02 J | 1.6E-01 J |
| Benzo(b)fluoranthene | 1.0E-01 | | 9.3E-01 | 1.7E-01 J | 2.1E-01 J | 1.8E-01 J | 2.2E-02 J | 2.5E-01 J | 9.7E-02 J | 2.3E-01 J | 9.2E-02 J | 1.1E-01 J | 7.4E-01 | 4.5E-02 J | 9.2E-02 J | 2.7E-01 J |
| Benzo(g,h,i)perylene | | | 1.4E+00 | 5.4E-01 J | 4.0E-01 J | 2.4E-01 J | 3.0E-02 J | 2.3E-01 J | 2.4E-01 J | 2.9E-01 J | 2.4E-01 J | 1.9E-01 J | 1.8E+00 | 4.0E-02 J | 9.8E-02 J | 3.5E-01 J |
| Benzo(k)fluoranthene | 1.0E-02 | | 2.7E-01 J | 3.9E-02 J | 5.0E-02 J | 4.2E-02 J | 2.5E-01 U | 4.8E-02 J | 2.4E-02 J | 7.4E-02 J | 2.6E-02 J | 3.1E-02 J | 1.6E-01 J | 2.5E-01 U | 2.5E-02 J | 8.8E-02 J |
| Chrysene | 1.0E-03 | | 2.9E-01 J | 8.3E-02 J | 2.1E-01 J | 1.7E-01 J | 2.1E-02 J | 1.3E-01 J | 5.7E-02 J | 2.6E-01 J | 1.2E-01 J | 9.0E-02 J | 3.1E-01 J | 4.3E-02 J | 8.5E-02 J | 1.5E-01 J |
| Dibenzo(a,h)anthracene | 1.0E+00 | | 2.7E-01 J | 7.2E-02 J | 5.8E-02 J | 3.9E-02 J | 2.5E-01 U | 4.9E-02 J | 2.7E-01 U | 6.1E-02 J | 3.2E-02 J | 3.0E-01 U | 2.9E-01 J | .25 U | 2.2E-02 J | 2.1E-01 J |
| Fluoranthene | | | 1.6E-01 J | 7.2E-02 J | 6.9E-02 J | 9.6E-02 J | 1.1E-02 J | 7.8E-02 J | 2.7E-01 U | 6.2E-02 J | 6.3E-02 J | 4.9E-02 J | 2.0E-01 J | 3.2E-02 J | 6.7E-02 J | 1.2E-01 J |
| Fluorene | | | 8.0E-02 J | 4.4E-02 J | 4.0E-02 J | 3.5E-02 J | 2.5E-01 U | 3.3E-02 J | 2.7E-01 U | 2.5E-01 U | 2.6E-02 J | 3.0E-01 U | 8.1E-02 J | 2.5E-01 U | 2.3E-02 J | 1.8E-01 J |
| Indeno(1,2,3-cd)Pyrene | 1.0E-01 | | 1.2E+00 | 4.4E-01 J | 3.2E-01 J | 1.9E-01 J | 2.0E-02 J | 2.2E-01 J | 1.8E-01 J | 2.3E-01 J | 1.6E-01 J | 1.5E-01 J | 1.7E+00 | 2.7E-02 J | 9.3E-02 J | 3.3E-01 J |
| Naphthalene | | | 4.6E-02 J | 1.7E-02 J | 2.1E-02 J | 2.3E-02 J | 2.5E-01 U | 2.2E-02 J | 2.7E-01 U | 2.5E-01 U | 1.4E-02 J | 3.0E-01 U | 3.9E-02 J | 2.5E-01 U | 3.2E-01 U | 1.6E-01 J |
| Phenanthrene | | | 5.6E-02 J | 2.9E-02 J | 3.8E-02 J | 4.1E-02 J | 2.5E-01 U | 3.1E-02 J | 2.7E-01 U | 2.9E-02 J | 2.6E-02 J | 3.0E-01 U | 7.8E-02 J | 1.9E-02 J | 2.6E-02 J | 1.8E-01 J |
| Pyrene | | | 2.4E-01 J | 5.8E-02 J | 6.5E-02 J | 6.5E-02 J | 2.5E-01 U | 4.8E-02 J | 3.6E-02 J | 6.4E-02 J | 4.7E-02 J | 4.6E-02 J | 1.9E-01 J | 3.0E-02 J | 4.7E-02 J | 1.1E-01 J |
| Pentachlorphenol | | | 1.6E+00 U | 1.4E+00 U | 1.5E+00 U | 1.7E+00 U | 1.2E+00 U | 1.5E+00 U | 1.3E+00 U | 1.2E+00 U | 1.3E+00 U | 1.5E+00 U | 1.3E+00 U | 1.2E+00 U | 1.6E+00 U | 1.4E+00 U |
| **Total PAHs** | | | 7.5E+00 J | 2.3E+00 J | 2.1E+00 J | 1.5E+00 J | 1.2E-01 J | 1.7E+00 J | 9.0E-01 J | 1.8E+00 J | 1.2E+00 J | 9.5E-01 J | 7.6E+00 J | 3.2E-01 J | 8.5E-01 J | 2.5E+00 J |
| **BaP-TE** | | | 1.2E+00 | 2.8E-01 | 2.9E-01 | 1.9E-01 | 2.2E-02 | 2.8E-01 | 1.3E-01 | 3.3E-01 | 1.2E-01 | 1.1E-01 | 1.2E+00 | 3.7E-02 | 9.9E-02 | 3.0E-01 |
| **PCDDs/PCDFs (ug/kg)** | avian | mamm | | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 1.0E-02 | 1.0E-02 | 6.3E+00 | 2.4E+00 | 1.8E-01 | 3.9E-01 | 1.6E-01 | 1.3E+00 | 4.4E-01 | 1.0E+00 | 2.1E+00 | 1.4E+00 | 1.8E+00 | 2.9E-01 | 2.3E-01 | 3.2E-01 |
| 1,2,3,4,6,7,8-HPCDF | 1.0E-02 | 1.0E-02 | 2.3E+00 B | 6.6E-01 | 4.7E-02 B | 1.0E-01 B | 4.6E-02 | 3.8E-01 | 1.2E-01 | 2.7E-01 | 6.1E-01 B | 3.4E-01 | 4.7E-01 B | 7.5E-02 | 6.0E-02 | 9.2E-02 |
| 1,2,3,4,7,8,9-HPCDF | 1.0E-02 | 1.0E-02 | 1.3E-01 | 6.6E-02 | 5.4E-03 | 9.6E-03 | 4.3E-03 | 3.3E-02 | 9.8E-03 | 3.1E-02 | 6.6E-02 | 2.2E-02 | 4.6E-02 | 7.9E-03 | 5.1E-03 | 8.5E-03 |
| 1,2,3,4,7,8-HxCDD | 1.0E-01 | 1.0E-01 | 1.7E-02 | 1.0E-02 | 1.1E-03 J | 2.2E-03 J | 7.6E-04 J | 5.6E-03 | 1.6E-03 J | 4.2E-03 | 8.8E-03 | 4.1E-03 | 7.4E-03 | 1.7E-03 J | 1.3E-03 J | 1.7E-03 J |
| 1,2,3,4,7,8-HxCDF | 1.0E-01 | 1.0E-01 | 6.7E-02 B | 6.9E-02 | 6.8E-03 B | 1.2E-02 B | 5.0E-03 | 3.5E-02 | 1.1E-02 | 4.5E-02 | 8.6E-02 B | 1.7E-02 | 5.1E-02 B | 1.1E-02 | 5.5E-03 | 9.1E-03 |
| 1,2,3,6,7,8-HxCDD | 1.0E-01 | 1.0E-01 | 2.1E-01 | 8.0E-02 | 6.7E-03 | 1.2E-02 | 4.7E-03 | 3.9E-02 | 1.3E-02 | 3.7E-02 | 7.1E-02 | 3.9E-02 | 5.3E-02 | 9.3E-03 | 7.3E-03 | 1.0E-02 |
| 1,2,3,6,7,8-HxCDF | 1.0E-01 | 1.0E-01 | 2.4E-02 BD | 2.3E-02 D | 3.8E-03 BD | 4.0E-03 B | 1.5E-03 J | 8.9E-03 D | 3.0E-03 D | 1.1E-02 D | 5.3E-02 BD | 6.2E-03 D | 2.1E-02 BD | 2.9E-03 D | 2.2E-03 JD | 2.5E-03 J |
| 1,2,3,7,8,9-HxCDD | 1.0E-01 | 1.0E-01 | 3.5E-02 | 1.8E-02 | 1.9E-03 J | 3.8E-03 | 1.3E-03 J | 1.0E-02 | 3.0E-03 | 8.0E-03 | 1.6E-02 | 7.5E-03 | 1.2E-02 | 2.9E-03 | 2.1E-03 J | 3.0E-03 J |
| 1,2,3,7,8,9-HxCDF | 1.0E-01 | 1.0E-01 | 1.1E-02 | 1.9E-02 | 2.2E-03 J | 3.0E-03 | 1.3E-03 J | 7.1E-03 | 2.6E-03 | 1.1E-02 | 3.3E-02 | 3.6E-03 | 1.3E-02 | 2.6E-03 | 1.5E-03 J | 2.1E-03 J |
| 1,2,3,7,8-PeCDD | 1.0E+00 | 1.0E+00 | 3.3E-03 | 2.6E-03 | 4.9E-04 J | 8.3E-04 J | 2.6E-04 J | 1.6E-03 J | 5.5E-04 J | 1.5E-03 J | 2.8E-03 | 7.3E-04 J | 2.2E-03 J | 5.8E-04 J | 4.2E-04 J | 5.7E-04 J |
| 1,2,3,7,8-PeCDF | 5.0E-02 | 3.0E-02 | 2.1E-03 J | 6.1E-03 | 9.5E-04 J | 1.5E-03 J | 5.1E-04 J | 2.3E-03 J | 9.5E-04 J | 3.6E-03 | 1.3E-02 | 1.0E-03 J | 4.1E-03 | 9.3E-04 J | 6.2E-04 J | 1.2E-03 J |
| 2,3,4,6,7,8-HxCDF | 1.0E-01 | 1.0E-01 | 3.6E-02 | 2.6E-02 | 3.1E-03 | 4.6E-03 | 1.9E-03 J | 1.3E-02 | 4.3E-03 | 1.6E-02 | 3.5E-02 | 6.9E-03 | 1.9E-02 | 3.7E-03 | 2.7E-03 | 3.5E-03 J |
| 2,3,4,7,8-PeCDF | 5.0E-01 | 3.0E-01 | 6.1E-03 | 1.2E-02 | 2.0E-03 J | 2.4E-03 J | 1.1E-03 J | 4.8E-03 | 2.4E-03 J | 8.9E-03 | 3.4E-02 | 2.7E-03 | 9.3E-03 | 2.0E-03 J | 1.4E-03 J | 1.6E-03 J |
| 2,3,7,8-TCDD | 1.0E+00 | 1.0E+00 | 3.3E-04 J | 3.8E-04 J | 2.3E-04 J | 9.8E-05 U | 7.3E-05 U | 3.7E-04 J | 4.6E-05 U | 3.5E-04 J | 5.3E-04 | 1.9E-04 J | 3.6E-04 J | 6.4E-05 U | 2.2E-04 J | 1.4E-04 J |
| 2,3,7,8-TCDF | 1.0E-01 | 1.0E-01 | 5.2E-04 | 1.0E-03 | 3.2E-04 J | 3.6E-04 J | 2.1E-04 J | 5.1E-04 | 3.2E-04 J | 6.1E-04 | 3.5E-03 | 3.4E-04 J | 8.4E-04 | 3.1E-04 J | 3.2E-04 J | 3.1E-04 J |
| OCDD | 1.0E-04 | 3.0E-04 | 6.1E+01 * | 2.3E+01 | 1.7E+00 | 4.1E+00 | 2.0E+00 | 1.6E+01 | 5.4E+00 | 1.2E+01 | 2.4E+01 | 1.4E+01 | 2.0E+01 | 3.2E+00 | 2.3E+00 | 3.1E+00 |
| OCDF | 1.0E-04 | 3.0E-04 | 1.1E+01 | 2.7E+00 | 1.9E-01 | 4.0E-01 | 1.9E-01 | 1.6E+00 | 6.1E-01 | 1.1E+00 | 2.3E+00 | 2.0E+00 | 2.0E+00 | 3.0E-01 | 2.9E-01 | 3.8E-01 |
| Total HpCDD | | | 1.1E+01 | 4.9E+00 | 3.7E-01 | 8.0E-01 | 3.2E-01 | 2.7E+00 | 8.9E-01 | 2.3E+00 | 4.2E+00 | 2.5E+00 | 3.6E+00 | 6.2E-01 | 4.6E-01 | 6.5E-01 |
| Total HpCDF | | | 1.1E+01 B | 4.0E+00 | 2.7E-01 B | 4.7E-01 B | 2.1E-01 | 1.7E+00 | 6.8E-01 | 1.8E+00 | 3.1E+00 B | 1.9E+00 | 2.3E+00 B | 3.9E-01 | 3.1E-01 | 4.9E-01 |
| Total HxCDD | | | 7.0E-01 | 4.1E-01 | 4.7E-02 | 7.9E-02 | 2.7E-02 | 2.1E-01 | 7.9E-02 | 2.2E-01 | 3.8E-01 | 1.8E-01 | 2.8E-01 | 6.1E-02 | 4.5E-02 | 6.2E-02 |
| Total HxCDF | | | 2.4E+00 D | 1.3E+00 BD | 1.4E-01 BD | 1.7E-01 BD | 7.8E-02 BD | 5.1E-01 BD | 2.5E-01 BD | 7.5E-01 BD | 1.7E+00 BD | 4.5E-01 BD | 8.3E-01 BD | 1.6E-01 BD | 1.1E-01 BD | 1.5E-01 BD |
| Total PeCDD | | | 2.4E-02 | 2.5E-02 | 1.0E-02 | 1.3E-02 | 4.6E-03 | 1.9E-02 | 9.1E-03 | 1.8E-02 | 2.9E-02 | 9.9E-03 | 2.1E-02 | 8.9E-03 | 8.1E-03 | 9.9E-03 |
| Total PeCDF | | | 2.1E-01 D | 1.8E-01 D | 3.4E-02 D | 3.3E-02 D | 1.0E-02 D | 5.6E-02 D | 2.6E-02 D | 6.3E-02 D | 4.8E-01 D | 4.3E-02 D | 1.6E-01 D | 2.0E-02 D | 1.8E-02 D | 2.0E-02 |
| **Total TCDD** | | | 1.3E-02 | 1.3E-02 | 9.5E-03 | 9.3E-03 | 6.8E-03 | 1.1E-02 | 7.7E-03 | 8.9E-03 | 1.3E-02 | 6.3E-03 | 9.3E-03 | 7.9E-03 | 8.3E-03 | 9.0E-03 |
| **Total TCDF** | | | 3.2E-02 D | 4.3E-02 D | 1.3E-02 D | 1.1E-02 D | 2.0E-03 | 1.4E-02 D | 5.9E-03 D | 1.2E-02 D | 1.3E-01 D | 1.0E-02 D | 5.1E-02 D | 5.5E-03 D | 8.0E-03 D | 8.0E-03 |
| **2,3,7,8-TCDD TEQ (mamm)** | | | 1.5E-01 | 7.1E-02 | 6.8E-03 | 1.2E-02 | 5.1E-03 | 3.8E-02 | 1.3E-02 | 3.5E-02 | 8.0E-02 | 3.2E-02 | 5.3E-02 | 9.4E-03 | 7.1E-03 | 9.8E-03 |
| **2,3,7,8-TCDD TEQ (avian)** | | | 1.4E-01 | 6.8E-02 | 6.8E-03 | 1.2E-02 | 4.9E-03 | 3.6E-02 | 1.2E-02 | 3.4E-02 | 8.2E-02 | 3.0E-02 | 5.0E-02 | 9.2E-03 | 6.9E-03 | 9.4E-03 |
| **Miscellaneous** | | | | | | | | | | | | | | | | |
| Percent Solids (%) | | | 50.8 | 58.8 | 52.6 | 47.7 | 66.7 | 54.4 | 62.6 | 66.2 | 61.5 | 55.8 | 61.6 | 65.8 | 51.9 | 56.65 |
| Total Organic Carbon (mg/kg) | | | 3.8E+04 | 1.5E+04 | 2.8E+04 | 4.4E+04 | 2.4E+04 | 3.5E+04 | 3.6E+04 | 3.1E+04 | 3.9E+04 | 3.2E+04 | 2.8E+04 | 2.9E+04 | 3.7E+04 | 3.9E+04 |

Notes:
non detects are at half detection limit
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (1998) TEFs for mammals, assuming 1/2 the sample-specific estimate detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimate detection limit.
*These samples were incorporated the results from both duplicate sampling locations. The listed value is one of the following: 1) the average of detected values,2) the lower detection limits if both values were non-detect,3) the average of one-half the detection limit and the detected value if one value was detected, while the other was non-detect

Penta/PAH data qualifiers:
U - Analyte Not detected above reporting limit.
Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 the estimated maximum possible concentration or 1/2 the sample-specific estimated detection limit)

B- Analyte detected in Method Blank.
1,2,3,4,6,7,8,8-HpCDF detected in Blank at 4.9E-2 ug/kg in June sampling and 9.6E-5 ug/kg in July.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Summary of Area 2 Representative Floodplain Soil Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Sample ID | SOIL-T14 | | SOIL-T16 | | SOIL-T17 | | SOIL-T18 | | SOIL-T19 | | SOIL-T20 | | SOIL-T21 | | SOIL-T22 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample Date** | 0 - 0.5 | | 0 - 0.5 | | 0 - 0.5 | | 0 - 0.5 | | 0 - 0.5 | | 0 - 0.5 | | 0 - 0.5 | | 0 - 0.5 | |
| **Sample Depth** | 06/06/05 | | 06/07/05 | | 06/07/05 | | 06/07/05 | | 06/06/05 | | 06/06/05 | | 06/06/05 | | 06/06/05 | |
| **Penta and PAHs (mg/kg)** | | | | | | | | | | | | | | | | |
| Acenaphthene | 1.3E-02 | J | 3.1E-01 | U | 2.8E-01 | U | 2.6E-01 | U | 2.3E-02 | J | 2.0E-02 | J | 2.7E-01 | U | 2.3E-01 | U |
| Acenaphthylene | 1.1E-01 | J | 3.1E-01 | U | 3.5E-02 | J | 7.1E-02 | J | 2.1E-01 | J | 2.0E-01 | J | 2.7E-01 | U | 2.3E-01 | U |
| Anthracene | 1.4E-01 | J | 3.1E-01 | U | 3.7E-02 | J | 1.0E-01 | J | 4.1E-01 | J | 3.3E-01 | J | 2.7E-01 | U | 2.3E-01 | U |
| Benzo(a)anthracene | 9.9E-02 | J | 3.1E-01 | U | 4.1E-02 | J | 8.8E-02 | J | 2.8E-01 | J | 1.1E-01 | J | 1.9E-02 | J | 2.2E-02 | J |
| Benzo(a)pyrene | 1.6E-01 | J | 3.1E-01 | U | 4.5E-02 | J | 2.2E-01 | J | 6.0E-01 | | 2.3E-01 | J | 1.7E-02 | J | 2.0E-02 | J |
| Benzo(b)fluoranthene | 2.3E-01 | J | 3.1E-01 | U | 6.8E-02 | J | 3.0E-01 | J | 7.2E-01 | | 3.3E-01 | J | 2.3E-02 | J | 3.2E-02 | J |
| Benzo(g,h,i)perylene | 3.4E-01 | J | 3.1E-01 | U | 9.1E-02 | J | 3.1E-01 | J | 9.5E-01 | | 6.6E-01 | | 1.5E-02 | J | 1.8E-02 | J |
| Benzo(k)fluoranthene | 6.9E-02 | J | 3.1E-01 | U | 2.1E-02 | J | 8.4E-02 | J | 2.5E-01 | J | 9.3E-02 | J | 2.7E-01 | U | 1.4E-02 | J |
| Chrysene | 2.3E-01 | J | 3.1E-01 | U | 7.7E-02 | J | 2.2E-01 | J | 1.4E+00 | | 2.3E-01 | J | 1.8E-02 | J | 3.8E-02 | J |
| Dibenzo(a,h)anthracene | 6.0E-02 | J | 3.1E-01 | U | 1.7E-02 | J | 6.0E-02 | J | 1.9E-01 | J | 1.1E-01 | J | 2.7E-01 | U | 2.3E-01 | U |
| Fluoranthene | 1.7E-01 | J | 3.1E-01 | U | 5.8E-02 | J | 1.2E-01 | J | 2.5E-01 | J | 1.6E-01 | J | 3.3E-02 | J | 5.8E-02 | J |
| Fluorene | 2.6E-02 | J | 3.1E-01 | U | 2.8E-01 | U | 2.2E-02 | J | 4.4E-02 | J | 4.5E-02 | J | 2.7E-01 | U | 2.3E-01 | U |
| Indeno(1,2,3-cd)Pyrene | 3.0E-01 | J | 3.1E-01 | U | 7.2E-02 | J | 2.8E-01 | J | 8.5E-01 | | 5.7E-01 | J | 1.3E-02 | J | 1.6E-02 | J |
| Naphthalene | 2.0E-02 | J | 3.1E-01 | U | 2.8E-01 | U | 1.5E-02 | J | 3.6E-02 | J | 2.9E-02 | J | 2.7E-01 | U | 2.3E-01 | U |
| Phenanthrene | 4.3E-02 | J | 3.1E-01 | U | 2.3E-02 | J | 3.3E-02 | J | 8.6E-02 | J | 6.3E-02 | J | 1.4E-02 | J | 1.8E-02 | J |
| Pyrene | 1.2E-01 | J | 3.1E-01 | U | 4.7E-02 | J | 2.5E-01 | J | 2.1E-01 | J | 1.7E-01 | J | 2.5E-02 | J | 5.2E-02 | J |
| Pentachlorphenol | 1.3E+00 | U | 1.5E+00 | U | 1.4E+00 | U | 1.3E+00 | U | 1.2E+00 | U | 1.5E+00 | U | 1.3E+00 | U | 1.1E+00 | U |
| **Total PAHs** | 2.1E+00 | J | | | 6.3E-01 | J | 2.2E+00 | J | 6.5E+00 | J | 3.4E+00 | J | 1.8E-01 | J | 2.9E-01 | J |
| **BaP-TE** | 2.8E-01 | | | | 8.0E-02 | | 3.5E-01 | | 9.8E-01 | | 4.4E-01 | | 2.7E-02 | | 3.1E-02 | |
| **PCDDs/PCDFs (ug/kg)** | | | | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 3.0E-01 | | 1.5E-01 | | 1.7E-01 | | 2.1E-01 | | 1.0E+00 | | 8.5E-02 | | 1.2E-02 | | 9.9E-03 | |
| 1,2,3,4,6,7,8-HPCDF | 8.1E-02 | B | 3.9E-02 | | 4.4E-02 | B | 5.9E-02 | B | 2.9E-01 | B | 2.6E-02 | B | 2.8E-03 | B | 1.4E-03 | JB |
| 1,2,3,4,7,8,9-HPCDF | 8.7E-03 | | 4.1E-03 | | 4.0E-03 | | 5.7E-03 | | 2.9E-02 | | 2.4E-03 | J | 3.1E-04 | J | 5.5E-05 | U |
| 1,2,3,4,7,8-HxCDD | 1.3E-03 | J | 8.8E-04 | J | 1.1E-03 | J | 1.0E-03 | J | 2.7E-03 | | 6.5E-04 | J | 9.2E-05 | U | 1.7E-04 | J |
| 1,2,3,4,7,8-HxCDF | 1.1E-02 | B | 5.0E-03 | | 5.0E-03 | B | 7.0E-03 | B | 3.5E-02 | B | 2.9E-03 | B | 3.5E-04 | JB | 1.8E-04 | JB |
| 1,2,3,6,7,8-HxCDD | 9.4E-03 | | 4.7E-03 | | 5.7E-03 | | 6.3E-03 | | 2.9E-02 | | 3.0E-03 | | 2.6E-04 | U | 3.6E-04 | J |
| 1,2,3,6,7,8-HxCDF | 9.3E-03 | BD | 1.7E-03 | J | 1.7E-03 | JBD | 2.7E-03 | BD | 1.5E-02 | BD | 1.3E-03 | JB | 3.5E-04 | JB | 1.9E-04 | JB |
| 1,2,3,7,8,9-HxCDD | 2.2E-03 | J | 1.6E-03 | J | 1.9E-03 | J | 1.9E-03 | J | 5.2E-03 | | 1.3E-03 | J | 3.7E-04 | J | 2.6E-04 | J |
| 1,2,3,7,8,9-HxCDF | 3.5E-03 | | 1.3E-03 | J | 1.4E-03 | J | 1.9E-03 | J | 6.9E-03 | | 7.1E-04 | J | 1.4E-04 | J | 2.3E-05 | U |
| 1,2,3,7,8-PeCDD | 5.2E-04 | J | 4.0E-04 | J | 4.6E-04 | J | 4.3E-04 | J | 9.1E-04 | J | 4.5E-04 | J | 1.7E-04 | J | 6.4E-05 | U |
| 1,2,3,7,8-PeCDF | 1.4E-03 | J | 2.5E-04 | U | 5.7E-04 | J | 1.1E-03 | J | 2.2E-03 | J | 5.8E-04 | J | 2.0E-04 | J | 1.5E-04 | J |
| 2,3,4,6,7,8-HxCDF | 4.4E-03 | | 1.9E-03 | J | 2.1E-03 | J | 2.4E-03 | J | 1.1E-02 | | 1.4E-03 | J | 2.7E-04 | J | 1.5E-04 | J |
| 2,3,4,7,8-PeCDF | 3.2E-03 | | 1.0E-03 | J | 1.2E-03 | J | 1.4E-03 | J | 4.9E-03 | | 1.1E-03 | J | 3.2E-04 | J | 7.1E-05 | U |
| 2,3,7,8-TCDD | 2.2E-04 | J | 7.5E-05 | U | 1.7E-04 | J | 4.9E-05 | U | 9.0E-05 | U | 8.2E-05 | U | 5.7E-05 | U | 4.4E-05 | U |
| 2,3,7,8-TCDF | 4.0E-04 | J | 2.4E-04 | J | 2.5E-04 | J | 2.3E-04 | J | 4.5E-04 | J | 5.4E-04 | | 2.3E-04 | J | 1.2E-04 | J |
| OCDD | 3.8E+00 | | 1.6E+00 | | 1.8E+00 | | 2.7E+00 | | 1.4E+01 | | 8.3E-01 | | 9.1E-02 | | 8.2E-02 | |
| OCDF | 3.2E-01 | | 1.5E-01 | | 1.7E-01 | | 2.3E-01 | | 1.3E+00 | | 8.7E-02 | | 7.0E-03 | | 3.6E-03 | J |
| Total HpCDD | 6.2E-01 | | 3.2E-01 | | 3.5E-01 | | 4.3E-01 | | 2.0E+00 | | 1.7E-01 | | 3.0E-02 | | 4.2E-02 | |
| Total HpCDF | 4.0E-01 | B | 1.9E-01 | | 1.9E-01 | B | 2.7E-01 | B | 1.4E+00 | B | 1.0E-01 | B | 9.6E-03 | B | 3.8E-03 | B |
| Total HxCDD | 5.3E-02 | | 3.3E-02 | | 3.6E-02 | | 3.7E-02 | | 1.4E-01 | | 2.2E-02 | | 6.8E-03 | | 7.4E-03 | |
| Total HxCDF | 2.2E-01 | BD | 7.3E-02 | BD | 7.2E-02 | BD | 9.8E-02 | BD | 5.1E-01 | BD | 4.1E-02 | BD | 6.0E-03 | BD | 2.8E-03 | BD |
| Total PeCDD | 7.7E-03 | | 8.7E-03 | | 8.3E-03 | | 7.9E-03 | | 1.1E-02 | | 5.2E-03 | | 4.6E-03 | | 3.8E-03 | |
| Total PeCDF | 7.0E-02 | D | 1.1E-02 | D | 1.3E-02 | D | 2.1E-02 | D | 1.1E-01 | D | 1.4E-02 | D | 4.9E-03 | D | 2.2E-03 | D |
| **Total TCDD** | 5.8E-03 | | 8.2E-03 | | 7.2E-03 | | 7.0E-03 | | 6.3E-03 | | 6.4E-03 | | 6.2E-03 | | 3.6E-03 | |
| **Total TCDF** | 2.2E-02 | D | 7.2E-03 | D | 5.3E-03 | D | 9.6E-03 | D | 4.0E-02 | D | 1.7E-02 | D | 8.0E-03 | D | 4.0E-03 | D |
| **2,3,7,8-TCDD TEQ (mamm)** | 1.1E-02 | | 4.9E-03 | | 5.7E-03 | | 6.9E-03 | | 3.1E-02 | | 3.4E-03 | | 7.1E-04 | | 4.2E-04 | |
| **2,3,7,8-TCDD TEQ (avian)** | 1.1E-02 | | 4.8E-03 | | 5.5E-03 | | 6.6E-03 | | 2.9E-02 | | 3.5E-03 | | 7.6E-04 | | 4.2E-04 | |
| **Miscellaneous** | | | | | | | | | | | | | | | | |
| Percent Solids (%) | 62.2 | | 52.9 | | 58.4 | | 64.1 | | 67.3 | | 52.6 | | 60.9 | | 72.3 | |
| Total Organic Carbon (mg/kg) | 2.6E+04 | | 3.7E+04 | | 3.1E+04 | | 3.0E+04 | | 2.5E+04 | | 9.8E+04 | | 3.0E+04 | | 2.3E+04 | |

Notes:
non detects are at half detection limit
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (1998) TEFs for mammals, assuming 1/2 the sample-specific estimate detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimate detection limit.
*These samples were incorporated the results from both duplicate sampling locations. The listed value is one of the following: 1) the average of detected values,2) the lower detection limits if both values were non-detect,3) the average of one-half the detection limit and the detected

Penta/PAH data qualifiers:
U - Analyte Not detected above reporting limit. Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 the estimated maximum possible concentration or 1/2 the sample-specific estimated detection limit)

B- Analyte detected in Method Blank.
1,2,3,4,6,7,6,8-HpCDF detected in Blank at 4.9E-2 ug/kg in June sampling and 9.6E-5 ug/kg in July.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Summary of Area 1 Representative Surface Water Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| **Sample ID**<br>**Sample Date** | **TEF** | **W1 8/9/1999** | |
|---|---|---|---|
| **Penta and PAHs (ug/L)** | | | |
| Acenaphthene | | 2.5E+00 | U |
| Acenaphthylene | | 2.5E+00 | U |
| Anthracene | | 2.5E+00 | U |
| Benzo(a)anthracene | 0.1 | 2.5E+00 | U |
| Benzo(a)pyrene | 1 | 2.5E+00 | U |
| Benzo(b)fluoranthene | 0.1 | 2.5E+00 | U |
| Benzo(g,h,i)perylene | | 2.5E+00 | U |
| Benzo(k)fluoranthene | 0.01 | 2.5E+00 | U |
| Chrysene | 0.001 | 2.5E+00 | U |
| Dibenzo(a,h)anthracene | 1 | 2.5E+00 | U |
| Fluoranthene | | 2.5E+00 | U |
| Fluorene | | 2.5E+00 | U |
| Indeno(1,2,3-cd)pyrene | 0.1 | 2.5E+00 | U |
| Methylnaphthalene | | NA | |
| Naphthalene | | 2.5E+00 | U |
| Phenanthrene | | 2.5E+00 | U |
| Pyrene | | 2.5E+00 | U |
| Pentachlorophenol | | 4.1E-01 | |
| **Total PAHs** | | ND | |
| **BaP-TE** | | 5.8E+00 | |

Notes:
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
NA: Not Analyzed, ND: individual PAHs were all Non-detect
Penta/PAH data qualifiers:
U - Analyte Not detected above reporting limit.
Concentration reported in table is 1/2 the
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.
PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 the
estimated maximum possible concentration or
B- Analyte detected in Method Blank.
1,2,3,4,6,7,6,8-HpCDF detected in Blank at 4.9E-2 ug/kg in June sampling and 9.6E-5 ug/kg in July.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Summary of Area 2 Representative Surface Water Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Sample ID<br>Sample Date | TEF | SW-06-<br>06/13/1996 | | SW-07-<br>06/10/1996 | | SW-08-<br>06/12/1996 | | SW-09-<br>06/12/1996 | | W2<br>8/9/1999 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Penta and PAHs (ug/L)** | | | | | | | | | | | |
| Acenaphthene | | 1.0E+00 | U | 1.0E+00 | U | 1.0E+00 | UJ | 1.0E+00 | UJ | 2.5E+00 | U |
| Acenaphthylene | | 1.0E+00 | U | 1.0E+00 | U | 1.0E+00 | UJ | 1.0E+00 | UJ | 2.5E+00 | U |
| Anthracene | | 1.6E-01 | | 5.0E-02 | U | 5.0E-02 | UJ | 5.0E-02 | UJ | 2.5E+00 | U |
| Benzo(a)anthracene | 0.1 | 1.0E-02 | U | 1.0E-02 | U | 1.0E-02 | UJ | 1.0E-02 | UJ | 2.5E+00 | U |
| Benzo(a)pyrene | 1 | 1.0E-01 | | 1.0E-02 | U | 4.0E-02 | J | 1.0E-02 | UJ | 2.5E+00 | U |
| Benzo(b)fluoranthene | 0.1 | 2.6E-01 | | 1.0E-02 | U | 6.1E-02 | J | 3.3E-02 | J | 2.7E-01 | |
| Benzo(g,h,i)perylene | | 3.0E-02 | U | 3.0E-02 | U | 3.0E-02 | UJ | 3.0E-02 | UJ | 2.5E+00 | U |
| Benzo(k)fluoranthene | 0.01 | 6.6E-02 | | 1.0E-02 | U | 4.2E-02 | J | 1.0E-02 | UJ | 2.5E+00 | U |
| Chrysene | 0.001 | 7.5E-02 | U | 8.0E-02 | U | 7.5E-02 | UJ | 8.0E-02 | UJ | 2.5E+00 | U |
| Dibenzo(a,h)anthracene | 1 | 1.5E-02 | U | 1.5E-02 | U | 1.5E-02 | UJ | 1.5E-02 | UJ | 2.5E+00 | U |
| Fluoranthene | | 1.0E-01 | U | 1.0E-01 | U | 1.0E-01 | UJ | 2.3E-01 | | 2.5E+00 | U |
| Fluorene | | 1.0E-01 | U | 1.0E-01 | U | 1.0E-01 | UJ | 1.0E-01 | UJ | 2.5E+00 | U |
| Indeno(1,2,3-cd)pyrene | 0.1 | 6.6E-02 | | 3.0E-02 | U | 3.0E-02 | UJ | 3.0E-02 | UJ | 2.5E+00 | U |
| Methylnaphthalene | | 1.0E+00 | U | 1.0E+00 | U | 1.0E+00 | UJ | 1.0E+00 | UJ | NA | |
| Naphthalene | | 1.0E+00 | U | 1.0E+00 | U | 1.0E+00 | UJ | 1.0E+00 | UJ | 2.5E+00 | U |
| Phenanthrene | | 3.0E-01 | U | 3.0E-01 | U | 3.0E-01 | UJ | 3.0E-01 | UJ | 2.5E+00 | U |
| Pyrene | | 1.0E-01 | U | 1.0E-01 | U | 1.0E-01 | UJ | 1.0E-01 | UJ | 2.5E+00 | U |
| Pentachlorophenol | | 2.5E-01 | U | 2.5E-01 | U | 2.5E-01 | U | 2.5E-01 | U | 7.5E-02 | |
| **Total PAHs** | | 6.5E-01 | | ND | | 1.4E-01 | J | 2.6E-01 | | 2.7E-01 | J |
| **BaP-TE** | | 1.5E-01 | | 3.0E-02 | | 6.6E-02 | | 3.3E-02 | | 5.6E+00 | |

Notes:
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
NA: Not Analyzed, ND: individual PAHs were all Non-detect

Penta/PAH data qualifiers:
U - Analyte Not detected above reporting limit. Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 the estimated maximum possible concentration or 1/2 the sample-specific estimated
B- Analyte detected in Method Blank.
1,2,3,4,6,7,6,8-HpCDF detected in Blank at 4.9E-2 ug/kg in June sampling and 9.6E-5 ug/kg in July.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Summary of Area 3 Representative Surface Water Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| **Sample ID**<br>**Sample Date** | **TEF** | **SW-10-**<br>**06/11/1996** | | **SW-11-**<br>**06/11/1996** | | **W3**<br>**8/9/1999** | |
|---|---|---|---|---|---|---|---|
| **Penta and PAHs (ug/L)** | | | | | | | |
| Acenaphthene | | 1.0E+00 | U | 1.0E+00 | U | 2.5E+00 | U |
| Acenaphthylene | | 1.0E+00 | U | 1.0E+00 | U | 2.5E+00 | U |
| Anthracene | | 5.0E-02 | U | 5.0E-02 | U | 2.5E+00 | U |
| Benzo(a)anthracene | 0.1 | 1.0E-02 | U | 1.0E-02 | U | 2.5E+00 | U |
| Benzo(a)pyrene | 1 | 1.0E-02 | U | 1.0E-02 | U | 2.5E+00 | U |
| Benzo(b)fluoranthene | 0.1 | 4.4E-02 | | 1.0E-02 | U | 2.5E+00 | U |
| Benzo(g,h,i)perylene | | 3.0E-02 | U | 2.5E-02 | U | 2.5E+00 | U |
| Benzo(k)fluoranthene | 0.01 | 1.0E-02 | U | 1.0E-02 | U | 2.5E+00 | U |
| Chrysene | 0.001 | 8.0E-02 | U | 7.5E-02 | U | 2.5E+00 | U |
| Dibenzo(a,h)anthracene | 1 | 1.5E-02 | U | 1.5E-02 | U | 2.5E+00 | U |
| Fluoranthene | | 1.0E-01 | U | 1.0E-01 | U | 2.5E+00 | U |
| Fluorene | | 1.0E-01 | U | 1.0E-01 | U | 2.5E+00 | U |
| Indeno(1,2,3-cd)pyrene | 0.1 | 3.0E-02 | U | 2.5E-02 | U | 2.5E+00 | U |
| Methylnaphthalene | | 1.0E+00 | U | 1.0E+00 | U | NA | |
| Naphthalene | | 1.0E+00 | U | 1.0E+00 | U | 2.5E+00 | U |
| Phenanthrene | | 3.0E-01 | U | 2.5E-01 | U | 2.5E+00 | U |
| Pyrene | | 1.0E-01 | U | 1.0E-01 | U | 2.5E+00 | U |
| Pentachlorophenol | | 2.5E-01 | U | 2.5E-01 | U | 2.5E-01 | U |
| **Total PAHs** | | 4.4E-02 | | ND | | ND | |
| **BaP-TE** | | 3.4E-02 | | 3.0E-02 | | 5.8E+00 | |

Notes:
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
NA: Not Analyzed, ND: individual PAHs were all Non-detect

Penta/PAH data qualifiers:
U - Analyte Not detected above reporting limit.
Concentration reported in table is 1/2 the
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 the estimated maximum possible concentration or 1/2 the sample-specific estimated detection limit)
B- Analyte detected in Method Blank.
1,2,3,4,6,7,6,8-HpCDF detected in Blank at 4.9E-2 ug/kg in June sampling and 9.6E-5 ug/kg in July.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Summary of Area 2 Representative Fish Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| **Sample ID**<br>**Sample Data**<br>**Sample Total Weight** | **TEFs** | | **FS-R4**<br>**7/14/05**<br>**22.8g** | | **FS-R5**<br>**7/14/05**<br>**16g** | | **FS-R6**<br>**7/13/05**<br>**17g** | |
|---|---|---|---|---|---|---|---|---|
| **Analytes** | | | | | | | | |
| **PAH and Penta (mg/kg)** | | | | | | | | |
| Acenaphthene | | | 2.4E+00 | | 5.8E+00 | | 4.9E-01 | |
| Acenaphthylene | | | 9.0E-02 | U | 8.5E-02 | J | 6.0E-02 | U |
| Anthracene | | | 2.9E-01 | | 1.0E+00 | | 1.1E-01 | J |
| Benzo(a)anthracene | 0.1 | | 1.1E-01 | J | 2.0E-01 | | 2.5E-02 | J |
| Benzo(a)pyrene | 1 | | 9.0E-02 | U | 1.1E-01 | J | 6.0E-02 | U |
| Benzo(b)fluoranthene | 0.1 | | 9.0E-02 | U | 2.1E-01 | | 6.0E-02 | U |
| Benzo(ghi)perylene | | | 9.0E-02 | U | 8.0E-02 | | 6.0E-02 | U |
| Benzo(k)fluoranthene | 0.01 | | 9.0E-02 | U | 6.4E-02 | J | 6.0E-02 | U |
| Chrysene | 0.001 | | 1.1E-01 | J | 2.1E-01 | | 4.4E-02 | J |
| Dibenzo(a,h)anthracene | 1 | | 9.0E-02 | U | 9.5E-02 | U | 6.0E-02 | U |
| Fluoranthene | | | 1.3E+00 | | 3.4E+00 | | 1.9E-01 | |
| Fluorene | | | 1.4E+00 | | 3.7E+00 | | 2.9E-01 | |
| Indeno(1,2,3-cd)pyrene | 0.1 | | 9.0E-02 | U | 9.5E-02 | U | 6.0E-02 | U |
| Naphthalene | | | 1.4E+00 | | 2.3E+00 | | 1.7E-01 | |
| Phenanthrene | | | 2.2E+00 | | 6.8E+00 | | 3.5E-01 | |
| Pyrene | | | 7.6E-01 | | 1.6E+00 | | 3.7E-01 | |
| Pentachlorophenol | | | | | | | | |
| **Total PAH** | | | **9.97E+00** | | **2.56E+01** | | **2.04E+00** | |
| **BaP-TE** | | | **2.10E-01** | | **2.56E-01** | | **1.35E-01** | |
| **Dioxins (ug/kg)** | mamm | avian | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 0.01 | 0.01 | 4.8E-03 | | 1.1E-02 | | 1.2E-02 | |
| 1,2,3,4,6,7,8-HpCDF | 0.01 | 0.01 | 1.3E-03 | J | 3.4E-03 | | 3.5E-03 | |
| 1,2,3,4,7,8,9-HpCDF | 0.01 | 0.01 | 8.5E-05 | U | 4.2E-04 | | 3.7E-04 | J |
| 1,2,3,4,7,8-HxCDD | 0.1 | 0.1 | 2.7E-04 | J | 3.2E-04 | | 3.8E-04 | J |
| 1,2,3,4,7,8-HxCDF | 0.1 | 0.1 | 9.7E-04 | J | 1.3E-03 | | 1.6E-03 | J |
| 1,2,3,6,7,8-HxCDD | 0.1 | 0.1 | 1.5E-03 | J | 2.0E-03 | | 2.1E-03 | J |
| 1,2,3,6,7,8-HxCDF | 0.1 | 0.1 | 5.4E-04 | J | 2.5E-04 | U | 1.1E-03 | J |
| 1,2,3,7,8,9-HxCDD | 0.1 | 0.1 | 3.1E-04 | J | 3.7E-04 | | 4.5E-04 | J |
| 1,2,3,7,8,9-HxCDF | 0.1 | 0.1 | 4.0E-05 | U | 8.0E-05 | U | 7.5E-05 | U |
| 1,2,3,7,8-PeCDD | 1 | 1 | 3.8E-04 | J | 1.8E-04 | U | 4.8E-04 | J |
| 1,2,3,7,8-PeCDF | 0.03 | 0.05 | 3.7E-04 | J | 4.6E-04 | | 5.0E-04 | J |
| 2,3,4,6,7,8-HxCDF | 0.1 | 0.1 | 1.3E-04 | U | 3.2E-04 | | 4.6E-04 | J |
| 2,3,4,7,8-PeCDF | 0.3 | 0.5 | 7.2E-04 | J | 9.3E-04 | | 9.9E-04 | J |
| 2,3,7,8-TCDD | 1 | 1 | 9.4E-05 | U | 1.9E-04 | | 2.0E-04 | J |
| 2,3,7,8-TCDF | 0.1 | 0.1 | 3.6E-04 | J | 3.1E-04 | | 3.8E-04 | J |
| OCDD | 0.0003 | 0.0001 | 2.3E-02 | | 1.1E-01 | | 8.3E-02 | |
| OCDF | 0.0003 | 0.0001 | 2.8E-03 | J | 1.1E-02 | | 7.0E-03 | |
| **2,3,7,8-TCDD TEQ (mamm)** | | | **1.2E-03** | | **1.3E-03** | | **1.8E-03** | |
| **2,3,7,8-TCDD TEQ (avian)** | | | **1.3E-03** | | **1.5E-03** | | **2.0E-03** | |
| **Miscellaneous** | | | | | | | | |
| Percent Lipids (%) | | | 1.77 | | 1.61 | | 3.14 | |

Notes:
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (1998) TEFs for mammals, assuming 1/2 the sample-specific estimate detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimate detection limit.
Penta/PAH data qualifiers:
U - Analyte Not detected above reporting limit.
Concentration reported in table is 1/2 the reporting
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 of the estimated detection limit)
B- Analyte detected in Method Blank.
OCDD detected in FS-REF and FLY-REF blank at 3.47E-4 ppb.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Summary of Area 3 Representative Fish Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| Sample ID<br>Sample Data<br>Sample Total Weight | TEFs | | FS-R1<br>7/14/2005<br>11.4g | | FS-R2<br>7/14/05<br>25g | | FS-R3<br>7/14/05<br>16g | |
|---|---|---|---|---|---|---|---|---|
| **Analytes** | | | | | | | | |
| **PAH and Penta (mg/kg)** | | | | | | | | |
| Acenaphthene | | | 4.0E-02 | J | 1.4E-01 | | 4.6E-01 | |
| Acenaphthylene | | | 4.4E-02 | U | 2.0E-02 | U | 1.6E-02 | J |
| Anthracene | | | 2.9E-02 | J | 6.0E-02 | | 1.3E-01 | |
| Benzo(a)anthracene | 0.1 | | 2.5E-02 | J | 2.0E-02 | U | 1.7E-01 | |
| Benzo(a)pyrene | 1 | | 4.4E-02 | U | 2.0E-02 | U | 8.1E-02 | |
| Benzo(b)fluoranthene | 0.1 | | 4.4E-02 | U | 1.4E-02 | J | 1.9E-01 | |
| Benzo(ghi)perylene | | | 4.4E-02 | U | 2.0E-02 | U | 3.3E-02 | J |
| Benzo(k)fluoranthene | 0.01 | | 4.4E-02 | U | 2.0E-02 | U | 3.8E-02 | U |
| Chrysene | 0.001 | | 1.9E-02 | J | 2.0E-02 | U | 8.2E-02 | |
| Dibenzo(a,h)anthracene | 1 | | 4.4E-02 | U | 2.0E-02 | U | 3.8E-02 | U |
| Fluoranthene | | | 7.9E-02 | J | 1.8E-01 | | 1.1E+00 | |
| Fluorene | | | 2.1E-02 | J | 9.1E-02 | | 2.8E-01 | |
| Indeno(1,2,3-cd)pyrene | 0.1 | | 4.4E-02 | U | 2.0E-02 | U | 3.8E-02 | U |
| Naphthalene | | | 4.4E-02 | U | 2.1E-02 | J | 4.6E-01 | |
| Phenanthrene | | | 7.6E-02 | J | 2.6E-01 | | 7.4E-01 | |
| Pyrene | | | 9.8E-02 | | 1.3E-01 | | 3.6E-01 | |
| Pentachlorophenol | | | | | | | | |
| **Total PAH** | | | **3.87E-01** | | **8.96E-01** | | **4.10E+00** | |
| **BaP-TE** | | | **9.98E-02** | | **4.56E-02** | | **1.59E-01** | |
| **Dioxins (ug/kg)** | mamm | avian | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 0.01 | 0.01 | 5.6E-03 | | 3.5E-03 | | 8.1E-03 | |
| 1,2,3,4,6,7,8-HpCDF | 0.01 | 0.01 | 6.9E-04 | U | 9.5E-04 | J | 1.8E-03 | |
| 1,2,3,4,7,8,9-HpCDF | 0.01 | 0.01 | 7.3E-05 | U | 8.9E-05 | U | 1.3E-04 | U |
| 1,2,3,4,7,8-HxCDD | 0.1 | 0.1 | 1.4E-04 | U | 1.9E-04 | U | 1.8E-04 | U |
| 1,2,3,4,7,8-HxCDF | 0.1 | 0.1 | 6.2E-04 | J | 5.0E-04 | J | 8.9E-04 | J |
| 1,2,3,6,7,8-HxCDD | 0.1 | 0.1 | 7.7E-04 | J | 7.4E-04 | J | 1.4E-03 | J |
| 1,2,3,6,7,8-HxCDF | 0.1 | 0.1 | 2.8E-04 | J | 2.0E-04 | J | 3.2E-04 | J |
| 1,2,3,7,8,9-HxCDD | 0.1 | 0.1 | 1.3E-04 | U | 1.8E-04 | U | 1.3E-04 | U |
| 1,2,3,7,8,9-HxCDF | 0.1 | 0.1 | 6.4E-05 | U | 5.8E-05 | U | 6.0E-05 | U |
| 1,2,3,7,8-PeCDD | 1 | 1 | 7.2E-05 | U | 8.7E-05 | U | 1.2E-04 | U |
| 1,2,3,7,8-PeCDF | 0.03 | 0.05 | 2.1E-04 | J | 1.4E-04 | U | 2.2E-04 | J |
| 2,3,4,6,7,8-HxCDF | 0.1 | 0.1 | 1.8E-04 | J | 8.3E-05 | U | 2.3E-04 | J |
| 2,3,4,7,8-PeCDF | 0.3 | 0.5 | 2.5E-04 | J | 1.3E-04 | U | 5.1E-04 | J |
| 2,3,7,8-TCDD | 1 | 1 | 6.1E-05 | U | 7.1E-05 | U | 7.2E-05 | U |
| 2,3,7,8-TCDF | 0.1 | 0.1 | 7.9E-05 | U | 1.0E-04 | U | 5.4E-05 | U |
| OCDD | 0.0003 | 0.0001 | 3.3E-02 | | 2.3E-02 | | 5.6E-02 | |
| OCDF | 0.0003 | 0.0001 | 3.1E-03 | J | 2.2E-03 | J | 4.8E-03 | |
| **2,3,7,8-TCDD TEQ (mamm)** | | | **5.2E-04** | | **4.6E-04** | | **8.0E-04** | |
| **2,3,7,8-TCDD TEQ (avian)** | | | **5.6E-04** | | **4.8E-04** | | **8.9E-04** | |
| **Miscellaneous** | | | | | | | | |
| Percent Lipids (%) | | | 1.56 | | 1.38 | | 1.16 | |

Notes:
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (1998) TEFs for mammals, assuming 1/2 the sample-specific estimate detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimate detection limit.
Penta/PAH data qualifiers:
U - Analyte Not detected above reporting limit. Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 of the estimated detection limit)
B- Analyte detected in Method Blank.
OCDD detected in FS-REF and FLY-REF blank at 3.47E-4 ppb.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Summary of Area 1 Representative Insect Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | | | | |
|---|---|---|---|---|
| **Sample ID** | | | **FLY-4** | |
| **Sample Date** | | | **7/14/05** | |
| **Sample Total Weight** | | | **25g** | |
| | **TEFs** | | | |
| **PAH and Penta (mg/kg)** | | | | |
| Acenaphthene | | | 1.2E-01 | U |
| Acenaphthylene | | | 1.2E-01 | U |
| Anthracene | | | 1.2E-01 | U |
| Benzo(a)anthracene | 0.1 | | 1.2E-01 | U |
| Benzo(a)pyrene | 1 | | 1.2E-01 | U |
| Benzo(b)fluoranthene | 0.1 | | 1.2E-01 | U |
| Benzo(ghi)perylene | | | 1.2E-01 | U |
| Benzo(k)fluoranthene | 0.01 | | 1.2E-01 | U |
| Chrysene | 0.001 | | 1.2E-01 | U |
| Dibenzo(a,h)anthracene | 1 | | 1.2E-01 | U |
| Fluoranthene | | | 2.3E-01 | J |
| Fluorene | | | 1.2E-01 | U |
| Indeno(1,2,3-cd)pyrene | 0.1 | | 1.2E-01 | U |
| Naphthalene | | | 1.2E-01 | U |
| Phenanthrene | | | 1.2E-01 | U |
| Pyrene | | | 1.2E-01 | U |
| Pentachlorophenol | | | | |
| **Total PAH** | | | **2.3E-01** | |
| **BaP-TE** | | | **2.8E-01** | |
| **Dioxins (ug/kg)** | mamm | avian | | |
| 1,2,3,4,6,7,8-HpCDD | 0.01 | 0.01 | 1.9E-02 | |
| 1,2,3,4,6,7,8-HpCDF | 0.01 | 0.01 | 5.4E-03 | |
| 1,2,3,4,7,8,9-HpCDF | 0.01 | 0.01 | 2.5E-04 | J |
| 1,2,3,4,7,8-HxCDD | 0.1 | 0.1 | 5.0E-04 | J |
| 1,2,3,4,7,8-HxCDF | 0.1 | 0.1 | 7.0E-04 | J |
| 1,2,3,6,7,8-HxCDD | 0.1 | 0.1 | 1.4E-03 | J |
| 1,2,3,6,7,8-HxCDF | 0.1 | 0.1 | 3.7E-04 | J |
| 1,2,3,7,8,9-HxCDD | 0.1 | 0.1 | 7.9E-04 | J |
| 1,2,3,7,8,9-HxCDF | 0.1 | 0.1 | 7.9E-05 | U |
| 1,2,3,7,8-PeCDD | 1 | 1 | 3.1E-04 | J |
| 1,2,3,7,8-PeCDF | 0.03 | 0.05 | 2.5E-04 | J |
| 2,3,4,6,7,8-HxCDF | 0.1 | 0.1 | 4.1E-04 | J |
| 2,3,4,7,8-PeCDF | 0.3 | 0.5 | 3.3E-04 | J |
| 2,3,7,8-TCDD | 1 | 1 | 1.0E-04 | U |
| 2,3,7,8-TCDF | 0.1 | 0.1 | 2.5E-04 | J |
| OCDD | 0.0003 | 0.0001 | 8.7E-02 | |
| OCDF | 0.0003 | 0.0001 | 4.6E-03 | J |
| **2,3,7,8-TCDD TEQ (mamm)** | | | **1.2E-03** | |
| **2,3,7,8-TCDD TEQ (avian)** | | | **1.3E-03** | |
| **Miscellaneous** | | | | |
| Percent Lipids (%) | | | 1.02 | |

Notes:
ND: individual PAHs were all Non-detect
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (1998) TEFs for mammals, assuming 1/2 the sample-specific estimate detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimate detection limit.
Penta/PAH data qualifiers:
U - Analyte Not detected above reporting limit. Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.
PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limit)
U = non-detect (associated value is 1/2 the estimated maximum possible concentration or sample-specific
B- Analyte detected in Method Blank.
OCDD detected in FS-REF and FLY-REF blank at 3.47E-4 ppb.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

**Summary of Area 2 Representative Insect Data**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| **Sample ID**<br>**Sample Date**<br>**Sample Total Weight** | | | **FLY-1**<br>**7/15/05**<br>**17g** | | **FLY-2**<br>**6/7/05**<br>**25g** | | **FLY-3**<br>**7/14/05**<br>**25g** | |
|---|---|---|---|---|---|---|---|---|
| | **TEFs** | | | | | | | |
| **PAH and Penta (mg/kg)** | | | | | | | | |
| Acenaphthene | | | 3.0E-02 | J | 2.0E-02 | U | 8.0E-02 | U |
| Acenaphthylene | | | 5.4E-01 | | 2.0E-02 | U | 8.0E-02 | U |
| Anthracene | | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U |
| Benzo(a)anthracene | 0.1 | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U |
| Benzo(a)pyrene | 1 | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U |
| Benzo(b)fluoranthene | 0.1 | | 5.3E-02 | j | 2.0E-02 | U | 8.0E-02 | U |
| Benzo(ghi)perylene | | | 7.5E-02 | U | 2.0E-02 | U | 8.0E-02 | U |
| Benzo(k)fluoranthene | 0.01 | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U |
| Chrysene | 0.001 | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U |
| Dibenzo(a,h)anthracene | 1 | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U |
| Fluoranthene | | | 2.2E-01 | | 2.0E-02 | U | 4.3E-01 | |
| Fluorene | | | 2.6E-02 | J | 2.0E-02 | U | 8.0E-02 | U |
| Indeno(1,2,3-cd)pyrene | 0.1 | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U |
| Naphthalene | | | 1.5E-01 | | 2.0E-02 | U | 4.3E-02 | J |
| Phenanthrene | | | 8.3E-02 | J | 2.0E-02 | U | 8.5E-02 | J |
| Pyrene | | | 6.0E-02 | U | 2.0E-02 | U | 8.0E-02 | U |
| Pentachlorophenol | | | | | | | | |
| **Total PAH** | | | **1.1E+00** | | **ND** | | **5.6E-01** | |
| **BaP-TE** | | | **1.4E-01** | | **4.6E-02** | | **1.8E-01** | |
| **Dioxins (ug/kg)** | mamm | avian | | | | | | |
| 1,2,3,4,6,7,8-HpCDD | 0.01 | 0.01 | 1.1E-02 | | 1.1E-01 | | 2.1E-02 | |
| 1,2,3,4,6,7,8-HpCDF | 0.01 | 0.01 | 3.2E-03 | J | 1.6E-02 | | 4.5E-03 | |
| 1,2,3,4,7,8,9-HpCDF | 0.01 | 0.01 | 1.5E-04 | U | 7.8E-05 | U | 7.0E-05 | U |
| 1,2,3,4,7,8-HxCDD | 0.1 | 0.1 | 2.9E-04 | J | 1.1E-03 | J | 4.4E-04 | J |
| 1,2,3,4,7,8-HxCDF | 0.1 | 0.1 | 4.3E-04 | J | 2.2E-03 | J | 8.7E-04 | J |
| 1,2,3,6,7,8-HxCDD | 0.1 | 0.1 | 1.0E-03 | J | 7.4E-03 | | 1.8E-03 | J |
| 1,2,3,6,7,8-HxCDF | 0.1 | 0.1 | 2.4E-04 | J | 6.3E-04 | J | 4.6E-04 | J |
| 1,2,3,7,8,9-HxCDD | 0.1 | 0.1 | 4.0E-04 | J | 1.0E-03 | J | 6.4E-04 | J |
| 1,2,3,7,8,9-HxCDF | 0.1 | 0.1 | 4.0E-05 | U | 4.4E-05 | U | 6.4E-05 | U |
| 1,2,3,7,8-PeCDD | 1 | 1 | 2.5E-04 | J | 3.7E-04 | J | 1.6E-04 | U |
| 1,2,3,7,8-PeCDF | 0.03 | 0.05 | 2.1E-04 | U | 7.2E-04 | J | 2.5E-04 | J |
| 2,3,4,6,7,8-HxCDF | 0.1 | 0.1 | 2.6E-04 | J | 8.5E-04 | J | 4.1E-04 | J |
| 2,3,4,7,8-PeCDF | 0.3 | 0.5 | 1.9E-04 | U | 6.8E-04 | J | 2.0E-04 | U |
| 2,3,7,8-TCDD | 1 | 1 | 1.4E-04 | U | 2.3E-04 | J | 9.8E-05 | U |
| 2,3,7,8-TCDF | 0.1 | 0.1 | 1.7E-04 | U | 9.8E-04 | | 2.5E-04 | J |
| OCDD | 0.0003 | 0.0001 | 5.6E-02 | | 5.8E-01 | | 1.0E-01 | |
| OCDF | 0.0003 | 0.0001 | 3.3E-03 | J | 1.1E-03 | J | 6.0E-03 | |
| **2,3,7,8-TCDD TEQ (mamm)** | | | **9.0E-04** | | **3.7E-03** | | **1.1E-03** | |
| **2,3,7,8-TCDD TEQ (avian)** | | | **9.3E-04** | | **3.7E-03** | | **1.1E-03** | |
| **Miscellaneous** | | | | | | | | |
| Percent Lipids (%) | | | 3.38 | | 1.67 | | 0.892 | |

Notes:
ND: individual PAHs were all Non-detect
Total PAH and BaP-TE calculated using 1/2 the reporting limit for non-detect results.
2,3,7,8-TCDD TEQ calculated by applying WHO (1998) TEFs for mammals, assuming 1/2 the sample-specific estimate detection limit.
2,3,7,8-TCDD TEQ calculated by applying WHO (2005) TEFs for birds, assuming 1/2 the sample-specific estimate detection limit.

Penta/PAH data qualifiers:
U - Analyte Not detected above reporting limit. Concentration reported in table is 1/2 the reporting limit.
J = estimated value (below the reporting limit)
D - Result was obtained from a re-analysis for dilution.

PCDD/PCDF data qualifiers:
J = estimated value (below the lower calibration limi
U = non-detect (associated value is 1/2 the estimated maximum possible concentration or sample-specific estimated detection limit)
B- Analyte detected in Method Blank.
OCDD detected in FS-REF and FLY-REF blank at 3.47E-4 ppb.
D = value is maximum possible concentration due to possible chlorinated diphenylether interference

# Appendix B

# Derivation of Dose-Response Values

## ACENAPHTHENE

Acenapthene is a member of the chemical class of polycyclic aromatic hydrocarbons (PAH), which are ubiquitous in the environment as the result of incomplete combustion of any carbon fuel. Acenaphthene is also present in crude and certain refined fractions of petroleum and coal products. Acenaphthene is of relatively low molecular weight relative to many other PAH, which renders the compound more water soluble and mobile than the higher molecular weight fractions, and also more subject to biodegradation.

Exposure may occur due to ingestion or dermal absorption, although the latter will be partially mitigated by adsorption of the chemical to environmental media such as soil. Acenaphthene is not highly volatile, so inhalation exposures to vapor are unlikely. The potential human toxic effects of acenaphthene may be similar to those observed in experimental animals following exposures such as those described below, although it is important to remember that the probability and/or severity of any effect is profoundly affected by the dose.

Due to lack of empirical data, acenaphthene is not considered carcinogenic, and therefore cancer slope factors are not available.

### Derivation of the Chronic Oral Reference Dose

The oral reference dose (RfD) for acenaphthene was derived from a 13 week corn oil gavage study in mice (U.S. EPA, 1989). The mice were given 175 to 700 mg/kg-day. The RfD is reported as 0.06 mg/kg-day (U.S. EPA 2004).

### References

U.S. EPA. 1989. Mouse oral subchronic study with Acenaphthene. Study conducted by Hazelton Laboratories for the Office of Solid Waste, Washington, DC.

U.S. EPA, 2004. Integrated Risk Information System (IRIS). On-Line Database. Environmental Criteria and Assessment Office. Cincinnati, OH.

## ACENAPHTHYLENE

Acenapthylene is a member of the chemical class of polycyclic aromatic hydrocarbons (PAH). Acenapthylene is of relatively low molecular weight relative to many other PAH, which renders the compound more water soluble and mobile than the higher molecular weight fractions, and also more subject to biodegradation. Exposure may occur due to ingestion or dermal absorption, although the latter will be partially mitigated by adsorption of the chemical to environmental media such as soil. Acenaphthylene is not highly volatile, so inhalation exposures to vapor are unlikely.

The U.S. EPA has not derived toxicity values for acenaphthylene and therefore naphlathene was selected as the surrogate for oral reference dose because of structural similarity. The dose-response information is presented in the section on naphthalene.

## ANTHRACENE

Anthracene is a member of the chemical class of polycyclic aromatic hydrocarbons (PAH). Anthracene is of relatively low molecular weight relative to many other PAH, which renders the compound more water soluble and mobile than the higher molecular weight fractions, and also more subject to biodegradation. Exposure may occur due to ingestion or dermal absorption, although the latter will be partially mitigated by adsorption of the chemical to environmental media such as soil. Anthracene is not highly volatile, so inhalation exposures to vapor are unlikely. The potential human toxic effects of anthracene may be similar to those observed in experimental animals following exposures such as those described below, although it is important to remember that the probability and/or severity of any effect is profoundly affected by the dose.

Anthracene has been classified by EPA as Category D, not classifiable as to human carcinogencity. Therefore, cancer slope factors are not available for this compound

### Derivation of the Chronic Oral Reference Dose

The oral RfD for anthracene was derived from a 90 day gavage study in male and female CD-1 (ICR) BR mice (U.S. EPA, 1989). The mice were given 250 to 1000 mg/kg/day for at least 90 days. The no observable adverse effect level (NOAEL) was 1000 mg/kg/day, and there was no LOAEL. Mortality, clinical signs, body weights, food consumption, ophthalmology findings, hematological and clinical chemistry results, organ weights, gross pathology, and histopathology were all evaluated. The RfD is reported as 0.3 mg/kg/day (U.S. EPA, 2004). This was derived by applying an uncertainty factor of 3000 to the NOAEL. The factor of 1000 results from applying factors of 10 each for intraspecies, interspecies, and subchronic to chronic extrapolation. U.S. EPA reports that the extra uncertainty factor of 3 was used to account for lack of reproductive and developmental data and lack of adequate toxicity data in a second species.

### References

U.S. EPA. 1989. Subchronic toxicity study in mice with anthracene. Conducted by Hazelton Laboratories, Inc., for the Office of Solid Waste, Washington, DC.

U.S. EPA, 2004. Integrated Risk Information System (IRIS). On-Line Database. Environmental Criteria and Assessment Office. Cincinnati, OH.

## BENZO(a)ANTHRACENE

Benzo(a)anthracene is considered by U.S. EPA to be a probable human carcinogen (U.S. EPA, 2004) but a cancer slope factor has not been derived by U.S. EPA. Using the oral cancer slope factor (CSF) for benzo(a)pyrene and a comparative toxicity approach, a CSF is derived for benzo(a)anthracene. The dose-response information for benzo(a)pyrene and the comparative toxicity approach are presented in the section on polynuclear aromatic hydrocarbons (PAH). The U.S. EPA has not derived toxicity values for benzo(a)anthracene and therefore, the oral RfD for naphthalene was used as a surrogate toxicity value for benzo(a)anthracene. The dose-response information is presented in the section on naphthalene.

**BENZO(a)PYRENE**

The dose response information for benzo(a)pyrene is presented in the section on PAH.

**BENZO(b)FLUORANTHENE**

Benzo(b)fluoranthene is considered by U.S. EPA to be a probable human carcinogen (U.S. EPA, 2004) but a cancer slope factor has not been derived by U.S. EPA. Using the oral cancer slope factor (CSF) for benzo(a)pyrene and a comparative toxicity approach, a CSF is derived for benzo(b)fluoranthene. The dose-response information for benzo(a)pyrene and the comparative toxicity approach are presented in the section on PAH. The U.S. EPA has not derived toxicity values for benzo(b)fluoranthene and therefore, the oral RfD for naphthalene was used as a surrogate toxicity value for Benzo(b)fluoranthene. The dose-response information is presented in the section on naphthalene.

**BENZO(g,h,i)PERYLENE**

The U.S. EPA has not derived toxicity values for benzo(g,h,i)perylene and therefore, the oral RfD for naphthalene was used as a surrogate toxicity value for benzo(g,h,i)perylene. The dose-response information is presented in the section on naphthalene.

**BENZO(k)FLUORANTHENE**

Benzo(k)fluoranthene is considered by U.S. EPA to be a probable human carcinogen (U.S. EPA, 2004) but a cancer slope factor has not been derived by U.S. EPA. Using the oral cancer slope factor (CSF) for benzo(a)pyrene and a comparative toxicity approach, a CSF is derived for benzo(k)fluoranthene. The dose-response information for benzo(a)pyrene and the comparative toxicity approach are presented in the section on PAH. The U.S. EPA has not derived toxicity values for benzo(k)fluoranthene and therefore, the oral RfD for naphthalene was used as a surrogate toxicity value for benzo(k)fluoranthene. The dose-response information is presented in the section on naphthalene.

**CHRYSENE**

Chrysene is considered by U.S. EPA to be a probable human carcinogen (U.S. EPA, 2004), but a cancer slope factor has not been derived by U.S. EPA. Using the oral cancer slope factor (CSF) for benzo(a)pyrene and a comparative toxicity approach, a CSF is derived for chrysene. The dose-response information for benzo(a)pyrene and the comparative toxicity approach are presented in the section on PAH. The U.S. EPA has not derived toxicity values for chrysene and therefore, the oral RfD for naphthalene was used as a surrogate toxicity value for chrysene. The dose-response information is presented in the section on naphthalene.

## DIBENZO(A,H)ANTHRACENE

Dibenzo(a,h)anthracene is considered by U.S. EPA to be a probable human carcinogen (U.S. EPA, 2004), but a cancer slope factor has not been derived by U.S. EPA. Using the oral cancer slope factor (CSF) for benzo(a)pyrene and a comparative toxicity approach, a CSF is derived for dibenzo(a,h)anthracene. The dose-response information for benzo(a)pyrene and the comparative toxicity approach are presented in the section on PAH. The U.S. EPA has not derived toxicity values for dibenzo(a,h)anthracene and therefore, the oral RfD for naphthalene was used as a surrogate toxicity value for dibenzo(a,h)anthracene. The dose-response information is presented in the section on naphthalene.

## FLUORANTHENE

Fluoranthene is a polycyclic aromatic hydrocarbon (PAH). It exists as pale yellow needles or plates. Fluoranthene is almost insoluble in water, but is soluble in alcohol, ether, benzene, and acetic acid. Fluoranthene can be absorbed through dermal exposure and, based on similar PAHs, would be expected to be absorbed from the digestive tract and lungs. Although a large body of literature exists on the toxicity and carcinogenicity of PAHs, toxicity data for fluoranthene are very limited. No human data were available that addressed the toxicity of fluoranthene. Toxicity studies in animals have shown that fluoranthene exposure can cause eye irritation, nephropathy, increased liver weights, and increased liver enzyme levels.

No oral or inhalation bioassays were available to assess the carcinogenicity of fluoranthene to humans; bioassays by other exposure routes generally gave negative results. Studies involving topical application to the skin of mice and subcutaneous injection in mice provided no evidence of carcinogenicity. Fluoranthene was also inactive in mouse skin initiation and promotion assays.

According to EPA, fluoranthene is a class D compound, not classifiable in terms of human carcinogenicity. Therefore, cancer slope factors are not available for this compound.

### Derivation of the Chronic Oral Reference Dose

The oral RfD for fluoranthene was derived from a 13 week corn oil gavage study in male and female CD-1 mice (U.S. EPA, 1988). The mice were given 125 to 500 mg/kg/day. The NOAEL was 125 mg/kg/day. The LOAEL was 250 mg/kg/day. Nephropathy, increased liver weights, hematological alterations, and clinical effects were seen at the LOAEL. The RfD is reported as 0.04 mg/kg/day (U.S. EPA 2004). This was derived by applying an uncertainty factor of 3000 to the NOAEL. The factor of 1000 results for applying factors of 10 each for intraspecies, interspecies, and subchronic to chronic extrapolation. U.S. EPA reports that the extra uncertainty factor of 3 was used to account for lack of reproductive and developmental data and lack of adequate toxicity data in a second species.

## References

U.S. EPA.1988. 13-week mouse oral subchronic toxicity study. Prepared by Toxicity Research Laboratories, LTD., Muskegon, MI for the Office of Solid Waste, Washington, DC.

U.S. EPA. 2004. Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office, Cincinnati, OH.

## FLUORENE

The oral RfD for fluorene was derived from a 13 week corn oil gavage study in mice (U.S. EPA, 1989). The mice were given 125 to 250 mg/kg/day. The NOAEL was 125 mg/kg/day. The LOAEL was 250 mg/kg/day. Hematologic effects, such as decreased red blood cell levels, decreased red cell volume, and decreased levels of hemoglobin, were seen at the LOAEL. The RfD is reported as 0.04 mg/kg/day (U.S. EPA 2004). This was derived by applying an uncertainty factor of 3000 to the NOAEL. The factor of 1000 results for applying factors of 10 each for intraspecies, interspecies, and subchronic to chronic extrapolation. Although not reported, the extra uncertainty factor of 3 was probably used to account for lack of reproductive and developmental data and lack of adequate toxicity data in a second species. According to EPA, fluoranthene is not classifiable as to human carcinogenicity.

## References

U.S. EPA.1989. 13-week mouse oral subchronic toxicity study. Prepared by Toxicity Research Laboratories, LTD., Muskegon, MI for the Office of Solid Waste, Washington, DC.

U.S. EPA. 2004. Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office, Cincinnati, OH.

## INDENO(1,2,3-cd)PYRENE

Indeno(1,2,3-cd)pyrene is considered by U.S. EPA to be a probable human carcinogen (U.S. EPA, 2004), but a cancer slope factor has not been derived by U.S. EPA. Using the oral cancer slope factor (CSF) for benzo(a)pyrene and a comparative toxicity approach, a CSF is derived for indeno(1,2,3-cd)pyrene. The dose-response information for benzo(a)pyrene and the comparative toxicity approach are presented in the section on PAH. The U.S. EPA has not derived toxicity values for indeno(1,2,3-cd)pyrene and therefore, the oral RfD for naphthalene was used as a surrogate toxicity value for indeno(1,2,3-cd)pyrene. The dose-response information is presented in the section on naphthalene.

## NAPHTHALENE

An oral RfD for naphthalene (0.02 mg/kg-day) is available from IRIS (U.S. EPA, 2004). This value is based on a subchronic study by NTP in which rats were administered naphthalene by gavage 5 days per week for 13 weeks. Based upon a critical effect of body weight changes in male rats greater than 10% compared with control values, a NOAEL of 100 mg/kg-day was identified. The duration-adjusted NOAEL is 71 mg/kg-day. An uncertainty factor of 3000 was applied to the NOAEL, to account for interspecies (10) and intraspecies (10) extrapolation, the subchronic duration of the study (10), and deficiencies in the database (3) (no chronic oral exposure studies and no 2-generation reproductive toxicity studies). The resulting RfD is 0.02 mg/kg-d. Naphthalene is classified by EPA as category C, a possible human carcinogen. Cancer slope factors for naphthalene have not been derived because of a lack of empirical data.

### References

U.S. EPA. 2004. Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office, Cincinnati, OH.

## PENTACHLOROPHENOL

The U.S. EPA has derived an oral RfD and an oral CSF for pentachlorophenol that are verified and available on IRIS.

The oral RfD for pentachlorophenol is 0.03 mg/kg/day (U.S. EPA, 2004). This value is based on a NOAEL of 3 mg/kg/day with an uncertainty factor of 100 applied. Schwetz et al., (1978) in the only chronic study available, dosed twenty-five rats with 3, 10, and 30 mg/kg/day pentachlorophenol. Females in the highest dose group showed slower weight gain and an increase in specific gravity of urine. Males given 30 mg/kg/day and females given 10 mg/kg/day of the chemical, exhibited liver and kidney pigmentation. As the NOAEL demonstrates, no effects were found with the lowest dose and an uncertainty factor of 100 was applied for intra- and inter-species variability. The Schwetz study is rated with high confidence, due to a moderate number of animals and thorough analysis. In addition, reproductive studies support this data, showing teratogenic and feto-maternal toxicity effects at the 30 mg/kg/day dose but none at the 3 mg/kg/day level. However, as no supporting chronic studies exist, the resulting RfD confidence is medium.

### Derivation of the Oral Cancer Slope Factor

The oral CSF for pentachlorophenol is 0.12 $(mg/kg/day)^{-1}$ (U.S. EPA, 2004). This value is based on two 2-year dietary studies with mice. Tumors were seen in the livers, adrenal, & circulatory systems.

## References

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U.S. EPA. 2004. Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office, Cincinnati, OH.

## PHENANTHRENE

The U.S. EPA has not derived toxicity values for phenanthrene and therefore, the oral RfD for naphthalene was used as a surrogate toxicity value for phenanthrene. The dose-response information is presented in the section on naphthalene.

## POLYNUCLEAR AROMATIC HYDROCARBONS (PAH)

Polynuclear aromatic hydrocarbons (PAH) are a class of related chemicals that are components of petroleum products, coal, and coal tar. They are also formed from the incomplete combustion of fuels. In hazardous waste site investigations, site media are typically analyzed for eighteen PAH. However, U.S. EPA-derived dose-response values are available for only seven of them. There are cancer slope factors for only benzo(a)pyrene (B(a)P) (U.S. EPA, 2004), and there are reference doses for only six PAH (U.S. EPA, 2004). The dose-response assessment for the each noncarcinogenic PAH evaluated in this risk assessment (acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene) is presented separately in this document. The following approach was taken in performing carcinogenic risk assessment for PAH.

For carcinogenic risk assessment, U.S. EPA's comparative potency approach was used to calculate benzo(a)pyrene toxic equivalents (U.S. EPA, 1993). Of the 18 commonly detected PAH, U.S. EPA has classified seven of them as "probable human carcinogens (class B2)." They include: benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(123-cd)pyrene, dibenz(ah)anthracene, and chrysene. However, as mentioned above, U.S. EPA has only derived a cancer slope factor for benzo(a)pyrene. The oral cancer slope factor for B(a)P is 7.3 (mg/kg-day) (U.S. EPA, 2004).

Benzo(a)pyrene is one of the most potent of the potentially carcinogenic PAH in animal experiments. A review of the scientific literature indicates that the other PAH are considerably less potent than B(a)P. To perform carcinogenic risk assessment for the other six potentially carcinogenic PAH, their carcinogenic potency in relation to that of B(a)P must be estimated.

A comparative potency approach was developed in which experimental studies on B(a)P and other PAH were used to derive comparative potency factors that relate the potency of other PAH to B(a)P. Then a properly derived cancer slope factor for B(a)P can be used to estimate the potential cancer risk posed by exposure to a mixture of potentially carcinogenic PAH. The U.S. EPA derived B(a)P Toxic Equivalent Factors (U.S. EPA, 1993) are listed below:

| | |
|---|---|
| · Benzo(a)pyrene | 1.0 |
| · Benzo(a)anthracene | 0.1 |
| · Benzo(b)fluoranthene | 0.1 |
| · Benzo(k)fluoranthene | 0.01 |
| · Chrysene | 0.001 |
| · Dibenzo(a,h)anthracene | 1.0 |
| · Indeno(1,2,3-cd)pyrene | 0.1 |

A possible reservation about using a comparative potency approach for risk assessment of PAH mixtures is that many such mixtures contain more than the 15 PAH on which U.S. EPA has focussed its regulatory attention. Some of these individual PAH when tested for mutagenic or carcinogenic activity in animal and in vitro test systems yield positive results. Data presented in the April, 1988 Interim Final Report (ICF-Clement Associates, 1988) indicate that this concern is not real. The relative potency of 8 naturally occurring complex PAH containing mixtures in a mouse skin tumor assay compared to B(a)P is reported. The mixtures include roofing tar emission extract, coke-oven emission extract, diesel exhaust extract, and others. In all cases, the mixtures were at least 100 fold less potent than B(a)P on a weight basis. This result is consistent with recent findings that the DNA binding potential of B(a)P in mouse skin is lower when present as a complex mixture, such as coal tar, than it is when applied as a pure compound (Schoket et al., 1990).

**Derivation of the Oral Cancer Slope Factor for Benzo(a)pyrene**

The oral CSF for B(a)P (7.3 $(mg/kg\text{-}day)^{-1}$) is the geometric mean of four slope factors derived from two rodent feeding studies: Neal and Rigdon (1967) and Brune *et al.* (1981). In the first study, CFW mice were dosed with B(a)P in their laboratory chow (diet). The diet was prepared by dissolving benzo(a)pyrene in benzene, mixing with wheat flour, evaporating the benzene and mixing the flour-benzo(a)pyrene mixture with laboratory chow pellets. In the second, Sprague Dawley rats were also dosed with B(a)P in their laboratory chow (diet).

Numerous other studies similarly demonstrate that orally administered benzo(a)pyrene can cause gastric tumors in several strains of mice (Collins et al., 1943; Peacock and Kirby, 1944; Nau et al., 1958; Rigdon and Neal, 1966; Federenko and Yanysheva, 1966). Previous studies, however, did not utilize large numbers of animals or multiple doses. Therefore, the study by Neal and Rigdon (1967), which used 608 mice and 10 dose levels, was chosen by the U.S. EPA for quantitative dose-response assessment.

Three of the four values employ the data from the Neal and Rigdon (1967) study. The different values are derived by the use of different mathematical models and assumptions:

1. Conditional upper bound two-stage model with terms for promotion and using historical control data from a related, but not identical, mouse strain (Rabstein et al. 1973);

2. Upper bound estimate using the same data and model as above from the 10% response point to background of the empirically fitted dose-response curve;

3. Generalized Weibull-type model using the data of Neal and Rigdon (1967) but not the historical control data of Rabstein et al. (1973).

The fourth cancer slope factor estimate was made using a toxicity study different from the Neal and Rigdon (1967) study. The linearized multistage model was used to calculate the upper 95% confidence interval on the slope in the low dose region using the data of Brune et al. (1981). In this study, Sprague-Dawley rats were fed B(a)P in their diet. Benign and malignant tumors of the forestomach, larynx, and esophagus were combined for the extrapolation. It is not known how many of the tumors were forestomach tumors versus other tumors of the gastrointestinal tract.

There are several aspects of the Neal and Rigdon study (1967) that have been criticized in the scientific literature. These criticisms are presented to highlight some of the toxicological uncertainties associated with the use of the benzo(a)pyrene cancer slope factor for quantifying incremental excess cancer risk.

Although there are data showing that various PAH containing mixtures cause cancer in humans when they are repeatedly inhaled or come into contact with the skin, there are no studies showing that ingestion of PAH can cause cancer in humans. Furthermore, the database from laboratory experiments is primarily composed of studies of the effects of dermal exposure to PAH and PAH containing mixtures. There are very few well designed ingestion studies in animals with any PAH containing mixture or pure PAH. This is the reason that U.S. EPA's Cancer Slope Factor (CSF) is based on a poorly executed study that has numerous flaws.

In the Neal and Rigdon (1967) study, male and female mice (CFW strain) were repeatedly fed B(a)P in their laboratory chow. The carcinogenic endpoint was forestomach tumors, both benign and malignant. This study is scientifically flawed in several areas. First, the various dose groups were exposed for varying lengths of time. Second, the observation period lasted only one-fifth of a lifetime. Third, the animals were of differing ages at the time of first exposure. Finally, the dosimetry was poor. The exact manner of preparing the diets was not reported. Animals were allowed to eat ad libitum, and the amount of B(a)P consumed was estimated assuming that each mouse consumed 13% of its body weight per day. Thus, in three of its four cancer slope factor estimates, U.S. EPA mathematically manipulated data from a poor animal bioassay that does not conform to the standards of modern toxicology.

The mouse cancer slope factor was translated into a human cancer slope factor by multiplying this value by the cube root of the body weight ratio. This approach is used by U.S. EPA to adjust for species-to-species extrapolation. The factor of $(70/0.12)^{1/3}$ was used to derive the human cancer slope factor of 7.3 $(mg/kg\text{-}day)^{-1}$.

To evaluate noncarcinogenic effects posed by B(a)P and other carcinogenic PAH, the oral RfD for naphthalene was used as a surrogate. The dose-response information is presented in the section on naphthalene.

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**PYRENE**

The oral RfD for pyrene was derived from a 13 week corn oil gavage study in male and female CD-1 mice (U.S. EPA, 1989). The NOAEL was 75 mg/kg-day. The LOAEL was 125 mg/kg-day. Kidney effects, such as renal tubular pathology and decreased kidney weights, were seen at the LOAEL. The kidney lesions were described as minimal or mild in all dose groups. The RfD is reported as 0.03 mg/kg-day (U.S. EPA 2004). This was derived by applying an uncertainty factor of 3000 to the NOAEL. The factor of 1000 results for applying factors of 10 each for intraspecies, interspecies, and subchronic to chronic extrapolation. U.S. EPA reports that the extra uncertainty factor of 3 was used to account for lack of reproductive and developmental data and lack of adequate toxicity data in a second species.

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**2,3,7,8-TCDD**

2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) and related polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) have been the subject of intensive scientific investigation to determine the health effects that may result from exposure and the physiological mechanism(s) by which they occur. These investigations by researchers employed in academic institutions, industry, and government agencies have resulted in a scientific consensus that a receptor-mediated mechanism is responsible for the effects of exposures to PCDDs and PCDFs.

2,3,7,8-TCDD is formed as an unintentional by-product of incomplete combustion. It may be released to the environment during the combustion of fossil fuels and wood, and during the incineration of municipal and industrial wastes. It causes chloracne in humans, a severe acne-like condition. It is known to be a developmental toxicant in animals, causing skeletal deformities, kidney defects, and weakened immune responses in the offspring of animals exposed to 2,3,7,8-TCDD during pregnancy. Human studies have shown an association between 2,3,7,8-TCDD and soft-tissue sarcomas, lymphomas, and stomach carcinomas. EPA has classified 2,3,7,8- TCDD as a probable human carcinogen (Group B2).

PCDDs and PCDFs or "dioxins" refer to a class of 210 different compounds. Of those, 75 are known as dioxins and the remainder are dibenzofurans. The toxicity of the different PCDD and PCDF isomers varies widely. However, much of the available research has used the 2, 3, 7, 8-tetrachlorodibenzo-p-dioxin isomer. While 2,3,7,8-TCDD appears to be the most toxic of the isomers, its mechanism of action is likely to be similar to that of the other isomers and congeners; therefore it is an appropriate model compound for studying the whole class. EPA has proposed the concept of toxic equivalency factors to facilitate risk assessments and regulatory control of exposure to mixtures of dioxin and recently proposed the adoption of the TEFs proposed by the World Health Organization (WHO) (U.S., EPA 2003).

**Derivation of Reference Dose**

Chloracne is reported as the major effect seen from chronic (long-term) exposure to 2,3,7,8-TCDD in humans. Animal studies have reported hair loss, loss of body weight, and a weakened immune system from oral exposure to 2,3,7,8-TCDD. EPA has not established a RfD for 2,3,7,8-TCDD.

**Derivation of Cancer Slope Factors**

Human studies, primarily of workers occupationally exposed to 2,3,7,8-TCDD by inhalation, have found an association between 2,3,7,8-TCDD and lung cancer, soft-tissue sarcomas, lymphomas, and stomach carcinomas, although for malignant lymphomas, the increase in risk is not consistent.

EPA has classified 2,3,7,8-TCDD as a Group B2; probable human carcinogen. EPA has calculated an inhalation cancer slope factor of $1.5 \times 10^5$ (mg/kg/d)-1 and an inhalation unit risk estimate of 3.3 x 10-5 (pg/m3)-1 for 2,3,7,8-TCDD. No information is available on the carcinogenic effects of 2,3,7,8-TCDD in animals following inhalation exposure.

EPA has calculated an oral cancer slope factor of $1.5 \times 10^5$ (mg/kg/d)-1 and an oral unit risk factor of 4.5 (µg/L)-1 for 2,3,7,8-TCDD. Animal studies have reported tumors of the liver, lung, tongue, thyroid, and nasal turbinates from oral exposure to 2,3,7,8-TCDD.

**References**


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**Appendix C**

**Absorption Adjustment Factors (AAFs) For Dermal Absorption of Polynuclear Aromatic Hydrocarbons In Soil And Sediment**

## ABSORPTION ADJUSTMENT FACTORS (AAFS) FOR DERMAL AND ORAL ABSORPTION OF POLYNUCLEAR AROMATIC HYDROCARBONS IN SOIL AND SEDIMENT

To estimate the potential risk to human health that may be posed by the presence of compounds in various environmental media (such as soil, sediment, water or air), it is first necessary to estimate the human exposure dose of each compound. The exposure dose is similar to the administered dose or applied dose of a laboratory experiment. The exposure dose is then combined with an estimate of the toxicity of the compound to produce an estimate of risk posed to human health.

The estimate of toxicity of a compound, termed the dose-response value, can be derived from human epidemiological data, but it is most often derived from experiments with laboratory animals. The dose-response value can be calculated based on the administered dose of the compound (similar to the human potential dose) or, when data are available, based on the absorbed dose, or internal dose, of the compound.

In animals, as in humans, the administered dose of a compound is not necessarily completely absorbed. Moreover, differences in absorption exist between laboratory animals and humans, as well as between different media and routes of exposure. Therefore, it is not always appropriate to directly apply a dose-response value to the human potential dose. In many cases, a correction factor in the calculation of risk is needed to account for differences between absorption in the dose-response study and absorption likely to occur upon human exposure to a compound. Without such a correction, the estimate of human health risk could be over- or under-estimated.

This correction factor is termed the absorption adjustment factor, or AAF. The AAF is used to adjust the human potential dose so that it is expressed in the same terms as the doses used to generate the dose-response curve in the dose-response study. The AAF is the ratio between the estimated human absorption factor for the specific medium and route of exposure, and the known or estimated absorption factor for the laboratory study from which the dose-response value was derived.

AAF = (fraction absorbed in humans for the environmental exposure)/
(fraction absorbed in the dose-response study).

The use of an AAF allows the risk assessor to make appropriate adjustments if the efficiency of absorption between environmental exposure and experimental exposure is known or expected to differ because of physiological effects and/or matrix or vehicle effects. Absorption adjustment factors can be less than one or greater than one, depending on the particular circumstances at hand. If it is thought that absorption from the site-specific exposure is the same as absorption in the laboratory study, then the AAF is 1.0.

AMEC has summarized the route of exposure and the experimental matrix (diet, drinking water, corn oil gavage, etc.) used in the experimental study from which the relevant dose-response value was derived for each PAH compound. In addition, AMEC has reviewed scientific literature on the absorption and bioavailability of PAHs for the relevant routes of exposure and matrices. Based on these data, AMEC has derived a scientifically defensible AAF for each relevant chemical/route/medium situation.

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**Absorption of PAHs From the Dose-Response Studies**

Absorption was not measured in the laboratory studies used to develop toxicity factors. Therefore, it was necessary to identify the dosing methods used in the toxicity reference studies and then to look to other studies of the absorption of PAHs for those particular methods.

Potentially carcinogenic PAHs are routinely evaluated using the comparative potency approach described in U.S. U.S. EPA (1993). With this approach, all potentially carcinogenic PAHs are assessed in terms of their benzo(a)pyrene toxic equivalent concentrations, and U.S. U.S. EPA's cancer slope factor for benzo(a)pyrene is used.

The risk assessment of potentially carcinogenic PAHs is performed using the oral cancer slope factor (CSF) for benzo(a)pyrene (B(a)P). The oral CSF for B(a)P (7.3 $(mg/kg\text{-}day)^{-1}$) is the geometric mean of four slope factors derived from two rodent feeding studies: Neal and Rigdon (1967) and Brune *et al.* (1981). In the first study, CFW mice were dosed with B(a)P in their laboratory chow (diet). The diet was prepared by dissolving benzo(a)pyrene in benzene, mixing with wheat flour, evaporating the benzene and mixing the flour-benzo(a)pyrene mixture with laboratory chow pellets. In the second, Sprague Dawley rats were also dosed with B(a)P in their laboratory chow (diet).

The oral RfD for anthracene was derived from a 90 day corn oil gavage study in male and female CD-1 (ICR) BR mice. The mice were given 250 to 1000 mg/kg-day for at least 90 days. The RfD is reported as 0.3 mg/kg-day (U.S. U.S. EPA 1999).

The oral RfD for fluoranthene was derived from a 13 week corn oil gavage study in male and female CD-1 mice. The mice were given 125 to 500 mg/kg-day. The RfD is reported as 0.04 mg/kg-day (U.S. EPA 1999).

The oral RfD for fluorene was derived from a 13 week corn oil gavage study in mice. The mice were given 125 to 250 mg/kg-day. The RfD is reported as 0.04 mg/kg-day (U.S. EPA 1999).

The oral RfD for pyrene was derived from a 13 week corn oil gavage study in male and female CD-1 mice. The mice were given 75 to 250 mg/kg-day. The RfD is reported as 0.03 mg/kg-day (U.S. EPA 1999).

The oral RfD for naphthalene was derived from a 13 week corn oil gavage study in rats (NTP, 1980). The rats were given 25 to 400 mg/kg-day. The RfD is reported as 0.02 mg/kg-day (U.S. EPA 1999).

Thus, studies of dosing by diet and gavage are of interest in determining the absorption relevant to PAH toxicity factors.

Absorption of B(a)P and other PAHs from food has been shown to be high in both humans and rodents by several researchers. Many articles on absorption were reviewed. However, studies that used inappropriate scientific methods were rejected for AAF derivation. For instance, studies that measured total radiolabel in the feces do not yield useful absorption information, because B(a)P metabolites are known to be excreted into bile (see, for instance, Chipman *et al.*, 1981a, 1981b; Bowes and Renwick, 1986) and therefore absorbed material would also appear in the feces.

As an example, data are presented in a paper by Chang (1943) on fecal excretion of benzo(a)pyrene and other PAHs. This paper cannot be used to estimate gastrointestinal absorption of PAH, because the gravimetric analytical method used is nonspecific and does not distinguish between unchanged PAHs and PAH metabolites. A paper by Flesher and Syndor (1960) is also deficient for AAF derivation, because total tritium is measured in feces after oral dosing of rats with $^{3}$H-3-methylcholanthrene. This method does not distinguish between unabsorbed PAHs and absorbed and metabolized PAHs excreted into the bile and feces.

Other studies are not useful because they only define a small fraction of a PAHs total disposition. For instance, in a study by Rees *et al.* (1971), benzo(a)pyrene was given to rats by stomach tube and the PAH was measured in the lymphatic duct. While the presence of B(a)P in the lymph indicates that absorption occurred, the experiment is not quantitative. Similarly, Foth *et al.* (1988) measured benzo(a)pyrene absorption in the rat after a continuous infusion into the duodenum by measuring B(a)P in the atrial blood and bile. In this case, the conditions of the experiment are unnatural, and the experiment does not account for a total mass balance of B(a)P. Other studies were rejected for similar reasons. The following principal studies are those in which useful absorption quantitative information can be determined.

*Hecht et al. (1979)*

Hecht and coworkers (Hecht *et al.,* 1979) fed B(a)P to both humans and F-344 rats and measured the unchanged B(a)P in the feces to obtain an estimate of the amount of the compound absorbed. Because unchanged B(a)P in the feces can be due to absorbed material that is excreted unchanged in the bile, these studies reveal the minimum amount of B(a)P that was absorbed. It is known, however, that B(a)P is extensively metabolized, so that the potential underestimate of absorption caused by biliary excretion of B(a)P is minor. Thus, these estimates of absorption are valid for AAF derivation.

For rats, at least 87% of B(a)P was absorbed from a low single dose in peanut oil (0.037 mg/kg). Minimum absorption from medium and high doses (0.37 mg/kg and 3.7 mg/kg) were 92.2% and 94.4%. The mean absorption of B(a)P in peanut oil in rats was 91.2% (n=30). This value was used in AAF derivation.

When rats were fed a single dose of charcoal-broiled hamburger containing B(a)P (0.002 mg/kg body weight), at least 89% was absorbed (n=10). In humans, a high percentage of B(a)P present in charcoal-broiled meat was also absorbed (0.0001 mg/kg body weight, assuming 70 kg), because no unchanged B(a)P was detected in the feces. Assuming that B(a)P was present in feces at 1/2 the detection limit, the minimal absorption is 98.8% (n=8). This study indicates that there is no significant difference in absorption between two dietary vehicles in rats. That is, absorption of B(a)P from peanut oil and meat was essentially the same. The results with rats and humans also indicate that there is no major difference in the gastrointestinal absorption of B(a)P between rats and humans when administered in food items. Both of the above values were used in AAF derivation.

*Mirvish et al. (1981)*

Mirvish and co-workers (Mirvish *et al.*, 1981) fed B(a)P to Syrian golden hamsters in their diets and measured the amount of unmetabolized B(a)P in their feces to determine the efficiency of absorption from the gastrointestinal tract. In method I, a B(a)P solution in 150 ml acetone was pipetted onto 1 kg pelleted diet contained in a glass bottle, with occasional gentle shaking. The pellets were dried overnight on trays. This method of preparing a B[a]P-containing diet is the same as the method used in the Neal and Rigdon (1967) study from which the cancer slope factor was derived. In Method II, B(a)P was dissolved in corn oil, and the corn oil was added to a commercial rodent chow. Animals were treated with B(a)P in the diet for 7 to 10 days before samples were collected to give adequate time to reach steady-state PAH concentrations in the feces and gastrointestinal tract contents.

The percentage of fecal excretion of unchanged B(a)P remained relatively constant (94.3% to 98.0%) as its concentration in commercial diet was varied over a wide range (0.16 mg/kg to 5.5 mg/kg). Absorption efficiency was not dose-dependent. The minimal gastrointestinal absorption of B(a)P was found to be 96.7% for the commercial chow using preparation method I (average of results from seven experiments at different dose levels; eleven animal groups, each containing 3-5 hamsters) or 98% for the commercial chow using preparation method II (one experiment; four animal groups, each containing 3-5 hamsters, 1.6 mg/kg). These two values (96.7% and 98%) were used in AAF derivation.

3-methyl cholanthrene (3-MC) absorption was also studied in hamsters. 3-MC (1.7 mg/kg) was dissolved in corn oil and added to a semisynthetic diet consisting of corn oil, corn starch, vitamin-free casein, and alphacel. Minimum gastrointestinal absorption was found to be 93.8% in four animal groups containing 3-5 hamsters each. This value is also used in AAF derivation.

Other experiments demonstrated that B(a)P was absorbed slightly more efficiently from semisynthetic diets than from commercial rodent diets. Addition of corn oil to the hamsters' semisynthetic diets had little effect on the fecal excretion of unchanged B(a)P, and thus its gastrointestinal absorption. Addition of bran to the semisynthetic diets caused a slight lowering of gastrointestinal absorption.

*Rabache et al. (1985)*

Rabache and co-workers (Rabache *et al.*, 1985) fed B(a)P to male Wistar rats in their diets for 22 days and measured the amount of unmetabolized B(a)P in their feces to determine the efficiency of absorption from the gastrointestinal tract. B(a)P was dissolved in soy oil and mixed with the synthetic ration, which was comprised of 10% soy oil. Young rats were given 1 g B(a)P/kg body weight, and adult rats were given 5 g/kg. The minimal gastrointestinal absorption of B(a)P was found to be 88.7% for young rats (n=8) and 99.6% for adult rats (n=12). Both of these values are used in AAF derivation.

*Withey et al. (1991)*

Withey and co-workers (Withey *et al.*, 1991) administered pyrene by stomach tube to male Wistar rats in an aqueous emulsion and measured the amount of C-14 radiolabel in the blood over time to make an estimate of the traditional pharmacokinetic parameter "bioavailability". A single dose of pyrene was given to 4 groups of six animals at a concentration ranging from 4-15 mg/kg as a solution in 20% Emulphor/80% physiological saline. Radiolabeled pyrene was also given intravenously for comparison. "Bioavailability" was defined as the area of the blood level-time curve of radiolabel over a specified time period after oral dosing (0-8 hours) divided by the corresponding area of the curve for intravenous dosing.

"Bioavailability" was found to vary from 65% to 84% depending on dose level. This pharmacokinetic parameter has its basis in classical drug studies where the circulating blood level of the parent (unmetabolized) drug is of primary interest. However, this parameter does not provide an optimal estimate of a chemical's gastrointestinal absorption, because the fraction of the chemical or its metabolites that leaves the blood and distributes to tissues is not properly counted.

For this reason, the urinary excretion data over 6 days were also used to derive an estimate of absorption for each group. Absorption was estimated as the fraction of total radiolabel excreted in the urine after oral dosing divided by the fraction excreted after intravenous dosing. Because the fraction excreted in the urine at day 6 post-dosing was slightly higher at every dose level for oral dosing compared to intravenous dosing, the estimates of gastrointestinal absorption are 100% for all four dose groups.

For each dose group, the blood level estimate of "bioavailability" was averaged with the urinary estimate of gastrointestinal absorption to derive an estimate of gastrointestinal absorption. These estimates are: 92%, 82.5%, 86.5%, and 87% for doses ranging from 4-15 mg/kg. The average of these four estimates (87%) is used in AAF derivation.

*Grimmer et al. (1988)*

Grimmer and co-workers (Grimmer *et al.*, 1988) administered chrysene by stomach tube to unfasted male Wistar rats in a solution of 33% dimethylsulfoxide and 66% corn oil. Eight rats weighing 200-250 grams received a single dose of 50 ug chrysene. Assuming an average weight of 225 g, the dose was 0.22 mg/kg. Feces and urine were collected for four days. Unchanged chrysene and specific metabolites were analyzed. The fraction of the unchanged chrysene in the feces was determined. This serves as an estimate of minimal gastrointestinal absorption. Average absorption for the eight rats was 86.9%. This value was used in AAF derivation.

*Bartosek et al. (1984)*

Bartosek and co-workers (Bartosek *et al.*, 1984) administered benz(a)anthracene, chrysene, or triphenylene to female CD-COBS rats by stomach tube in an aqueous emulsion of 10% Pluronic F68 emulsifier and 90% olive oil. Animals were fasted for 24 hours prior to being given a single oral dose of the PAHs. Each group consisted of 3-5 rats weighing 150-170 g. PAHs were given at single doses of 11.4 and 22.8 mg/ animal, which corresponds to 71.3 mg/kg and 142.5 mg/kg, assuming an average weight of 160 g. Rats were allowed access for food 3 hours after dosing. The fraction of administered dose of the unchanged PAHs recovered in the feces after 72 hours was taken as an estimate of the minimal absorption. Results were 94% for benz(a)anthracene, 75% for chrysene, and 97% for triphenylene. These three values were used in AAF derivation.

**Summary of Absorption Data for Exposure Methods used in the Dose-Response Studies**

The data presented above and summarized in Table 1, indicate that, although there is some variability in the absorption of various PAHs, no consistent trend is apparent that would lead one to conclude that absorption of one PAH differs significantly from another when administered in the ways used to derive dose-response data. In addition, the data show that gastrointestinal absorption of PAHs is relatively high, whether given in oil vehicles or in the diet. Accordingly, all of the data from the dose-response studies from which the cancer slope factor for B(a)P and the RfDs for various noncarcinogenic PAHs were derived, were merged to derive an absorption estimate for all PAHs of interest. The resulting estimate of gastrointestinal absorption of PAHs is 92%.

However, each data point in a study was not given equal weight in deriving the final estimate of oral absorption in the dose-response studies. For instance, in the Mirvish *et al.* study the 96.7% value represents the average of results from seven experiments at different dose levels. There were eleven animal groups, each containing 3-5 hamsters. Thus, this value represents experiments with 33-55 animals. The 98% value represents one experiment at one dose group. There were four animal groups, each containing 3-5 hamsters. Thus, this data point represents 12-20 animals. There are many ways to summarize such a large and diverse set of experimental results. Table 2, however, demonstrates that the resulting estimate of absorption in the PAH dose-response studies is not particularly sensitive to the manner of summarizing the available data.

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**TABLE 1**
**SUMMARY OF ABSORPTION DATA FOR PAH DOSE-RESPONSE STUDIES**

| Value | Citation | Animal | PAH | Vehicle |
|---|---|---|---|---|
| 91.2% | Hecht | male F344 rats | B(a)P | Peanut oil (single dose) |
| 89% | Hecht | male F344 rats | B(a)P | Char-broiled hamburger (single dose) |
| 98.8% | Hecht | Humans | B(a)P | Char-broiled hamburger (single dose) |
| 88.7% | Rabache | young male Wistar rats | B(a)P | Synthetic diet + soy oil (22 days) |
| 99.6% | Rabache | adult male Wistar rats | B(a)P | Synthetic diet + soy oil (22 days) |
| 96.7% | Mirvish | male Syrian golden hamsters | B(a)P | Commercial Diet Method I (7-10 days) |
| 98.0% | Mirvish | male Syrian golden hamsters | B(a)P | Corn oil + commercial diet Method II (7-10 days) |
| 87% | Withey | male Wistar rats | pyrene | 20% Emulphor/ 80% saline (single dose) |
| 86.9% | Grimmer | male Wistar rats | chrysene | 33% DMSO/ 66% corn oil (single dose) |
| 94% | Bartosek | female CD-COBS rats | B(a)A | 10% emulsifier/ 90% olive oil (single dose) |
| 75% | Bartosek | female CD-COBS rats | chrysene | 10% emulsifier/ 90% olive oil (single dose) |
| 97% | Bartosek | female CD-COBS rats | triphenylene | 10% emulsifier/ 90% olive oil (single dose) |
| 93.8% | Mirvish | male Syrian golden hamsters | 3-methyl cholanthrene | Corn oil + semisynthetic diet (7-10 days) |

**Table 2**
**METHODS OF SUMMARIZING PAH GASTROINTESTINAL ABSORPTION DATA**

| Method Used | # Data Points | Average Absorption |
|---|---|---|
| Each experiment within a study used as a single data point* | 13 | 92.0% |
| Each result presented in each study used as a single data point | 24 | 92.1% |
| Each result presented in each B(a)P study used as a single data point | 15 | 95.0% |
| Each study represented as a single data point | 7 | 90.9% |
| Each B(a)P study represented as a single data point | 3 | 94.4% |

* Method used in this AAF derivation.

**Derivation of Oral-Soil AAF for PAHs**

Four studies were identified in which the gastrointestinal absorption of PAHs was measured from a soil matrix. These include Goon *et al.* (1991), Weyand *et al.* (1996), Magee, et al. (1999) and Koganti, et al (1998). Each of these studies is discussed below. Each of these studies used exposure methods similar to those employed in the dose-response investigations (feeding or gavage) and, additionally, had their own internal controls. Therefore, AAFs may be calculated directly from the work, without use of fractional absorption observations noted in the studies described previously.

*Weyand et al. (1996)*

Weyand *et al.* (1996) studied the bioavailability of pyrene from manufactured gas plant (MGP) residue (coal tar) by comparing the urinary pyrene metabolite levels in animals receiving pyrene as methylene chloride extracts of MGP contaminated soil in their diet to animals receiving pyrene as MGP contaminated soil in their diet. The two contaminated soil samples were aged soils from MGP sites. They were sieved to a particle size range of less than or equal to 0.150 mm. Soil was added to powder diets from PMI Feeds, Inc. (rodent laboratory diet #5001) (20% soil / 80% powder diet). MGP contaminated soil extracts were added to gel diets from Bio-Serv (rodent basal gel diet) so that the same amount of pyrene was present as in the soil/diet groups. Groups of female $B_6C_3F_1$ mice were fed soil or organic extract for 14 days. Urine was collected on day 14. The level of pyrene metabolites (1-hydroxypyrene, 1-hydroxypyrene glucuronide conjugates, and 1-hydroxypyrene sulfate conjugates) were determined by HPLC using fluorescence detection (Singh *et al.*, 1995).

"Fractional urinary excretion" is defined as the amount of pyrene excreted in the urine over 24 hours on day 15 divided by the amount of pyrene ingested on day 15 x 100. The amount of pyrene excreted into the urine is not, itself, a direct measure of total absorption of pyrene from the diet, because PAHs are efficiently excreted into the feces via the biliary system. However, the level of pyrene and its metabolites in urine on day 15 gives a measure of the steady state level of pyrene excretion.

As shown in Table 3, the "fractional urinary excretion" of pyrene from soil #1 was 6.2% and from soil #2 was 1.7%. The "fractional urinary excretion" of pyrene from the organic extract of soil #1 was 17.2% and from soil #2 was 16.1%.

The ratio of "fractional urinary excretion" from MGP contaminated soil to "fractional urinary excretion" from an extract of MGP contaminated soil added to diet is a direct estimate of the oral-soil AAF. It is a measure of the degree to which the presence of soil increases or decreases the absorption of pyrene from the diet. The AAF from soil #1 was 36% (6.2%/17.2% x 100).

**Table 3**
**PYRENE URINARY METABOLITES**
**SOIL VS ORGANIC EXTRACT OF SOIL**
**(WEYAND *ET AL.*, 1996)**

| Diet | [a]Pyrene Ingested (µg/mouse) | [b]Pyrene Excreted (µg/mouse) | [c]Fractional Urinary Excretion |
|---|---|---|---|
| Extracted Soil #1 | 0 | 0 | ND |
| Extracted Soil #2 | 0 | 0 | ND |
| Soil #1 | 0.60 | 0.039 | 6.2 |
| Soil #2 | 30.42 | 0.527 | 1.7 |
| Organic Extract #1 | 0.56 | 0.097 | 17.2 |
| Organic Extract #2 | 25.91 | 4.16 | 16.1 |

[a]The sum of 1-OH P-GlcUA, 1-OH P-Sul, and 1-OH P levels is expressed in terms of equivalents of pyrene.
[b]The amount of soil and pyrene consumed in metabolism cages on day 15 over a period of 24 hr.
[c]Fractional Urinary Excretion = (amount of pyrene excreted / amount of pyrene consumed on day 15) x 100. (The authors termed this "bioavailability." Because this is a nonstandard use of the term, it is renamed here.)

Note: Soil #1: 1 ppm pyrene; 9 ppm total PAHs; Soil #2: 35 ppm pyrene; 377 ppm total PAHs.

The AAF from soil #2 was 11% (1.7%/16.1% x 100). This study clearly shows that pyrene in aged soil is absorbed in the gastrointestinal tract to a lesser degree than is pyrene added to rodent food as an organic extract.

DNA adducts in lung tissue were also measured for soil #2 (246 cPAH) and its organic extract, and the resulting AAF, which is relevant to potentially carcinogenic PAHs, is 0.17.

*Koganti, et al. (1998)*

Koganti, et al (1998), is another study by workers in Weyand's laboratory and the methods described above were also used here. In this case, soils and soil extracts from three MGP sites were fed to female mice. However, in contrast to earlier work from this laboratory, two measurements of systemic absorption of PAHs were used. The first method was equivalent to that described for earlier studies: measurement of urinary metabolites of pyrene. The second method was the quantitative measurement of covalent binding of PAH metabolites to DNA of lung tissue (DNA adducts). This is of interest because the measurements may address the absorption of two different groups of PAHs. Pyrene is a low molecular weight PAH with less affinity for soil sorption than higher molecular weight PAHs, such as B(a)P. Thus, the pyrene metabolite measurements may relate specifically to low molecular weight PAHs and might be hypothesized to be more available for absorption from a soil matrix than higher molecular weight compounds. DNA adduct measurement may be indicative of the absorption of high molecular weight PAHs and may be used to evaluate comparative absorption of high molecular weight PAHs, if combined with the appropriate measure of PAH dosing.

Koganti, et al (1998) fed mice (four in each dosing group) with a mixture of soil and feed or organic extract or soil plus feed at three to four different nominal concentrations. AAFs were calculated based on the ratio of fractional urinary excretion (described in the discussion of the Weyand, 1996 report) observed between animals fed soils and those fed organic extract of the soil. The results of this evaluation are shown in Table 4 of Koganti, et al (1998). Although Koganti, et al (1996) used a soil or extract addition to make up several different final concentrations of PAHs in the feed, no trend in fractional absorption with concentration was observed. Therefore, all AAFs calculated in this report were used separately and are included in the AAF summary table for pyrene metabolites of this report (Table 7).

In addition to measurement of pyrene metabolites in urine, Koganti, et al (1998) quantified DNA adducts. Adducts were measured in only one large organ (lung) and do not fully capture total adduct mass in the animal. However, Koganti, et al (1998) used a ratio approach to calculate the "fractional lung adduct" as a proportion of the total exposure to PAH (mg PAH per mouse). The ratio of fractional lung adduct in mice fed to that observed in mice fed organic extract is a means of calculating AAFs that is identical to the fractional urinary excretion method described above. Koganti, et al (1998) expressed the opinion that only higher molecular weight PAH generally believed to be rodent or human carcinogens were responsible for DNA adduct formation. Therefore, they normalized fractional lung adducts based on the total exposure of each mouse to "carcinogenic PAH" (cPAH). As such, the AAFs calculated from DNA adduct quantification (these appear in Table 5 of Koganti, et al (1998)) may be specifically relevant to high molecular weight, potentially carcinogenic PAH. These AAFs are summarized in a separate table in this report, along with other AAFs that may also be specifically relevant to cPAH (Table 8). As with previously-described observations using pyrene metabolites, Koganti, et al (1998) discern no association of AAF with the concentration of cPAH administered, so Table 8 contains all AAF calculations.

*Goon et al. (1991)*

Goon, *et al.* (1991) studied the bioavailability of a specific PAH, benzo(a)pyrene, administered orally as the pure chemical or as B(a)P adsorbed onto soil particles. Additional information about the study was obtained directly from the authors (Goon et al., 1996) and an analysis of the work of Goon and co-workers has been published (Magee, et al, 1996)Male Sprague-Dawley rats were gavaged with B(a)P mixed with $^{14}$C-B(a)P in solution [0.5% Tween 80 (v/v in saline)] (1.0 µmol B(a)P/kg, 25 µCi/kg) or the equivalent dose adsorbed onto a clay-based soil or a sand-based soil. The soils consisted of 2.5 g solid/kg containing 100 mg/kg B(a)P. All animals received 7.5 mL of 0.5% Tween 80 (v/v in saline).

Venous blood samples were collected from the retro-orbital plexus at predetermined times (0.5, 1, 2, 4, 8, 12, 24, 48, 72, 96, 120, 144, and 168 hours), and excreta were collected continuously over 24-hour intervals. After 168 hours, animals were euthanized and tissues collected for analysis. Total radioactivity was measured by liquid scintillation in blood, urine, feces, and tissues.

The sandy soil was classified as a loam which was very low in organic content, 0.04%. It contained 47% sand, 41% silt, and 12% clay. The pH was 6.5, and the cation exchange content was 0.6 meq/100 g. The clay-based soil was classified as a clay with low organic content, 1.35%. It contained 6% sand, 18% silt, and 76% clay. The pH was 7.0 and the cation exchange content was 45.65 meq/100 g. The sandy soil was ground and sonic sifted. The clay-based soil was dried and passed through a Brickman ultra-centrifugal mill. In both cases, the particles size was small, <100 um. Both soils were washed twice with methylene chloride and dried before use. This destroyed any microbial activity that may have existed in the soils.

B(a)P and $^{14}$C-B(a)P were added in acetone to soils. The acetone was evaporated, leaving soils that were 100 ppm in B(a)P and 10 uCi/g in radiolabel. Animals were administered the soil-adsorbed B(a)P at various time intervals after the soil and the B(a)P were mixed: 1 day, 7 days, 30 days, 6 months and one year. Animals were fasted for 12 hours prior to dosing. Two hours after dosing, Purina Rodent Chow 5001 and water were available *ad libitum*.

In this experiment, three dosing vehicles were prepared that contained radiolabeled B[a]P: emulsified aqueous solution, sandy soil, and clayey soil. Male Sprague Dawley rats were gavaged with the three vehicles and followed for seven days. Blood, urine, and feces were measured at numerous time points for seven days. After seven days, the animals were sacrificed, and more than ten tissues were analyzed for radiolabel. Animals received equal doses of B[a]P regardless of dosing group. After the initial experiment, the same vehicles were administered to different animals after seven days, one month, six months, and one year. Recoveries for these experiments were reasonable:

Solution: 76%
Sandy Soil: 102%
Clayey Soil: 105%

After normalizing to each animal's individual total recovery, the data were summarized and AAFs were derived by comparing the fractional seven-day urinary excretion to that in the solution group and by comparing the seven day blood area-under-the-curve to that in the solution group (see Table 4). Because the reanalysis of the 1990 experiment showed that there was no difference between the solution and diet groups, no normalization of the results of the solution groups was deemed necessary to create AAFs that are directly relevant to use with the cancer slope factor, which was derived from dietary studies.

**TABLE 4**
**SUMMARY OF AAFS FROM GOON et al. (1991) REANALYSIS**

| | Urinary AAF | Urinary AAF | Blood AUC AAF | Blood AUC AAF |
|---|---|---|---|---|
| **Ageing Period** | **Sandy Soil** | **Clayey Soil** | **Sandy Soil** | **Clayey Soil** |
| One Day | 0.47 | 0.40 | 0.43 | 0.35 |
| Seven Days | 0.46 | 0.52 | 0.49 | 0.38 |
| One Month | 0.56 | 0.40 | 0.45 | 0.36 |
| Six Months | 0.48 | 0.33 | 0.37 | 0.22 |
| One Year | 0.50 | 0.26 | 0.40 | 0.24 |

For site aged sandy soil the AAF based on the blood AUC data is 0.39. The AAF based on urinary data is 0.49. These values are the averages of the six month and one year experiments.

For site aged clayey soil the AAF based on the blood AUC data is 0.23. The AAF based on urinary data is 0.30. These values are the averages of the six month and one year experiments.

One way to measure relative bioavailability is to compare the area under the blood curve (AUC) for total radiolabel over the entire 168 hour experimental period during which blood B(a)P levels were measured. Radiolabel in the blood represents a fraction the B(a)P that was absorbed in the gastrointestinal tract, including parent B(a)P and metabolites.

The use of AUC measurements is a classic approach in drug pharmacology where systemic bioavailability is defined as the blood AUC after an intravenous dose divided by the AUC after an oral dose. In the case of drugs, the amount of parent drug circulating in the blood over a long period of time is of primary interest, because, in most cases, first pass metabolism of the drug in the liver reduces the drug efficacy. Metabolites are inactive and are excreted. Thus, total blood levels of parent drug is of greater interest than is drug plus metabolites.

This same concern is not relevant for the risk assessment of PAHs, such as B(a)P, because B(a)P is not direct acting. No toxic effects are manifested by the parent, unmetabolized B(a)P. Instead, metabolism is required for toxicity. It is the metabolites of B(a)P and other PAH that bind to cellular macromolecules, such as DNA, and cause adverse effects in various tissues. Metabolism of PAHs occurs in all tissues, and orally administered B(a)P has caused tumors in laboratory animals in various tissues, including stomach, lung, esophagus, larynx, and others. B(a)P metabolism is also multistepped. In order for the B(a)P diol epoxide, the putative mutagenic metabolite, to be formed, several metabolic conversions involving several enzymes must occur.

Thus, in some cases the toxic metabolite in a distant tissue, such as the lung, is caused by a B(a)P molecule that was absorbed through the gastrointestinal tract, was *not* metabolized in the liver, circulated through the blood, and was metabolized in several steps in the lung. In other cases, the toxic lung metabolite was formed by a molecule that was absorbed though the gastrointestinal tract, was metabolized to an intermediate metabolite in the liver, and circulated through the blood as a B(a)P metabolite, and was metabolized several more times in the lung to a toxic metabolite.

In addition, B(a)P and B(a)P metabolites excreted in the bile are known to be reabsorbed in the gastrointestinal tract by a process known as enterohepatic recirculation (Chipman et al., 1981). Thus, some B(a)P metabolites are known to be excreted into the bile and the gastrointestinal tract. When present in the gastrointestinal tract parent B(a)P can be reabsorbed. In addition, conjugated metabolites, such as glucuronide, sulfate, and glutathione metabolites can be de-conjugated by enzymes residing in bacteria present naturally in the gastrointestinal tract. After de-conjugation, the primary metabolite can and is reabsorbed. After reabsorption, it can travel to a distant tissue via the systemic circulation and cause damage.

Thus, for B(a)P and other PAHs, the circulating blood level of just the parent compound is not a relevant dose metric. Instead, the total B(a)P dose including parent B(a)P and metabolites is the critical parameter to measure. This is because some metabolites are directly toxic to distant tissues, some metabolites are metabolic precursors of secondary metabolites that are toxic to distant tissues and can be formed therein, and some metabolites can be excreted and reabsorbed and can later cause damage in distant tissues, including the gastrointestinal tract itself.

While the total blood radiolabel AUC from 0-168 hours does not define the fraction of the administered B(a)P that was absorbed in an animal or a treatment group, the ratio of AUC measurements for two treatment groups administered the B(a)P by the same route of exposure in an excellent measure of *relative* bioavailability between the two treatment groups.

AMEC notes that the two soils studied were very low in organic content (0.04% and 1.35%). Certainly, the value for sandy soil is much lower than a typical soil. For instance, in its Risk Based Corrective Action guidance, the ATSM assumes 1% as a default value for typical soils. Accordingly, the AAF for clay-based soil is probably more typical of average soils than the AAF for sandy soil.

*Goon et al. (1990)*

In an earlier experiment, Goon et al. (1990) studied the bioavailability of B(a)P in aqueous solution, in laboratory chow, in unaged sandy soil and in unaged clay-based soil. Additional information was obtained directly from the authors (Goon et al., 1996). The study was performed in the same manner as the one described above with the exception that 4 male rats and 4 female rats were placed in each of four study groups, including rodent chow.

AMEC rejected the data from the Goon et al. (1990) study for AAF derivation and relied solely on the 1991 experiment because of low recovery and high variability.

After dosing, urine, feces, and blood were analyzed for seven days. Then, at the end of seven days, the animals were sacrificed, and all tissues were analyzed. Total recovery of B[a]P was calculated by comparing the amount recovered to the amount administered. Recoveries of total B[a]P were generally poor in all treatment groups in the 1990 study:

| | |
|---|---|
| Solution | 75% |
| Diet | 62% |
| Sand | 65% |
| Clay | 48% |

It is not known what the cause of the poor recoveries was, but such poor recovery of administered dose is reason enough to reject this study from AAF derivation.

However, for the sake of completeness AMEC summarized the tissue, urine, and fecal B[a]P for each animal. In view of the high variability among animals within treatment groups, each animal was analyzed separately, and statistical tests were performed to determine if the groups were statistically significantly different from each other. Because only total radiolabel was measured, one cannot distinguish between unmetabolized B[a]P and B[a]P metabolites in the feces. Tissue radioactivity was found to be insignificant compared to the amount excreted in the urine. Thus, it is not possible to make estimates of total absorption from this experiment. Accordingly, relative bioavailability is determined by comparing the amount of the administered dose cumulatively found in the urine over the seven day period after dosing.

## TABLE 5
## SUMMARY OF URINARY EXCRETION RESULTS
## Goon et al. (1990)

| TREATMENT GROUP | MEAN FRACTIONAL 7-DAY URINARY EXCRETION (%)* | STANDARD DEVIATION (%) | SAMPLE SIZE |
|---|---|---|---|
| Solution | 4.9 % (1) | 1.9 % | 8 |
| Diet (unaged) | 4.4 % (2) | 1.8 % | 10 |
| Solution + Diet (unaged) | 4.6 % (3) | 1.8 % | 18 |
| Sand (unaged) | 3.7 % (4) | 2.2 % | 10 |
| Clay (unaged) | 1.9 % (5) | 0.8 % | 8 |

* Total amount detected in urine over seven days (nmol) / administered dose (nmol) x 100.
(1) Not significantly different from diet group.
(2) Not significantly different from solution group.
(3) Solution and diet groups combined.
(4) Not significantly different from solution + diet group.
(5) Significantly different from solution + diet group.

As noted above (see Table 5), bioavailability as measured by urinary excretion was not statistically different between the solution and diet groups. This finding differs from the results reported by Goon et al. (1990) for two reasons. First, the urinary, fecal and tissue data had not been analyzed at that time, and estimates of urinary excretion were lacking. Second, the blood area-under-the-curve (AUC) data presented by Goon et al. in 1990 were grouped, so that the great variability from animal-to-animal was masked. The result that follows the animal-by-animal reanalysis of the raw data is consistent with the general literature on PAH absorption.

Because the solution and diet groups were not different, data from these two groups were merged for comparison with the sand and clay groups. Bioavailability was not statistically different between the solution/diet group and the unaged sand group. This contradicts results from the study that were presented at the 1990 Society of Toxicology meeting, which indicated that the bioavailability from the sand group was *higher* than from the solution and diet groups. In fact, the mean urinary excretion in the sand group is lower than the absorption in the solution, diet, or diet/solution group. Because of the great variability within both groups, however, there is no statistically significant difference between the solution/diet and sand groups. This result does not demonstrate that the presence of sandy soil has no effect on bioavailability. Instead, the experiment has so much variability in it that the experiment is unable to detect any difference that may actually exist.

Bioavailability as measured by cumulative urinary excretion *was statistically different* between the solution/diet group and the unaged clay group. This confirms results from the study that were presented at the 1990 Society of Toxicology meeting, which indicated a lower bioavailability from the clay group. Results could be used to derive an AAF for unaged clay (AAF=0.42).

In conclusion, the animal-by-animal evaluation of the data from the Goon et al. (1990) study shows there is very high animal-to-animal variability and that recoveries of administered B[a]P were low, ranging from 48% to 75%. Because of the high variability, statistical tests show that there is no difference in the bioavailability of B[a]P in the groups treated with the test chemical in emulsified aqueous solutions, dietary vehicle, or in sandy soil. There was a statistically significant difference in the B[a]P absorption from clayey soil. We conclude from this detailed analysis that the experiment in which males and female animals were both used lacks sufficient power to measure bioavailability and must be rejected for AAF derivation purposes.

*Magee, et al. (1999)*

Magee, et al. (1999) studied the absorption of PAH from soils collected from residential yards in the vicinity of a Superfund site (not MGP waste). Three samples (identified as 007-009) were selected from available material based on the availability of a size fraction (<250 μm) most appropriate for absorption studies. The concentration of PAH in the soils ranged from 66 to 388 ppm, and benzo[a]pyrene- toxic equivalent concentrations range from 9 to 70 ppm.

This study was performed using organic extracts of the soils as an internal control, as was described in the discussion of studies by Weyand, et al (1996). Powder rat chow containing either soil or organic extract of that soil was fed to mice (2 replicates of 4 mice each for each of the 3 soil samples) for 14 days and urine was collected for analysis of both pyrene and B(a)P metabolites. Additionally, rats were sacrificed at the end of the exposure period and lung tissue was harvested for quantification of DNA adducts. AAFs were calculated as the ratio of either the fractional urinary excretion of B(a)P metabolites or the fractional lung adducts between soil and organic extract fed mice (the lung adducts were divided by cPAH exposure, as done in the Koganti, et al (1998) study and therefore relates specifically to cPAH availability). The average fractional urinary excretion and fractional lung adduct values for each soil sample (based on observations in eight animals each) are shown in Table 6, with the corresponding AAF.

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**Table 6**

**AAF CALCULATIONS OF B(A)P AND cPAH AAFS BY MAGEE, ET AL (1999)**

| Soil Sample | Mean Fractional Urinary Excretion of 3-hydroxy B(a)P (ug 3OH-B(a)P per mouse/ug BaP ingested per mouse) | | AAF based on B(a)P metabolite excretion | Mean Fractional Lund Adduct (pmol/mg DNA per mouse/mg cPAH ingested per mouse) | | AAF based on DNA Adducts |
|---|---|---|---|---|---|---|
| | Soil | Organic Extract | | Soil | Organic Extract | |
| Soil 009 | 0.0116 | 0.1587 | 0.07 | 3.04 | 40.99 | 0.07 |
| Soil 008 | 0.0375 | 0.386 | 0.1 | 6.97 | 36.14 | 0.19 |
| Soil 007 | 0.0587 | 0.2029 | 0.29 | 5.93 | 16.31 | 0.36 |

**Summary of Oral-Soil AAFs**

Several estimates of oral-soil AAFs were derived from five studies, as shown in Tables 7 and 8. These estimates of oral-soil AAFs were derived from studies with B(a)P, a five-ring potentially carcinogenic PAH,;a general measure of cPAH ; and pyrene, a four-ring noncarcinogenic PAH. Because of the physical property differences (specifically, affinity for sorption to soil) between low molecular weight PAH such as pyrene and the higher molecular weight PAH such as B(a)P and other cPAH, it is likely that the relative absorption of these subclasses of PAH will be different. Indeed, the average of AAFs based on pyrene (Table 7) is 0.43, whereas the AAFs based on studies of B(a)P and other cPAH is smaller: 0.27. It is recommended that the average pyrene AAF be used for all low molecular weight PAH and the average value of observations from Table 8 be used for all cPAH.

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**Table 7**
**SUMMARY OF ORAL-SOIL AAFS FOR PYRENE**

| Oral-Soil AAF | Notes | Source |
|---|---|---|
| 0.08 | B6CF1 mice, Site B MGP soil, 1 ppm pyrene, 4 ppm tPAH | Koganti, *et al* 1999. |
| 0.11 | B6CF1 mice, Site B MGP soil, 5 ppm pyrene, 36 ppm | Koganti, *et al* 1999. |
| 0.11 | B6C3F1 mice, MGP soil, 35 ppm pyrene, 377 ppm tPAH | Weyand *et al.* (1996) |
| 0.21 | B6C3F1 mice, Site A MGP soil, 17 ppm pyrene, 135 ppm tPAH | Koganti, *et al* 1999. |
| 0.26 | B6CF1 mice, Site C MGP soil, 627 ppm pyrene, 3120 ppm tPAH | Koganti, *et al* 1999. |
| 0.30 | B6CF1 mice, Site A MGP soil, 193 ppm pyrene, 1600 ppm tPAH | Koganti, *et al* 1999. |
| 0.31 | B6CF1 mice, Site B MGP soil, 148 ppm pyrene, 975 ppm tPAH | Koganti, *et al* 1999. |
| 0.36 | $B_6C_3F_1$ mice, MGP soil, 1 ppm pyrene, 9 ppm tPAH | Weyand *et al.* (1996) |
| 0.46 | $B_6C_3F_1$ mice, MGP soil, 57 ppm pyrene, 456 ppm tPAH | Magee *et al.* (1998) |
| 0.47 | $B_6C_3F_1$ mice, MGP soil, 44 ppm pyrene, 388 ppm tPAH | Magee *et al.* (1998) |
| 0.52 | B6CF1 mice, Site C MGP soil, 3 ppm pyrene, 20 ppm tPAH | Koganti, *et al* 1999. |
| 0.55 | B6CF1 mice, Site A MGP soil, 1 ppm pyrene, 8 ppm tPAH | Koganti, *et al* 1999. |
| 0.75 | B6CF1 mice, Site A MGP soil, 0.2 ppm pyrene, 0.6 ppm | Koganti, *et al* 1999. |
| 0.97 | $B_6C_3F_1$ mice, MGP soil, 7 ppm pyrene, 66 ppm tPAH | Magee *et al.* (1998) |
| 1.0 | B6CF1 mice, Site C MGP soil, 21 ppm pyrene, 132 ppm tPAH | Koganti, *et al* 1999. |

## Table 8
## SUMMARY OF ORAL-SOIL AAFS FOR B(A)P AND cPAH

| Oral-Soil AAF | Notes | Source |
|---|---|---|
| 0.07 | B6C3F1 mice MGP soil; 48 ppm BAP, 388 ppm tPAH (BAP metabolites) | Magee, *et al* (1998) |
| 0.07 | B6C3F1 mice MGP soil; 239 ppm cPAH, 388 ppm tPAH (DNA adducts) | Magee, *et al* (1998) |
| 0.08 | B6C3F1 mice, Site A MGP soil, 86 ppm cPAH, 135 ppm tPAH (DNA adducts) | Koganti, *et al* (1998) |
| 0.10 | B6C3F1 mice MGP soil; 50 ppm BAP, 456 ppm tPAH (BAP metabolites) | Magee, *et al* (1998) |
| 0.15 | B6C3F1 mice, Site B MGP soil, 24 ppm cPAH, 36 ppm tPAH (DNA adducts) | Koganti, *et al* (1998) |
| 0.17 | B6C3F1 mice, Site A MGP soil, 5 ppm cPAH, 8 ppm tPAH (DNA adducts) | Koganti, *et al* (1998) |
| 0.17 | B6C3F1 mice, MGP soil, 247 ppm cPAH, 377 ppm tPAH (DNA adducts) | Weyand *et al.* (1996) |
| 0.20 | B6C3F1 mice, Site C MGP soil, 895 ppm cPAH, 3120 ppm tPAH (DNA adducts) | Koganti, *et al* (1998) |
| 0.19 | B6C3F1 mice MGP soil; 271 ppm cPAH, 456 ppm tPAH (DNA adducts) | Magee, *et al* (1998) |
| 0.23 | Sprague-Dawley Rats, clay-based soils,<br>100 ppm BAP, 100 ppm tPAH (blood measurements) | Goon, *et* al (1991) |
| 0.29 | B6C3F1 mice MGP soil; 6 ppm BAP, 66 ppm tPAH (BAP metabolites) | Magee, *et al* (1998) |
| 0.30 | Sprague-Dawley Rats, clay-based soils, 100 ppm BAP, 100 ppm tPAH (urine measurements) | Goon, *et* al (1991) |
| 0.32 | B6C3F1 mice, Site B MGP soil, 238 ppm cPAH, 975 ppm tPAH (DNA adducts) | Koganti, *et al* (1998) |
| 0.36 | B6C3F1 mice MGP soil; 41ppm cPAH, 66 ppm tPAH (DNA adducts) | Magee, *et al* (1998) |
| 0.39 | Sprague-Dawley Rats, sandy | Goon, *et al* (1991) |

| | | |
|---|---|---|
| | soils, 100 ppm BAP, 100 ppm tPAH (blood measurements) | |
| 0.47 | B6C3F1 mice, Site A MGP soil, 986 ppm cPAH, 1600 ppm tPAH (DNA adducts) | Koganti, *et al* (1998) |
| 0.49 | Sprague-Dawley Rats, sandy soils, 100 ppm BAP, 100 ppm tPAH (urine measurements) | Goon, *et al* (1991) |
| 0.76 | B6C3F1 mice, Site C MGP soil, 55 ppm cPAH, 132 ppm tPAH (DNA adducts) | Koganti, *et al* (1998) |
| | | |

**Derivation of Dermal-soil AAF for Potentially Carcinogenic PAH**

Two studies were identified in which the dermal absorption of PAHs was measured from a soil matrix. These include Yang *et al.* (1989) and Wester *et al.* (1990). These studies are discussed below. Estimates of dermal-soil AAFs can be derived from the results of these studies when combined with data on absorption from investigations using dosing methods similar to the dose-response studies.

**Dermal Absorption Studies**

*Yang et al. (1989)*

Yang, *et al.* (1989) measured the percutaneous absorption of benzo(a)pyrene (B(a)P) from petroleum crude-fortified soil and from pure petroleum crude oil both in live rats and in *in vitro* studies using excised rat skin (see Table 9). The soil was a loam containing 1.64% organic matter, 46% sand, 36% silt, and 18% clay. The B(a)P-soil mixture was prepared by adding the radiolabelled crude oil in dichloromethane to the soil. The solvent was removed by rotary evaporator. All soils were used within 72 hours of preparation.

Radiolabelled B(a)P ($^3$H-B(a)P) was added at a known concentration for quantification. In the *in vivo* experiments, soil containing B(a)P in crude petroleum or pure crude petroleum containing B(a)P was applied to the dorsal skin of the female Sprague-Dawley rats. In both cases, the dose of B(a)P was 0.01 ug/cm$^2$. For the crude oil, 90 ug/cm$^2$ of oil containing 100 ppm B(a)P was applied. For soil, 9 mg/cm$^2$ of soil containing 1 ppm of B(a)P was applied. The dorsal area was covered with a non-occlusive glass cell to prevent ingestion of the B(a)P by grooming behavior.

Absorption was determined by measuring the radioactivity in the urine and feces once daily and the urine, feces and tissues at 96 hours. Data from five animals were averaged. After 96 hours, cumulative absorption of B(a)P from crude-soaked soil (9.2%) was less than that from the crude alone (35.3%).

In the *in vitro* experiments, dorsal skin was excised from female Sprague-Dawley rats after sacrifice. 350 um skin sections were placed in consoles containing 15 mm diameter Franz diffusion cells. The receptor fluid was an aqueous solution of 6% Volpo-20, a nonionic surfactant. The absorption was measured by analyzing the surfactant containing receptor fluid that bathed the receiving reservoir of the absorption chamber for radiolabelled B(a)P. The receptor fluid was sampled once every 24 hours for four days. Data from five trials were averaged. Again, 96 hour cumulative absorption was greater for B(a)P in oil (38.1%) versus B(a)P in oil-soaked soil (8.4%).

**Table 9**
**DERMAL ABSORPTION OF BENZO(a)PYRENE FROM SOIL IN THE RAT**
**YANG, *ET AL.* (1989)**

| Time Point | *In Vivo* Results | *In Vitro* Results |
|---|---|---|
| 24 Hours[1] | 1.1% (0.3)[1,2] | 1.5%[4] |
| 48 Hours[1] | 3.7% (0.8)[1,2] | 3.5%[4] |
| 72 Hours[1] | 5.8% (1.0)[1,2] | 5.5%[4] |
| 96 Hours[3] | 9.2% (1.2)[1,3] | 8.4%[4] |

[1]Values shown for 48-96 hours are cumulative. Results are the mean for five rats (standard error).
[2] Urine plus feces
[3] Urine plus feces plus tissues.
[4] See Figure 1 of Yang, *et al.* (1989)

*Wester et al.* (1990)

Wester *et al.* (1990) measured the absorption of B(a)P *in vivo* over 24 hours in the monkey using acetone as vehicle or using soil containing B(a)P at the 10 ppm level (see Table 10). The soil used contained 26% sand, 26% clay, and 48% silt. The organic content was not specified. The B(a)P containing soil was prepared by adding the B(a)P in (7:3, v/v) hexane:methylene chloride. The soil was mixed by hand and left open to the air to allow dissipation of the solvent. The B(a)P-soil mixture was not aged before use.

Four female Rhesus monkeys were tested with 40 mg soil/cm$^2$ applied to the abdominal skin. The skin area was covered with a nonocculusive cover to prevent loss of soil or ingestion of soil by grooming behavior. Percutaneous absorption was measured by comparing the quantity of radiolabel ($^{14}$C-B(a)P) in the urine following topical application to that following intravenous application. Urine was collected for 24 hours. After 24 hours, all visible soil was collected from the application site. The skin surface was washed with soap and water, and the monkeys were returned to metabolic cages for urine collection for an additional six days. *In vivo*, the absorption was 51.0% for acetone vehicle and 13.2% for soil.

*In vitro* studies were also carried out with viable human cadaver skin in cells of the flow-through design. Human serum was used as the receptor fluid. Radiolabel was determined in the receptor fluid after 24 hours as well as in the skin after a surface wash with soap and water. The amount of B(a)P that cannot be removed from the skin with a soap and water wash is designated here as "absorbed" for the purposes of AAF derivation. In six experiments with skin from two donors, 23.8% of the B(a)P was absorbed with acetone vehicle. From soil (10 ppm), 1.45% was absorbed in 24 hours.

*Roy, et al (1998)*

This investigation is worth mention because it utilized soils from sites containing MGP tars. And is the most recent evaluation of dermal absorption. In this paper, the authors note substantial reduction in the absorption of B(a)P in soils applied to skin in an in vitro diffusion apparatus when compared to organic extracts of the same material. However, these investigators used an excess of B(a)P source in doing these experiments and, as such, are calculating the flux rate of B(a)P under conditions of "infinite source". Thus, while the absorption reduction is interesting, it cannot be converted to an AAF for risk assessment purposes in that both the dose-response data and the relevant environmental exposure (dermal absorption of PAH on the skin) are likely to be finite sources, that are controlled as much by reduction in available PAH as the rate at which the compounds cross the skin. Therefore, this study was not used to estimate AAFs for the dermal absorption exposure route.

**Dermal-Soil AAF Derivation**

The fraction absorbed in a 24-hour or 96-hour experiment has little relevance to human risk assessment. Receptors who might touch, walk on, or otherwise contact PAH-containing soil would only realistically be exposed for a period of 6-12 hours at maximum before washing themselves or before the soil would drop off or be rubbed off the skin. The Wester, *et al.* (1990) paper demonstrates that soap and water wash can remove a large amount of the administered dose (53-91%), even after 24 hours. Even more would be removed after only 6-12 hours exposure.

U.S. EPA guidance for dermal risk assessment recognizes that the time period of a dermal experiment is an important factor to consider when evaluating experimental data. U.S. EPA (1992b) has noted: "The experiment should provide absorption estimates over a time corresponding to the time that soil is likely to remain on skin during actual human exposures."

**Table 10**
**DERMAL ABSORPTION OF BENZO(a)PYRENE FROM SOIL**
**WESTER, *ET AL.* (1990)**

| Sample | Monkey Skin | Human Skin |
|---|---|---|
| 1 | 13.1%[1] | 1.01%[3] |
| 2 | 10.8%[1] | 1.52%[3] |
| 3 | 18.0%[1] | 0.61%[3] |
| 4 | 11.0%[1] | 2.21%[3] |
| 5 | NA | 0.31%[3] |
| 6 | NA | 3.01%[3] |
| Mean +/- SD | 13.2% +/- 3.4%[2] | 1.45% +/- 1.02% [2] |

[1]Percentage of applied dose absorbed = ($^{14}C$ urinary excretion for seven days following 24 hour topical application) /($^{14}C$ urinary excretion following intravenous administration) x 100
[2] Mean +/- Standard Deviation
[3] Fraction of applied dose in the skin plus fraction in receptor fluid.

Accordingly, the data from the Yang, *et al.* (1989) and Wester, *et al.* (1990) experiments should be prorated for a reasonable exposure period, such as 6-12 hours. A health-protective way to do this is to simply assume that absorption is linear over time. The Yang, *et al.* (1989) *in vitro* study showed a linear absorption into rat skin from 24-96 hours, but no data are available for the 0-24 hour period.

In fact, Kao *et al.* (1985) have shown that the appearance of radiolabel from topically applied benzo(a)pyrene and other chemicals in human, rodent, and other species' skin in the culture medium of their *in vitro* system was exponential, not linear. A distinct time lag is apparent before any absorption occurs. A time lag has also been shown for various chlorophenols in human skin (Roberts, *et al.*, 1977; Huq, *et al.*, 1986). U.S. EPA (1992b) also recognizes that a time lag may exist: "time is required after initial contact with the skin for such a steady-state to be achieved." Also: "Linear adjustments may not be accurate, since it is unknown how soon steady-state is established and since steady-state conditions may not be maintained throughout the experiment due to mass balance constraints."

Thus, linear adjustments of 24 hour absorption data to estimate absorption over 6-12 hours may overestimate the absorption true absorption, but it is not likely to underestimate absorption. A health-protective approach would be to assume that a relevant absorption period is as high as 8 hours. (U.S. EPA in its recently proposed Hazardous Waste Identification Rule assumes 8 hour exposures.) With this assumption, the Yang *et al*, 1989 data from the *in vitro* experiment can be adjusted to 0.27% absorption over 8 hours using a linear regression of all four time points. The data from the *in vivo* experiment can be adjusted to 0.8% absorption over 8 hours. The 96 hour data is used in this case, because tissue-bound B(a)P was measured only for this time point. The 8 hour estimated absorption using a linear regression is only 0.01%, and was thus rejected for AAF derivation.

The Wester, *et al.* (1990) data can be adjusted to 4.4% absorption in the *in vivo* monkey experiment over an 8 hour exposure period. Similarly, the 8 hour estimated exposure for the *in vitro* human skin experiment is 0.48%.

For deterministic risk assessments, a single estimate of the dermal-soil AAF is needed. In this case, four estimates of the dermal absorption of PAHs from soil were presented: 0.27%, 0.80%, 4.4%, and 0.48%. In addition, 12 estimates of the absorption of PAHs from the dose-response study were presented in Table 1. The average value is 92%. Four AAF estimates are 0.003, 0.009, 0.048, and 0.005. The deterministic estimate of the dermal-soil AAF is simply the average of the four AAFs, 0.02.

**Applicability of Dermal-Soil AAF to Other PAHS**

Dermal-soil AAFs have been derived for B(a)P based on four experimental data points with B(a)P. However, risk assessment of PAHs involves the calculation of benzo(a)pyrene-toxic equivalents, which includes the seven PAHs designated as potentially carcinogenic. The following section addresses the applicability of the B(a)P AAF to other potentially carcinogenic PAHs.

Various researchers have investigated the dermal absorption of different PAHs from pure mixtures, such as coal tar, or from solvent vehicles, such as acetone. From these studies, data on the comparative dermal absorption of various pure PAHs are available, but no studies are available on the dermal absorption of various PAHs from a soil matrix.

For instance, Sanders, *et al.* (1984) studied the dermal absorption of B(a)P and dimethylbenz(a)anthracene (DMBA) in Swiss-Webster mice from an acetone vehicle. The dermal absorption was similar for the two PAHs. For instance, at similar dose levels, the amount found in the tissues and excreta 24 hours after dosing was 84% for B(a)P and 82% for DMBA.

Yang and coworkers (Yang *et al.* 1986a, 1986b) studied dermal absorption of B(a)P and anthracene at similar doses from solvent vehicles in the female Sprague-Dawley rat in both *in vivo* and *in vitro* systems. Absorption was similar for the two PAHs. *In vivo*, absorption after 144 hours was 46.2% for B(a)P and 52.3% for anthracene. *In vitro*, absorption after 144 hours was 49.9% for B(a)P and 55.9% for anthracene.

Ng and coworkers (Ng *et al.*, 1992) studied dermal absorption of B(a)P and pyrene at similar doses from an acetone vehicle in the hairless guinea pig. Absorption after 24 hours was 73.3% for B(a)P and 93.9% for pyrene. In an *in vitro* experiment, absorption of B(a)P was 67.4% versus 89.9% for pyrene. In another *in vitro* experiment, absorption of B(a)P was 39.8% versus 40.8% for pyrene.

Dankovic and colleagues (Dankovic *et al.*, 1989) studied the comparative dermal absorption in female CD-1 mice of 12 high molecular weight PAHs isolated from the 800-850 degree (F) complex organic mixture (COM) derived from a coal liquefaction process. Absorption was measured as the half life of disappearance of the PAH from the mouse skin. The half life was 5.0 hours for pyrene. For B(a)P, the half life was 6.7 hours. All other PAH had half lives similar to B(a)P, including benz(a)anthracene (6.5 hr), chrysene (7.3 hr), and benzo(j/k)fluoranthene (8.1 hr).

VanRooij *et al.* (1995) studied the dermal absorption in the blood-perfused pig ear of 10 PAHs present in coal tar. The blood-perfused pig ear was chosen as a test system because pig skin resembles human skin morphologically and functionally and because percutaneous absorption rates of various chemicals in pig skin are comparable to the rates seen in human skin.

The absorption after 3.3 hours varied among PAHs. Absorption was greatest for phenanthrene and fluorene. Anthracene, fluoranthene, and pyrene showed similar absorption rates that were roughly ten times less than those for phenanthrene and fluorene. The 4-6 ring PAHs showed substantially lower dermal absorption, which was 100-1000 times less than that seen with phenanthrene and fluorene. It should be noted, however, that the maximum fractional absorption seen, which was with fluorene, was only 0.004% of the applied dose.

Of the potentially carcinogenic PAH studied in the above dermal absorption experiments, B(a)P showed equal or greater dermal absorption. None of these experiments were performed with soil matrices. They all involved applying the PAHs as solutions in organic solvents.

As noted above, dimethylbenz(a)anthracene, benz(a)anthracene, and benzo(b)fluoranthene were absorbed to a degree similar to B(a)P. Chrysene, benzo(k)fluoranthene, indeno[1,2,3-cd]pyrene, and dibenzo(a,h)anthracene were absorbed to a lesser degree than was B(a)P. Accordingly, it is health protective to use dermal-soil AAFs derived for B(a)P for performing risk assessment of all potentially carcinogenic PAH.

**Derivation of Dermal-Soil AAF for Noncarcinogenic PAHs**

Noncarcinogenic PAH with smaller molecular weights, however, were absorbed to a greater degree than was B(a)P in several experiments. Fluorene, phenanthrene, anthracene, fluoranthene, and pyrene were absorbed at rates varying from 1.03 times the B(a)P rate to 92 times the B(a)P rate. Accordingly it may be appropriate to modify upward the dermal-soil AAF derived from studies with B(a)P by the use of an uncertainty factor so that it can be used in the risk assessment of noncarcinogenic PAHs.

However, all of the experiments used coal tar or PAHs in solutions. No information is available on the comparative absorption of different PAHs from soil matrices. It is possible that small molecular weight PAHs in pure form are absorbed through skin to a greater degree than are large molecular weight PAHs, but that these smaller PAHs are also *less* bioavailable in soil matrices than are large PAHs. This could occur if the smaller PAHs more efficiently enter the small pore spaces of the soil matrices than do larger PAHs.

In the absence of appropriately designed experiments for noncarcinogenic PAH AAF derivation, it is difficult to determine a reasonable uncertainty factor. The dermal-soil AAF for noncarcinogenic PAHs may be higher or lower or the same as the dermal-soil AAF for potentially carcinogenic PAHs. The uncertainty factor is defined as a factor of 5. For deterministic risk assessments, the dermal-soil AAF for noncarcinogenic PAHs is 0.10 (0.02 x 5).

## Summary of AAFs for PAH

| | | |
|---|---|---|
| Oral-Diet | 1.0 | |
| Oral-Soil | ~~0.27~~ | ~~carcinogenic PAH~~ Default of 1.0 used per WDNR |
| Oral-Soil | ~~0.43~~ | ~~noncarcinogenic PAH~~ Default of 1.0 used per WDNR |
| Oral-Water | 1.0 | carcinogenic and noncarcinogenic PAH |
| Dermal-Soil | 0.02 | carcinogenic PAH |
| Dermal-Soil | 0.1 | noncarcinogenic PAH |
| Dermal-Water | 1.1 | carcinogenic and noncarcinogenic PAH |
| Inhalation | 1.0 | carcinogenic and noncarcinogenic PAH |

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# Appendix D

## Absorption Adjustment Factors (AAFs) For Dermal Absorption of Pentachlorophenol In Soil And Sediment

# ABSORPTION ADJUSTMENT FACTORS (AAFS) FOR DERMAL AND ORAL ABSORPTION OF PENTACHLOROPHENOL IN SOIL AND SEDIMENT

The oral RfD for pentachlorophenol (3E-02 mg/kg/day) and the oral cancer slope factor (0.12 $(mg/kg/day)^{-1}$ ) are both based on dietary studies in rodents. Limited studies of absorption have been carried out in several species including humans, rats, and monkeys. Rats and monkeys given single oral doses in corn oil of 10 mg [$^{14}$C] pentachlorophenol/kg and rats were also dosed with 100 mg/kg (Braun and Sauerhoff, 1976; Braun et al., 1977). Absorption was extensive in both species with greater than 90% recovery of the dose in urine, feces, expired air, and tissues. Kinetic analyses were also performed. Essentially complete absorption by rats dosed with pentachlorophenol or sodium pentachlorophenate in water or food has also been reported (Meerman et al., 1983).

Hoben et al. (1976) studied pulmonary absorption of pentachlorophenol vapors in the rat. 70-75% of the dose was absorbed as determined by recovery of radioactivity in urine, plasma, liver, and lungs 24 hours post exposure.

**Oral-Water and Oral-Soil/Sediment**

Studies in humans also indicate high absorption following oral administration. Based upon these results, AMEC has assumed that absorption in the dose-response study was 100%. Furthermore, it is assumed that absorption is the same in animals and humans for gavage, drinking water, diet, and soil or sediment ingestion exposures. Thus, the AAF (oral-water), the AAF (oral-diet) and the AAF (oral-soil/sediment) are all 1.0.

**Dermal-Soil/Sediment**

Wester et al. (1993) studied the percutaneous absorption of $^{14}$C-pentachlorophenol mixed in a soil matrix both *in vivo* in Rhesus monkeys and *in vitro* with excised human skin. The free phenol compound was used for their experiments. They dissolved pentachlorophenol in hexane:methylene chloride (7:3, v/v), mixed the solution with the test soil, and let the solvent evaporate by letting the mixture sit in the open air. The soil was not in contact with water, so the form of the chemical throughout the experiment would be expected to be the free phenol (un-ionized) form.

The experiment of Wester at al. (1993) used a low organic content soil, which was only 0.9% organic content. The soil composition also included: 26% sand, 26% clay, and 48% silt. The pentachlorophenol-soil mixture was unaged. Wester, et al. (1993) dissolved pentachlorophenol in hexane:methylene chloride (7:3, v/v), mixed the solution with the test soil, and let the solvent evaporate by letting the mixture sit in the open air. They then immediately executed their *in vivo* and *in vitro* dermal absorption experiments.

Pentachlorophenol was present in the soil at a concentration of 17 mg/kg. Soil was placed in contact with skin at the loading rate of 40 mg soil/$cm^2$ skin area. At this rate, pentachlorophenol was present at a rate of 0.7 ug/$cm^2$ skin area. With Rhesus monkeys, the treated area (abdominal skin) was covered with a nonocculsive cover, which allowed free passage of water vapor. Four monkeys were treated for 24 hours. Afterwards, the area was washed with soap and water. Urine was collected for a total of 14 days.

In the *in vitro* experiment, three replicates from two donor human skin sources were treated. The skin was viable. Flow through cells were used with human serum as the receptor fluid. As with the monkeys, the dose was 40 mg/cm$^2$ of soil containing 17 ppm pentachlorophenol. The skin was treated for 15 hours. After that time, the receptor fluid, the soap and water washes, and the skin were analyzed for radiolabel.

In the monkey experiment, 11.1% of the administered dose was excreted in the urine over 14 days. Assuming that urinary excretion is quantitatively equivalent for intravenous and topical exposures, this corresponds to 24.4% absorption over 24 hours.

In the human skin experiment, 0.17% of the administered dose was found in the receptor fluid or the skin (after washing) after a 15 hour exposure.

Absorption estimates taken from such long experiments are not relevant to human health risk assessment. People who might touch, walk on, or otherwise contact pentachlorophenol-containing soil would only be exposed for a period of 6-12 hours at maximum before washing themselves or before the soil would drop off or be rubbed off the skin. The paper clearly demonstrates that soap and water wash can remove a large amount of the administered dose (38-60%), even after 24 hours. Even more still would be removed after only 6-12 hours exposure.

Accordingly, the data from the Wester et al. (1993) experiment should be prorated for a reasonable exposure period, such as 6-12 hours. A health-protective way to do this is to simply assume that absorption is linear over time. In fact, Kao et al. (1985) have shown that the appearance of radiolabel from topically applied benzo(a)pyrene and other chemicals in human, rodent, and other species' skin in the culture medium of their *in vitro* system is exponential, not linear. A distinct time lag is apparent before any absorption occurs. A time lag has also been shown for various chlorophenols in human skin (Roberts, et al., 1977; Huq, et al., 1986). EPA (1992a) also recognizes that a time lag exists: "time is required after initial contact with the skin for such a steady-state to be achieved." Also: "Linear adjustments may not be accurate, since it is unknown how soon steady-state is established and since steady-state conditions may not be maintained throughout the experiment due to mass balance constraints."

Thus, linear adjustments of 15 and 24 hour absorption data to estimate absorption over 6-12 hours clearly overestimates the absorption. A health-protective approach would be to assume that a relevant absorption period is not higher than 8 hours. With this assumption, the absorption from the monkey experiment is 8.1% and the absorption from the human experiment is 0.09%.

The data from the Wester et al. (1993) study present a dilemma, because the results vary significantly between monkey and human skin. AMEC evaluated various aspects of the study to determine the appropriate approach for AAF derivation.

I. Adjustment for Presence of Pentachlorophenate in Soil:

In aqueous solutions, the presence of ionized and unionized species will be governed by pentachlorophenol's acid dissociation constant (pKa), which is 4.7 (Howard, 1991). At pH 6.7, pentachlorophenol in aqueous environments is 99% ionized (IARC, 1991).

Thus, if pentachlorophenol as its free phenol is placed in contact with soils, the majority of the chemical in contact with soil pore water will be the pentachlorophenate ion at soil pH values ranging from weakly acidic to alkaline.

Wester, et al. (1993) used the free phenol compound for their dermal absorption experiments. They dissolved pentachlorophenol in hexane:methylene chloride (7:3, v/v), mixed the solution with the test soil, and let the solvent evaporate by letting the mixture sit in the open air. In the monkey experiment, the soil was not in contact with water, so the form of the chemical throughout the experiment would be expected to be the free phenol (un-ionized) form.

However, in the human skin experiment, a thin section of skin (500 um) which had been stored in an aqueous medium (Eagel's minimum essential medium) was placed in the cell, with an aqueous solution (human serum) flowing beneath it at 3.09 mL/min. It is probable that the pentachlorophenol in the soil was in contact with a considerable amount of water and was thus ionized.

It is generally recognized that ionized chemicals are poorly absorbed through the skin of humans and other animals compared to unionized chemicals. For instance, Scheuplein and Blank (1971) state that the ionization of a weak electrolyte is known to "radically decrease its permeability." They cite the decreased permeability of sodium salicylate compared to salicylic acid as an example. Huq at al. (1986) studied a series of substituted phenols, including chlorophenols, and also found that skin permeability was pH dependent, indicating that the absorption of chlorophenols was much greater when they were in their un-ionized states. The same would be true for pentachlorophenol.

Data showing that the skin permeability of the pentachlorophenate ion is much less than that of the un-ionized pentachlorophenol are also available. EPA (1984) states that the human dermal absorption of an aqueous pentachlorophenate solution was five times less than the absorption of pentachlorophenol in an organic solution. Similarly, Horstman et al. (1989) reported that absorption into human skin of sodium pentachlorophenate was four times less than the absorption of pentachlorophenol in diesel oil.

In conclusion, the dermal absorption data from the monkey experiment in the Wester, et al. (1993) study overestimates the dermal absorption that would be expected from pentachlorophenate ion. This ionized chemical species is certainly present in soils at waste sites. In fact, pentachlorophenate may be the predominant form of pentachlorophenol in site soils that a human may contact. This may partially explain the low absorption seen with the human skin experiment in where the pentachlorophenol was likely present as the ionized species. Based on the data of Horstman et al (1989), the overestimation may be as high as 4 fold.

II. Adjustment for Use of Rhesus Monkey:

Several *in vivo* studies have been done in which absorption in monkeys (rhesus and squirrel) was directly compared to absorption in humans at the same anatomical site (usually the ventral forearm) [Wester and Maibach (1975); Wester and Noonan (1980); Wester and Maibach (1989); Wester and Maibach (1993)]. The following table shows that for 16 chemicals studied, absorption in the monkey was greater than absorption in human for 13 chemicals. For one, absorption was the same and for two, absorption was slightly less in monkeys.

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# COMPARISON OF DERMAL ABSORPTION IN MONKEYS AND HUMANS

| CHEMICAL TESTED | MONKEY ABSORPTION/ HUMAN ABSORPTION | TYPE OF MONKEY |
|---|---|---|
| 2,4-dinitrochlorobenzene | 1.0 | rhesus |
| nitrobenzene | 2.8 | rhesus |
| cortisone | 1.6 | rhesus |
| testosterone | 1.4 | rhesus |
| hydrocortisone | 1.5 | rhesus |
| benzoic acid | 1.4 | rhesus |
| resorcinol | 2.3 | rhesus |
| p-phenylenediamine | 0.9 | rhesus |
| 2-nitro-p-phenylenediamine | 3.9 | rhesus |
| HC-Blue #1 | 0.9 | rhesus |
| lindane | 1.7 | squirrel monkey |
| parathion | 3.1 | squirrel monkey |
| malathion | 2.4 | squirrel monkey |
| diethyl maleate | 1.3 | rhesus |
| DDT | 1.9 | rhesus |
| retinoic acid | 2.0 | rhesus |

On average, dermal penetration in the monkey is 1.9 times greater than in the human for the same anatomical site. Wester and Maibach (1993) have concluded that there is no statistical difference in the absorption for some of the chemicals because of statistical error in the measurements. However, for those chemicals that are statistically different, the absorption seen in the monkey is 2.1 times higher on average than in humans.

Because the dermal absorption in rats, mice, guinea pigs, and rabbits, which have been used for absorption experiments in the past, is often shown to be 10-50 times higher than absorption in humans, Wester and Maibach (1989, 1993) conclude that the monkey is much more similar to humans than other experimental animals (with the possible exception of the pig). Accordingly, they have concluded: "In general, the comparative in vivo data that have been reviewed demonstrate that percutaneous absorption in the pig and the monkey (rhesus and squirrel) is usually similar to that in man..." (Wester and Maibach, 1989). Also, "This [monkey] is the most relevant animal model for percutaneous absorption" (Wester and Maibach, 1993).

The fact that absorption in the monkey is more similar to absorption in the human than many other animal species cannot be disputed, but the fact remains that dermal absorption in the monkey has been shown to be on average 1.9 times higher than absorption in the human when monkeys and humans are tested concurrently in the same laboratory and at the same anatomical site. Thus, absorption estimates taken from experiments in monkeys will overestimate absorption in humans by a factor of 1.9.

III. Adjustment for Use of Abdomen as Site of Exposure:

Wester et al. (1993) have used the abdomen as the site of application in their pentachlorophenol dermal absorption study in Rhesus monkeys. However, it is extremely unlikely that a person would contact pentachlorophenol/pentachlorophenate containing soil from the former Koppers site on their stomach. It is more likely that if a human contacted this soil, it would be by walking on it, touching it with the hands, or perhaps getting a small amount of it on their arms or legs.

Several scientific studies demonstrate that dermal penetration of organic chemical substances is greater through skin on the stomach (abdomen) than through skin on the hands, arms, legs, and feet. For instance, Maibach et. al. (1971) demonstrated that the 24 hour absorption of parathion through the abdomen of humans was 2.2 times the absorption through the forearm, 1.6 times the absorption through the palm of the hand, and 1.4 times the absorption through the ball of the foot. With malathion, abdominal absorption was 1.4 times that of the forearm, 1.6 times that of the palm of the hand, and 1.4 times that of the ball of the foot. In both cases, the abdominal absorption was slightly less than that on the back of the hand (0.9 and 0.8 times).

Rougier et al. (1986) compared dermal absorption of benzoic acid in humans by site of application. They found that absorption through the abdomen was 1.8 times that of the back, 1.6 times that of the arm, 1.3 times that of the chest, and 1.2 times that of the thigh. No data on absorption though the skin of the hands and feet were available from this experiment.

Bronaugh (1985) measured absorption of urea and cortisone in rats on their backs and their abdomens. The abdomen showed greater penetration by a factor of 11.8 for urea and by a factor of 7.2 for cortisone.

Wester et al. (1980) studied regional variation in dermal penetration of testosterone in Rhesus monkeys and found differences in permeability among forearm, chest, cheek, scalp, and vagina. In addition, Moody and co-workers compared absorption of three pesticides in Rhesus monkey from the forearm and the forehead. Unfortunately, the abdomen was not studied by either set of investigators. However, Wester and Maibach (1989) when summarizing these studies noted that, for a variety of chemicals, the ratios of penetration (scalp/forearm and forehead/forearm) were similar in humans and Rhesus monkeys. Their conclusion was: "Therefore, the rhesus monkey probably can be a relevant model for human region variation." In another review article, Wester and Maibach (1993) state: "The rhesus monkey has certain physical advantages in that the inner parts of the arms, legs, and truck are relatively hairless; similar to that in man. Also, since percutaneous absorption differs from regions of the body, the same anatomic site can be used in both the rhesus monkey and man (i.e., ventral forearm)."

It is odd that Wester, Maibach and coworkers decided to execute rhesus monkey experiments for use in waste site risk assessments using abdominal skin sites, because they have previously concluded that: (1) human regional variation is similar to rhesus monkey regional variation and (2) human absorption through abdominal skin exceeds absorption through skin areas relevant to human waste site risk assessments (arms, legs, and feet) for several different chemicals tested. If the above data for parathion, malathion, and benzoic acid are averaged for all skin sites, the use of the abdomen will overestimate absorption for relevant skin sites by a factor of 1.4.

IV. General Evaluation of Wester et al. (1993) Monkey Study:

In the Wester study, the same amount (amount/$cm^2$) of pentachlorophenol was placed onto the abdomen of monkeys either as a pure liquid or as a soil mixture. In the case of the control, the dose was 0.8 ug/$cm^2$. Because the density of pentachlorophenol is 2 g/$cm^3$, one can calculate that the thin layer of the chemical on the skin was only $4x10^{-7}$ cm high or 4 nm high. However, the pentachlorophenol-containing soil was placed on the skin at a loading rate of 0.040 g/$cm^2$. Assuming that the soil had a density of 1.5 g/$cm^3$, the layer of soil was 0.03 cm high. Thus, the top level of the soil layer was 75,000 times higher than the top level of the liquid pentachlorophenol layer.

The reported results of the experiment, however, are that there was no difference in the absorption between the pure liquid and the soil mixture. Although these investigators are recognized as leaders in the field of dermal absorption experiments, this result is simply difficult to understand logically. If the pentachlorophenol was truly bound to the soil as it is at the site after years of contact with the soil, how can the pentachlorophenol molecules that are bound to soil at the top of the soil layer behave the same as liquid pentachlorophenol molecules that are directly in contact with the skin?

AMEC notes that the pure pentachlorophenol in acetone solvent was absorbed 23-29 times more efficiently in the *in vitro* human skin experiment. This is a logical result that is expected based on general knowledge about the interactions of organic chemicals with soil matrices.

It is possible that the experimental results reported by Wester et al. (1993) from the monkey experiment are artifacts. Perhaps the fraction of urinary excretion in the monkey is not the same for dermal exposure and intravenous exposure as assumed by the researchers. Perhaps the "nonocclusive" cover device did not behave as planned, and heat and water vapor increased in the device designed to hold the soil in place. Perhaps the shaving of the monkey's skin inadvertently damaged the skin. It is impossible to know if the experimental protocol was executed properly or not, but the *in vivo* monkey results are just not logical.

V. Conclusion:

Taking into consideration the three factors above, the monkey experiment may overestimate the absorption of pentachlorophenol from soil in human skin by a factor of 10.6. If adjustments are made for: (1) phenate ion, (2) monkey versus human skin, and (3) abdomen versus other sites, the monkey absorption result (8.1% over 8 hours) can be adjusted to 0.8% absorption.

Qiao et al. (1997) studied dermal absorption of pentachlorophenol in a soil matrix in the swine model. The soil used was 31.2% sand, 16.8% silt, 53.0% clay, 0.3% organic matter, and 1% water which was passed through a 80 mesh sieve. $^{14}C$-labeled pentachlorophenol was given to the animals in a soil slurry composed of 55% soil, 31% water, and 15% ethanol. The pentachlorophenol dose was 40 ug pentachlorophenol/cm$^2$. The slurry was added at a rate of 13 mg/cm$^2$, which provided a soil loading rate of 7 mg/cm$^2$.

Pentachlorophenol was given to 8-10 week old female weanling Yorkshire-Landrace cross pigs. Pre-acclimated and jugular-vein-cannulated pigs were individually housed in metabolism cages after radiolabelled pentachlorophenol application. The skin site was the abdominal skin, because it is more predictable of human dermal absorption. The pentachlorophenol was applied to a 7.5 cm$^2$ region that was protected by a customized circular glass chamber with 3 mm diameter holes covered with nylon sieve screening and then positioned with Elasticon tape.

Radioactivity was then measured in the blood, plasma, urine and feces for a period of 408 hours. The blood and plasma curves for the nonocclusive soil dose showed an increase in total radioactivity for the first 12 hours and then a plateauing of the level of radioactivity in the blood and plasma. This indicated that absorption reached a steady state level after about 12 hours.

Urinary excretion as a fraction of the total dose was linear up to 48 hours and then plateaued. Fecal excretion rates as a fraction of the total dose was linear up to 72 hours and then plateaued. Both were plotted over the linear regions and the fraction of the dose excreted over 8 hours was determine. At 8 hours 0.44% of the total dose had been excreted.

After the entire 408 hour period, animals were sacrificed, and radioactivity was measured in all major tissues and organs. It was found that 16.51% of the total dose was present in the various tissues and organs (1.18X) compared to 13.94% of the total dose, which was excreted over the entire period. Thus, the 8-hour absorption estimate was derived taking into account the amount excreted (0.44%) plus the amount estimated to be present in the tissues (0.44% x 1.18 = 0.52%). In addition, the estimate was modified to account for total recovery, which was 62.78%. The final estimate of dermal absorption over 8 hours is 1.53% from the Qiao et al. (1997) study.

AMEC notes that this experiment used a slurry of soil, water and ethanol. The dermal absorption of pentachlorophenol in soil in the absence of an organic solvent is probably less than the value reported in this study. As such, the study is health-protective.

The available absorption estimates for pentachlorophenol in soil are summarized below:

| SPECIES | TYPE | 8-HOUR DERMAL ABSORPTION | CITATION |
|---|---|---|---|
| Monkey | *in vivo* | 8.1% (0.81% if modified, see text) | Wester et al. (1993) |
| Human | *in vitro* | 0.09% | Wester et al. (1993) |
| Pig | *in vivo* | 1.53% | Qiao et al. (1997) |

The average of the three values is 3.24%, and the average of the three values if the monkey result is modified as described in the text is 0.81%. AMEC notes that the latter estimate is almost identical to the EPA default values for organic chemicals, which is 1% (EPA, 1992b). However, to be health-protective, AMEC recommends that the data from the three experiments be simply averaged without modification. The resulting 8-hour estimate of dermal absorption of pentachlorophenol is 3.24%, giving an AAF of 0.032.

**Dermal-Water**

The AAF (dermal-water) is used when estimating the human risks posed by dermally contacting surface water when bathing or wading or swimming. The methodology for quantitating risks posed by this exposure pathway uses a chemical-specific permeability constant that estimates the rate at which the chemical passes into and through the skin from an aqueous solution. By definition, the dose estimated by this procedure is an absorbed dose. Most dose-response criteria, however, are based on administered doses. An adjustment is necessary to account for the absorption in the dose-response study. In order to use consistent dose-response criteria across all exposure pathways, the AAF is used to make an adjustment to the absorbed dermal dose, instead of adjusting the dose-response criteria. Here, the AAF is defined as (100%)/(estimated absorption in the dose-response study). For pentachlorophenol, the AAF (dermal-water) is 100%/100% = 1.0.

**Summary of AAFs for Pentachlorophenol**

| | |
|---|---|
| Oral-Diet | 1.0 |
| Oral-water | 1.0 |
| Oral-soil | 1.0 |
| Dermal-soil | 0.032 |
| Dermal-water | 1.0 |

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# Appendix E

## Derivation of Dermal Permeability Constants for PAH's

## Derivation of $K_p$ Values from Experiments with PAHS in Aqueous Solutions

$K_p$ values for surface water and groundwater dermal risk assessment of PAHs can be derived from an experiment in which PAHs in aqueous solutions were administered to human volunteers. van Schooten et al. (1994) performed an experiment with aqueous solutions of PAHs that allows a $K_p$ for one PAH, pyrene, to be estimated. In this experiment, 11 healthy human volunteers (4 male, 7 female, aged 21-26) shampooed with a coal tar-containing shampoo, and the level of 1-hydroxypyrene in their urine was monitored as an indicator of PAH exposure. Two additional volunteers served as controls (1 male, 1 female).

The shampoo contained 2,840 mg/kg total PAH and 285 mg/kg pyrene. Shampooing was done in the evening (twice for 30 seconds). Urine was collected during the day before treatment and for two days after treatment. The average amount of 1-hydroxypyrene in the urine was 28 nmol.

To determine the amount of pyrene absorbed during the shampooing, additional information is required from the literature. An estimate is required for the fraction of absorbed pyrene that is excreted in the urine as free and conjugated 1-hydroxypyrene. Viau et al. (1995) administered 500 ug of pyrene dissolved in 3 mL of olive oil to two human volunteers (healthy nonsmoking males, aged 37 and 45). Urine was then collected for 48 hours. Free and conjugated 1-hydroxypyrene were measured in the urine. A toxicokinetic model was developed that yields estimates of the fraction of the exposure dose of pyrene that was eliminated by urinary excretion as 1-hydroxypyrene. The average fraction excreted in the urine as 1-hydroxypyrene was 3.7%. The fraction of an oral dose of pyrene that is absorbed has been estimated by Withey et al. (1991) to be 87% (see Magee et al., 1996). Thus, the fraction of the absorbed dose that is excreted as 1-hydroxypyrene is 3.7%/87% = 4.3%.

The average amount of pyrene that was absorbed in the coal tar shampoo experiment was thus, 28 nmol/0.043 = 651 nmol, or 132 ug of pyrene. Given the concentration of pyrene in the shampoo (285 ug/g), the skin area dosed (assumed to be 1140 $cm^2$), and the exposure time (0.017 hours), a $K_p$ value can be derived for the van Schooten et al. (1994) experiment. The $K_p$ value is 0.02 cm/hr assuming that the shampoo was used full strength. If the shampoo was diluted 50/50 with water when used, the experimentally derived $K_p$ value is 0.04 cm/hr.

These experimentally derived $K_p$ values are for pyrene, which is much less lipophilic than benzo(a)pyrene and other potentially carcinogenic PAH. Based on the results of VanRooij *et al.* (1995) and Roy et al. (1997), one would expect the $K_p$ for potentially carcinogenic PAHs to be significantly less than 0.02 - 0.04 cm/hr. In the experiment of Roy et al. (1997), the dermal absorption of benzo(a)pyrene was 0.5 times the value for pyrene. In the experiment of VanRooij *et al.* (1995), the dermal absorption of benzo(a)pyrene was <0.13 times the value for pyrene. Thus, an estimated $K_p$ for benzo(a)pyrene would range from 0.003 cm/hr to 0.02 cm/hr.

### Summary

A $K_p$ value for pyrene from aqueous solution has been derived from empirical experiments to be 0.02 cm/hr if the shampoo was used full strength and 0.04 cm/hr if the shampoo was diluted 50/50 with water. A reasonable $K_p$ to use for risk assessment of pyrene and other noncarcinogenic PAHs is the more conservative value for pyrene, 0.04 cm/hr.

Dermal permeability of benzo(a)pyrene and other potentially carcinogenic PAHs has been shown to be less than that of pyrene and other noncarcinogenic PAHs. Using comparative data from the literature, estimates of the $K_p$ for benzo(a)pyrene and other potentially carcinogenic PAHs would range from 0.003 cm/hr to 0.02 cm/hr. A reasonable $K_p$ to use for risk assessment of benzo(a)pyrene and other potentially carcinogenic PAHs is the more conservative value of 0.02 cm/hr.

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# Appendix F

# Human Health Risk Calculations

**Area 1**
**Human Health Risk Calculations**
**Using AMEC's Exposure Assumptions**

**Evaluation of Potential Risk to Child Recreational Visitor from Sediment using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (15-16) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Sediment (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Sediment) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 3133 |
| AF: Adherence Factor (mg/cm2) | 0.18 |
| AAF: Absorption Adjustment Factor (Dermal-Sediment) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 6 |
| BW: Body Weight (kg) | 56 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 2190 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment Concentration (mg/kg) | Oral-Sediment RAF (noncancer) Chronic | Dermal-Sediment RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Sediment HQ | Oral-Sediment AAF (cancer) | Dermal-Sediment AAF | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Sediment Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 4.0E-02 | NA | NA | NA | 1 | 0.04 | 1.4E-14 | 1.5E+05 | 2.1E-09 |
| Acenaphthene | 9.3E+01 | 1 | 1.0E-01 | 4.8E-07 | 6.0E-02 | 8.1E-06 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 1.0E-01 | 1.0E-08 | 2.0E-02 | 5.2E-07 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 1.0E-01 | 7.3E-07 | 3.0E-01 | 2.4E-06 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 2.0E-02 | 1.3E-07 | 2.0E-02 | 6.4E-06 | 1 | 0.02 | 1.1E-08 | 7.3E-01 | 8.1E-09 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 2.0E-02 | 4.2E-08 | 2.0E-02 | 2.1E-06 | 1 | 0.02 | 3.6E-09 | 7.3E+00 | 2.6E-08 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 2.0E-02 | 5.7E-08 | 2.0E-02 | 2.8E-06 | 1 | 0.02 | 4.9E-09 | 7.3E-01 | 3.6E-09 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 1.0E-01 | 3.1E-08 | 2.0E-02 | 1.6E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 2.0E-02 | 2.2E-08 | 2.0E-02 | 1.1E-06 | 1 | 0.02 | 1.9E-09 | 7.3E-02 | 1.4E-10 |
| Chrysene | 6.0E+01 | 1 | 2.0E-02 | 1.8E-07 | 2.0E-02 | 9.0E-06 | 1 | 0.02 | 1.5E-08 | 7.3E-03 | 1.1E-10 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 2.0E-02 | 4.8E-09 | 2.0E-02 | 2.4E-07 | 1 | 0.02 | 4.1E-10 | 7.3E+00 | 3.0E-09 |
| Fluoranthene | 1.8E+02 | 1 | 1.0E-01 | 9.4E-07 | 4.0E-02 | 2.3E-05 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 1.0E-01 | 4.4E-07 | 4.0E-02 | 1.1E-05 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 2.0E-02 | 1.6E-08 | 2.0E-02 | 8.2E-07 | 1 | 0.02 | 1.4E-09 | 7.3E-01 | 1.0E-09 |
| Naphthalene | 1.4E+02 | 1 | 1.0E-01 | 7.3E-07 | 2.0E-02 | 3.6E-05 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 1.0E-01 | 1.2E-06 | 2.0E-02 | 6.2E-05 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 1.0E-01 | 6.8E-07 | 3.0E-02 | 2.3E-05 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 2.0E-02 | 6.7E-08 | 2.0E-02 | 3.4E-06 | 1 | 0.02 | 5.8E-09 | 7.3E+00 | 4.2E-08 |
| Pentachlorophenol | 5.0E-01 | 1 | 3.0E-02 | 1.6E-09 | 3.0E-02 | 5.5E-08 | 1 | 0.03 | 1.4E-10 | 1.2E-01 | 1.7E-11 |
| Total Risks | | | | | | 1.9E-04 | | | | | 4.4E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Recreational Visitor from Sediment using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Sediment Ingestion and Dermal Contact |

$$ADD\ (mg/kg\text{-}day) = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Sediment (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Sediment) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 3341 |
| AF: Adherence Factor (mg/cm2) | 0.18 |
| AAF: Absorption Adjustment Factor (Dermal-Sediment) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment Concentration (mg/kg) | Oral-Sediment RAF (noncancer) Chronic | Dermal-Sediment RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Sediment HQ | Oral-Sediment AAF (cancer) | Dermal-Sediment AAF | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Sediment Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 4.0E-02 | NA | NA | NA | 1 | 0.04 | 4.5E-14 | 1.5E+05 | 6.7E-09 |
| Acenaphthene | 9.3E+01 | 1 | 1.0E-01 | 3.9E-07 | 6.0E-02 | 6.5E-06 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 1.0E-01 | 8.4E-09 | 2.0E-02 | 4.2E-07 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 1.0E-01 | 5.9E-07 | 3.0E-01 | 2.0E-06 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 2.0E-02 | 1.0E-07 | 2.0E-02 | 5.1E-06 | 1 | 0.02 | 3.5E-08 | 7.3E-01 | 2.5E-08 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 2.0E-02 | 3.3E-08 | 2.0E-02 | 1.7E-06 | 1 | 0.02 | 1.1E-08 | 7.3E+00 | 8.3E-08 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 2.0E-02 | 4.5E-08 | 2.0E-02 | 2.2E-06 | 1 | 0.02 | 1.5E-08 | 7.3E-01 | 1.1E-08 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 1.0E-01 | 2.5E-08 | 2.0E-02 | 1.3E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 2.0E-02 | 1.7E-08 | 2.0E-02 | 8.5E-07 | 1 | 0.02 | 5.8E-09 | 7.3E-02 | 4.3E-10 |
| Chrysene | 6.0E+01 | 1 | 2.0E-02 | 1.4E-07 | 2.0E-02 | 7.1E-06 | 1 | 0.02 | 4.9E-08 | 7.3E-03 | 3.6E-10 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 2.0E-02 | 3.8E-09 | 2.0E-02 | 1.9E-07 | 1 | 0.02 | 1.3E-09 | 7.3E+00 | 9.5E-09 |
| Fluoranthene | 1.8E+02 | 1 | 1.0E-01 | 7.6E-07 | 4.0E-02 | 1.9E-05 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 1.0E-01 | 3.5E-07 | 4.0E-02 | 8.8E-06 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 2.0E-02 | 1.3E-08 | 2.0E-02 | 6.5E-07 | 1 | 0.02 | 4.5E-09 | 7.3E-01 | 3.3E-09 |
| Naphthalene | 1.4E+02 | 1 | 1.0E-01 | 5.9E-07 | 2.0E-02 | 2.9E-05 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 1.0E-01 | 1.0E-06 | 2.0E-02 | 5.0E-05 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 1.0E-01 | 5.5E-07 | 3.0E-02 | 1.8E-05 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 2.0E-02 | 5.3E-08 | 2.0E-02 | 2.7E-06 | 1 | 0.02 | 1.8E-08 | 7.3E+00 | 1.3E-07 |
| Pentachlorophenol | 5.0E-01 | 1 | 3.0E-02 | 1.3E-09 | 3.0E-02 | 4.3E-08 | 1 | 0.03 | 4.5E-10 | 1.2E-01 | 5.3E-11 |
| Total Risks | | | | | | 1.5E-04 | | | | | 1.4E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Hunter from Sediment using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (15-16) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Sediment (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Sediment) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.02 |
| SA: Skin Surface Area (cm2/event) | 928 |
| AF: Adherence Factor (mg/cm2) | 0.2 |
| AAF: Absorption Adjustment Factor (Dermal-Sediment) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.02 |
| EF: Exposure Frequency (days/year) | 16 |
| ED: Exposure Duration (years) | 6 |
| BW: Body Weight (kg) | 56 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 2190 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| Compound | Sediment Concentration (mg/kg) | Noncancer Hazard Quotient: Oral-Sediment RAF (noncancer) Chronic | Dermal-Sediment RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Sediment HQ | Excess Lifetime Cancer Risk: Oral-Sediment AAF (cancer) | Dermal-Sediment AAF | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Sediment Risk (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 4.0E-02 | NA | NA | NA | 1 | 0.04 | 3.7E-15 | 1.5E+05 | 5.5E-10 |
| Acenaphthene | 9.3E+01 | 1 | 1.0E-01 | 1.0E-07 | 6.0E-02 | 1.7E-06 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 1.0E-01 | 2.2E-09 | 2.0E-02 | 1.1E-07 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 1.0E-01 | 1.6E-07 | 3.0E-01 | 5.2E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 2.0E-02 | 3.8E-08 | 2.0E-02 | 1.9E-06 | 1 | 0.02 | 3.2E-09 | 7.3E-01 | 2.4E-09 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 2.0E-02 | 1.2E-08 | 2.0E-02 | 6.1E-07 | 1 | 0.02 | 1.1E-09 | 7.3E+00 | 7.7E-09 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 2.0E-02 | 1.7E-08 | 2.0E-02 | 8.3E-07 | 1 | 0.02 | 1.4E-09 | 7.3E-01 | 1.0E-09 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 1.0E-01 | 6.7E-09 | 2.0E-02 | 3.4E-07 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 2.0E-02 | 6.3E-09 | 2.0E-02 | 3.2E-07 | 1 | 0.02 | 5.4E-10 | 7.3E-02 | 3.9E-11 |
| Chrysene | 6.0E+01 | 1 | 2.0E-02 | 5.3E-08 | 2.0E-02 | 2.6E-06 | 1 | 0.02 | 4.5E-09 | 7.3E-03 | 3.3E-11 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 2.0E-02 | 1.4E-09 | 2.0E-02 | 7.0E-08 | 1 | 0.02 | 1.2E-10 | 7.3E+00 | 8.8E-10 |
| Fluoranthene | 1.8E+02 | 1 | 1.0E-01 | 2.0E-07 | 4.0E-02 | 5.0E-06 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 1.0E-01 | 9.4E-08 | 4.0E-02 | 2.3E-06 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 2.0E-02 | 4.8E-09 | 2.0E-02 | 2.4E-07 | 1 | 0.02 | 4.1E-10 | 7.3E-01 | 3.0E-10 |
| Naphthalene | 1.4E+02 | 1 | 1.0E-01 | 1.6E-07 | 2.0E-02 | 7.8E-06 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 1.0E-01 | 2.7E-07 | 2.0E-02 | 1.3E-05 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 1.0E-01 | 1.5E-07 | 3.0E-02 | 4.8E-06 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 2.0E-02 | 2.0E-08 | 2.0E-02 | 9.8E-07 | 1 | 0.02 | 1.7E-09 | 7.3E+00 | 1.2E-08 |
| Pentachlorophenol | 5.0E-01 | 1 | 3.0E-02 | 4.5E-10 | 3.0E-02 | 1.5E-08 | 1 | 0.03 | 3.9E-11 | 1.2E-01 | 4.7E-12 |
| Total Risks | | | | | | 4.3E-05 | | | | | 1.3E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Hunter from Sediment using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Sediment Ingestion and Dermal Contact |

$$\text{ADD (mg/kg-day)} = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Sediment (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Sediment) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.02 |
| SA: Skin Surface Area (cm2/event) | 904 |
| AF: Adherence Factor (mg/cm2) | 0.2 |
| AAF: Absorption Adjustment Factor (Dermal-Sediment) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.02 |
| EF: Exposure Frequency (days/year) | 16 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment Concentration (mg/kg) | Oral-Sediment RAF (noncancer) Chronic | Dermal-Sediment RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Sediment HQ | Oral-Sediment AAF (cancer) | Dermal-Sediment AAF | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Sediment Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 4.0E-02 | NA | NA | NA | 1 | 0.04 | 1.1E-14 | 1.5E+05 | 1.7E-09 |
| Acenaphthene | 9.3E+01 | 1 | 1.0E-01 | 8.1E-08 | 6.0E-02 | 1.3E-06 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 1.0E-01 | 1.7E-09 | 2.0E-02 | 8.7E-08 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 1.0E-01 | 1.2E-07 | 3.0E-01 | 4.0E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 2.0E-02 | 2.9E-08 | 2.0E-02 | 1.5E-06 | 1 | 0.02 | 1.0E-08 | 7.3E-01 | 7.3E-09 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 2.0E-02 | 9.5E-09 | 2.0E-02 | 4.8E-07 | 1 | 0.02 | 3.3E-09 | 7.3E+00 | 2.4E-08 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 2.0E-02 | 1.3E-08 | 2.0E-02 | 6.5E-07 | 1 | 0.02 | 4.4E-09 | 7.3E-01 | 3.2E-09 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 1.0E-01 | 5.2E-09 | 2.0E-02 | 2.6E-07 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 2.0E-02 | 4.9E-09 | 2.0E-02 | 2.5E-07 | 1 | 0.02 | 1.7E-09 | 7.3E-02 | 1.2E-10 |
| Chrysene | 6.0E+01 | 1 | 2.0E-02 | 4.1E-08 | 2.0E-02 | 2.0E-06 | 1 | 0.02 | 1.4E-08 | 7.3E-03 | 1.0E-10 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 2.0E-02 | 1.1E-09 | 2.0E-02 | 5.5E-08 | 1 | 0.02 | 3.7E-10 | 7.3E+00 | 2.7E-09 |
| Fluoranthene | 1.8E+02 | 1 | 1.0E-01 | 1.6E-07 | 4.0E-02 | 3.9E-06 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 1.0E-01 | 7.3E-08 | 4.0E-02 | 1.8E-06 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 2.0E-02 | 3.8E-09 | 2.0E-02 | 1.9E-07 | 1 | 0.02 | 1.3E-09 | 7.3E-01 | 9.4E-10 |
| Naphthalene | 1.4E+02 | 1 | 1.0E-01 | 1.2E-07 | 2.0E-02 | 6.1E-06 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 1.0E-01 | 2.1E-07 | 2.0E-02 | 1.0E-05 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 1.0E-01 | 1.1E-07 | 3.0E-02 | 3.8E-06 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 2.0E-02 | 1.5E-08 | 2.0E-02 | 7.7E-07 | 1 | 0.02 | 5.3E-09 | 7.3E+00 | 3.8E-08 |
| Pentachlorophenol | 5.0E-01 | 1 | 3.0E-02 | 3.5E-10 | 3.0E-02 | 1.2E-08 | 1 | 0.03 | 1.2E-10 | 1.2E-01 | 1.5E-11 |
| Total Risks | | | | | | 3.3E-05 | | | | | 4.0E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Recreational Visitor from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (15-16) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 6 |
| BW: Body Weight (kg) | 56 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 2190 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 1.8E-04 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 4.8E-14 | 1.5E+05 | 7.2E-09 |
| Acenaphthene | 7.1E-02 | 1 | 0.1 | 2.9E-10 | 6.0E-02 | 4.9E-09 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.8E+00 | 1 | 0.1 | 7.2E-09 | 2.0E-02 | 3.6E-07 | NA | NA | NA | NA | NA |
| Anthracene | 3.0E+00 | 1 | 0.1 | 1.2E-08 | 3.0E-01 | 4.1E-08 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 6.9E-01 | 1 | 0.02 | 1.9E-09 | 2.0E-02 | 9.7E-08 | 1 | 0.02 | 1.7E-10 | 7.3E-01 | 1.2E-10 |
| Benzo(a)pyrene | 3.7E+00 | 1 | 0.02 | 1.0E-08 | 2.0E-02 | 5.1E-07 | 1 | 0.02 | 8.7E-10 | 7.3E+00 | 6.4E-09 |
| Benzo(b)fluoranthene | 3.6E+00 | 1 | 0.02 | 1.0E-08 | 2.0E-02 | 5.0E-07 | 1 | 0.02 | 8.5E-10 | 7.3E-01 | 6.2E-10 |
| Benzo(g,h,i)perylene | 2.8E+00 | 1 | 0.1 | 1.2E-08 | 2.0E-02 | 5.8E-07 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.4E+00 | 1 | 0.02 | 4.0E-09 | 2.0E-02 | 2.0E-07 | 1 | 0.02 | 3.4E-10 | 7.3E-02 | 2.5E-11 |
| Chrysene | 4.3E+00 | 1 | 0.02 | 1.2E-08 | 2.0E-02 | 6.0E-07 | 1 | 0.02 | 1.0E-09 | 7.3E-03 | 7.5E-12 |
| Dibenz(a,h)anthracene | 5.3E-01 | 1 | 0.02 | 1.5E-09 | 2.0E-02 | 7.4E-08 | 1 | 0.02 | 1.3E-10 | 7.3E+00 | 9.3E-10 |
| Fluoranthene | 7.4E-01 | 1 | 0.1 | 3.1E-09 | 4.0E-02 | 7.6E-08 | NA | NA | NA | NA | NA |
| Fluorene | 2.4E-01 | 1 | 0.1 | 9.9E-10 | 4.0E-02 | 2.5E-08 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 2.6E+00 | 1 | 0.02 | 7.2E-09 | 2.0E-02 | 3.6E-07 | 1 | 0.02 | 6.1E-10 | 7.3E-01 | 4.5E-10 |
| Naphthalene | 1.0E-01 | 1 | 0.1 | 4.2E-10 | 2.0E-02 | 2.1E-08 | NA | NA | NA | NA | NA |
| Phenanthrene | 4.0E-01 | 1 | 0.1 | 1.7E-09 | 2.0E-02 | 8.3E-08 | NA | NA | NA | NA | NA |
| Pyrene | 7.3E-01 | 1 | 0.1 | 3.0E-09 | 3.0E-02 | 1.0E-07 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E+00 | 1 | 0.02 | 1.4E-08 | 2.0E-02 | 6.8E-07 | 1 | 0.02 | 1.2E-09 | 7.3E+00 | 8.5E-09 |
| Pentachlorophenol | 2.8E+00 | 1 | 0.03 | 8.2E-09 | 3.0E-02 | 2.7E-07 | 1 | 0.03 | 7.1E-10 | 1.2E-01 | 8.5E-11 |
| Risk Total | | | | | | 3.9E-06 | | | | | 1.6E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Recreational Visitor from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Soil Ingestion and Dermal Contact |

$$\text{ADD (mg/kg-day)} = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 1.8E-04 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 1.5E-13 | 1.5E+05 | 2.3E-08 |
| Acenaphthene | 7.1E-02 | 1 | 0.1 | 2.3E-10 | 6.0E-02 | 3.9E-09 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.8E+00 | 1 | 0.1 | 5.7E-09 | 2.0E-02 | 2.9E-07 | NA | NA | NA | NA | NA |
| Anthracene | 3.0E+00 | 1 | 0.1 | 9.8E-09 | 3.0E-01 | 3.3E-08 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 6.9E-01 | 1 | 0.02 | 1.5E-09 | 2.0E-02 | 7.6E-08 | 1 | 0.02 | 5.2E-10 | 7.3E-01 | 3.8E-10 |
| Benzo(a)pyrene | 3.7E+00 | 1 | 0.02 | 8.0E-09 | 2.0E-02 | 4.0E-07 | 1 | 0.02 | 2.7E-09 | 7.3E+00 | 2.0E-08 |
| Benzo(b)fluoranthene | 3.6E+00 | 1 | 0.02 | 7.8E-09 | 2.0E-02 | 3.9E-07 | 1 | 0.02 | 2.7E-09 | 7.3E-01 | 2.0E-09 |
| Benzo(g,h,i)perylene | 2.8E+00 | 1 | 0.1 | 9.1E-09 | 2.0E-02 | 4.6E-07 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.4E+00 | 1 | 0.02 | 3.1E-09 | 2.0E-02 | 1.6E-07 | 1 | 0.02 | 1.1E-09 | 7.3E-02 | 7.8E-11 |
| Chrysene | 4.3E+00 | 1 | 0.02 | 9.3E-09 | 2.0E-02 | 4.7E-07 | 1 | 0.02 | 3.2E-09 | 7.3E-03 | 2.3E-11 |
| Dibenz(a,h)anthracene | 5.3E-01 | 1 | 0.02 | 1.2E-09 | 2.0E-02 | 5.8E-08 | 1 | 0.02 | 4.0E-10 | 7.3E+00 | 2.9E-09 |
| Fluoranthene | 7.4E-01 | 1 | 0.1 | 2.4E-09 | 4.0E-02 | 6.0E-08 | NA | NA | NA | NA | NA |
| Fluorene | 2.4E-01 | 1 | 0.1 | 7.8E-10 | 4.0E-02 | 2.0E-08 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 2.6E+00 | 1 | 0.02 | 5.6E-09 | 2.0E-02 | 2.8E-07 | 1 | 0.02 | 1.9E-09 | 7.3E-01 | 1.4E-09 |
| Naphthalene | 1.0E-01 | 1 | 0.1 | 3.3E-10 | 2.0E-02 | 1.7E-08 | NA | NA | NA | NA | NA |
| Phenanthrene | 4.0E-01 | 1 | 0.1 | 1.3E-09 | 2.0E-02 | 6.5E-08 | NA | NA | NA | NA | NA |
| Pyrene | 7.3E-01 | 1 | 0.1 | 2.4E-09 | 3.0E-02 | 7.9E-08 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E+00 | 1 | 0.02 | 1.1E-08 | 2.0E-02 | 5.3E-07 | 1 | 0.02 | 3.7E-09 | 7.3E+00 | 2.7E-08 |
| Pentachlorophenol | 2.8E+00 | 1 | 0.03 | 6.5E-09 | 3.0E-02 | 2.2E-07 | 1 | 0.03 | 2.2E-09 | 1.2E-01 | 2.7E-10 |
| Risk Total | | | | | | 3.1E-06 | | | | | 5.0E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Hunter from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (15-16) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.17 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.17 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 6 |
| BW: Body Weight (kg) | 56 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 2190 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 1.8E-04 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 9.6E-14 | 1.5E+05 | 1.4E-08 |
| Acenaphthene | 7.1E-02 | 1 | 0.1 | 5.9E-10 | 6.0E-02 | 9.8E-09 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.8E+00 | 1 | 0.1 | 1.4E-08 | 2.0E-02 | 7.2E-07 | NA | NA | NA | NA | NA |
| Anthracene | 3.0E+00 | 1 | 0.1 | 2.5E-08 | 3.0E-01 | 8.2E-08 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 6.9E-01 | 1 | 0.02 | 3.9E-09 | 2.0E-02 | 1.9E-07 | 1 | 0.02 | 3.3E-10 | 7.3E-01 | 2.4E-10 |
| Benzo(a)pyrene | 3.7E+00 | 1 | 0.02 | 2.0E-08 | 2.0E-02 | 1.0E-06 | 1 | 0.02 | 1.7E-09 | 7.3E+00 | 1.3E-08 |
| Benzo(b)fluoranthene | 3.6E+00 | 1 | 0.02 | 2.0E-08 | 2.0E-02 | 1.0E-06 | 1 | 0.02 | 1.7E-09 | 7.3E-01 | 1.2E-09 |
| Benzo(g,h,i)perylene | 2.8E+00 | 1 | 0.1 | 2.3E-08 | 2.0E-02 | 1.2E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.4E+00 | 1 | 0.02 | 8.0E-09 | 2.0E-02 | 4.0E-07 | 1 | 0.02 | 6.8E-10 | 7.3E-02 | 5.0E-11 |
| Chrysene | 4.3E+00 | 1 | 0.02 | 2.4E-08 | 2.0E-02 | 1.2E-06 | 1 | 0.02 | 2.0E-09 | 7.3E-03 | 1.5E-11 |
| Dibenz(a,h)anthracene | 5.3E-01 | 1 | 0.02 | 3.0E-09 | 2.0E-02 | 1.5E-07 | 1 | 0.02 | 2.5E-10 | 7.3E+00 | 1.9E-09 |
| Fluoranthene | 7.4E-01 | 1 | 0.1 | 6.1E-09 | 4.0E-02 | 1.5E-07 | NA | NA | NA | NA | NA |
| Fluorene | 2.4E-01 | 1 | 0.1 | 2.0E-09 | 4.0E-02 | 4.9E-08 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 2.6E+00 | 1 | 0.02 | 1.4E-08 | 2.0E-02 | 7.2E-07 | 1 | 0.02 | 1.2E-09 | 7.3E-01 | 9.0E-10 |
| Naphthalene | 1.0E-01 | 1 | 0.1 | 8.4E-10 | 2.0E-02 | 4.2E-08 | NA | NA | NA | NA | NA |
| Phenanthrene | 4.0E-01 | 1 | 0.1 | 3.3E-09 | 2.0E-02 | 1.7E-07 | NA | NA | NA | NA | NA |
| Pyrene | 7.3E-01 | 1 | 0.1 | 6.0E-09 | 3.0E-02 | 2.0E-07 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E+00 | 1 | 0.02 | 2.7E-08 | 2.0E-02 | 1.4E-06 | 1 | 0.02 | 2.3E-09 | 7.3E+00 | 1.7E-08 |
| Pentachlorophenol | 2.8E+00 | 1 | 0.03 | 1.6E-08 | 3.0E-02 | 5.5E-07 | 1 | 0.03 | 1.4E-09 | 1.2E-01 | 1.7E-10 |
| Risk Total | | | | | | 7.8E-06 | | | | | 3.2E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Hunter from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.17 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.17 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 1.8E-04 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 3.0E-13 | 1.5E+05 | 4.5E-08 |
| Acenaphthene | 7.1E-02 | 1 | 0.1 | 4.6E-10 | 6.0E-02 | 7.7E-09 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.8E+00 | 1 | 0.1 | 1.1E-08 | 2.0E-02 | 5.7E-07 | NA | NA | NA | NA | NA |
| Anthracene | 3.0E+00 | 1 | 0.1 | 2.0E-08 | 3.0E-01 | 6.5E-08 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 6.9E-01 | 1 | 0.02 | 3.0E-09 | 2.0E-02 | 1.5E-07 | 1 | 0.02 | 1.0E-09 | 7.3E-01 | 7.6E-10 |
| Benzo(a)pyrene | 3.7E+00 | 1 | 0.02 | 1.6E-08 | 2.0E-02 | 8.0E-07 | 1 | 0.02 | 5.5E-09 | 7.3E+00 | 4.0E-08 |
| Benzo(b)fluoranthene | 3.6E+00 | 1 | 0.02 | 1.6E-08 | 2.0E-02 | 7.8E-07 | 1 | 0.02 | 5.4E-09 | 7.3E-01 | 3.9E-09 |
| Benzo(g,h,i)perylene | 2.8E+00 | 1 | 0.1 | 1.8E-08 | 2.0E-02 | 9.1E-07 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.4E+00 | 1 | 0.02 | 6.2E-09 | 2.0E-02 | 3.1E-07 | 1 | 0.02 | 2.1E-09 | 7.3E-02 | 1.6E-10 |
| Chrysene | 4.3E+00 | 1 | 0.02 | 1.9E-08 | 2.0E-02 | 9.3E-07 | 1 | 0.02 | 6.4E-09 | 7.3E-03 | 4.7E-11 |
| Dibenz(a,h)anthracene | 5.3E-01 | 1 | 0.02 | 2.3E-09 | 2.0E-02 | 1.2E-07 | 1 | 0.02 | 7.9E-10 | 7.3E+00 | 5.8E-09 |
| Fluoranthene | 7.4E-01 | 1 | 0.1 | 4.8E-09 | 4.0E-02 | 1.2E-07 | NA | NA | NA | NA | NA |
| Fluorene | 2.4E-01 | 1 | 0.1 | 1.6E-09 | 4.0E-02 | 3.9E-08 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 2.6E+00 | 1 | 0.02 | 1.1E-08 | 2.0E-02 | 5.6E-07 | 1 | 0.02 | 3.8E-09 | 7.3E-01 | 2.8E-09 |
| Naphthalene | 1.0E-01 | 1 | 0.1 | 6.6E-10 | 2.0E-02 | 3.3E-08 | NA | NA | NA | NA | NA |
| Phenanthrene | 4.0E-01 | 1 | 0.1 | 2.6E-09 | 2.0E-02 | 1.3E-07 | NA | NA | NA | NA | NA |
| Pyrene | 7.3E-01 | 1 | 0.1 | 4.7E-09 | 3.0E-02 | 1.6E-07 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E+00 | 1 | 0.02 | 2.1E-08 | 2.0E-02 | 1.1E-06 | 1 | 0.02 | 7.3E-09 | 7.3E+00 | 5.3E-08 |
| Pentachlorophenol | 2.8E+00 | 1 | 0.03 | 1.3E-08 | 3.0E-02 | 4.3E-07 | 1 | 0.03 | 4.4E-09 | 1.2E-01 | 5.3E-10 |
| Risk Total | | | | | | 6.1E-06 | | | | | 9.9E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Recreational Visitor from Surface Water using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (15-16) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 1 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3133 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 12 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 6 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 2190 | |
| BW: Body Weight | kg | 56 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | EPC | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Risk(SW) | HI(SW) |
| Acenaphthene | 0.0E+00 | 0.06 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Acenaphthylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Anthracene | 0.0E+00 | 0.3 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(a)anthracene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(a)pyrene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(g,h,i)perylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(k)fluoranthene | 0.0E+00 | 0.02 | 0.073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 0.0E+00 | 0.02 | 0.0073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Dibenz(a,h)anthracene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Fluoranthene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Fluorene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Indeno(1,2,3-cd)pyrene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Naphthalene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Phenanthrene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Pyrene | 0.0E+00 | 0.03 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| BAP-TEQ | 5.8E-03 | 0.02 | 7.3 | 1 | 3.4E-08 | 2.5E-07 | 3.4E-08 | 1.7E-06 | 0.02 | 1 | 2.1E-07 | 1.6E-06 | 2.1E-07 | 1.1E-05 | 1.8E-06 | 1.2E-05 |
| Pentachlorophenol | 4.1E-04 | 0.03 | 0.12 | 1 | 2.4E-09 | 2.9E-10 | 2.4E-09 | 8.0E-08 | 0.65 | 1 | 4.9E-07 | 5.9E-08 | 4.9E-07 | 1.6E-05 | 5.9E-08 | 1.6E-05 |
| Total | | | | | | 2.9E-10 | | 8.0E-08 | | | | 5.9E-08 | | 1.6E-05 | 5.9E-08 | 1.6E-05 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium
Only one sample collected in this area
All individual PAHs were non-detect, but detection limit was elevated (5ug/L), zero assumed for all PAHs.

**Evaluation of Potential Risk to Adult Recreational Visitor from Surface Water using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 1 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3341 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 12 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | EPC | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Risk(SW) | HI(SW) |
| Acenaphthene | 0.0E+00 | 0.06 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Acenaphthylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Anthracene | 0.0E+00 | 0.3 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(a)anthracene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(a)pyrene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(g,h,i)perylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(k)fluoranthene | 0.0E+00 | 0.02 | 0.073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 0.0E+00 | 0.02 | 0.0073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Dibenz(a,h)anthracene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Fluoranthene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Fluorene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Indeno(1,2,3-cd)pyrene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Naphthalene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Phenanthrene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Pyrene | 0.0E+00 | 0.03 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| BAP-TEQ | 5.8E-03 | 0.02 | 7.3 | 1 | 2.6E-08 | 1.9E-07 | 2.6E-08 | 1.3E-06 | 0.02 | 1 | 1.8E-07 | 1.3E-06 | 1.8E-07 | 8.8E-06 | 1.5E-06 | 1.0E-05 |
| Pentachlorophenol | 4.1E-04 | 0.03 | 0.12 | 1 | 1.9E-09 | 2.3E-10 | 1.9E-09 | 6.3E-08 | 0.65 | 1 | 4.1E-07 | 4.9E-08 | 4.1E-07 | 1.4E-05 | 4.9E-08 | 1.4E-05 |
| Total | | | | | | 2.3E-10 | | 6.3E-08 | | | | 4.9E-08 | | 1.4E-05 | 4.9E-08 | 1.4E-05 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium
All PAHs were non-detect in this area: 0.0025 mg/L is 1.2 the detection limit for PAHs

**Evaluation of Potential Risk to Child Hunter from Surface Water using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (15-16) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 1 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 928 | |
| ET: Surface Water Exposure Time | h/d | 0.5 | |
| EF: Surface Water Exposure Frequency | d/y | 16 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 6 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 2190 | |
| BW: Body Weight | kg | 56 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | EPC | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Risk(SW) | HI(SW) |
| Acenaphthene | 0.0E+00 | 0.06 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Acenaphthylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Anthracene | 0.0E+00 | 0.3 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(a)anthracene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(a)pyrene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(g,h,i)perylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(k)fluoranthene | 0.0E+00 | 0.02 | 0.073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 0.0E+00 | 0.02 | 0.0073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Dibenz(a,h)anthracene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Fluoranthene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Fluorene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Indeno(1,2,3-cd)pyrene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Naphthalene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Phenanthrene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Pyrene | 0.0E+00 | 0.03 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| BAP-TEQ | 5.8E-03 | 0.02 | 7.3 | 1 | 4.5E-08 | 3.3E-07 | 4.5E-08 | 2.3E-06 | 0.02 | 1 | 4.2E-08 | 3.1E-07 | 4.2E-08 | 2.1E-06 | 6.4E-07 | 4.4E-06 |
| Pentachlorophenol | 4.1E-04 | 0.03 | 0.12 | 1 | 3.2E-09 | 3.9E-10 | 3.2E-09 | 1.1E-07 | 0.65 | 1 | 9.7E-08 | 1.2E-08 | 9.7E-08 | 3.2E-06 | 1.2E-08 | 3.3E-06 |
| Total | | | | | | 3.9E-10 | | 1.1E-07 | | | | 1.2E-08 | | 3.2E-06 | 1.2E-08 | 3.3E-06 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium
All PAHs were non-detect in this area: 0.0025 mg/L is 1.2 the detection limit for PAHs

**Evaluation of Potential Risk to Adult Hunter from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 1 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 904 | |
| ET: Surface Water Exposure Time | h/d | 0.5 | |
| EF: Surface Water Exposure Frequency | d/y | 16 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | Incidental Ingestion RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Dermal Contact Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Total Risk(SW) | HI(SW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 0.0E+00 | 0.06 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Acenaphthylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Anthracene | 0.0E+00 | 0.3 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(a)anthracene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(a)pyrene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(g,h,i)perylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(k)fluoranthene | 0.0E+00 | 0.02 | 0.073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 0.0E+00 | 0.02 | 0.0073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Dibenz(a,h)anthracene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Fluoranthene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Fluorene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Indeno(1,2,3-cd)pyrene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Naphthalene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Phenanthrene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Pyrene | 0.0E+00 | 0.03 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| BAP-TEQ | 5.8E-03 | 0.02 | 7.3 | 1 | 3.5E-08 | 2.6E-07 | 3.5E-08 | 1.8E-06 | 0.02 | 1 | 3.2E-08 | 2.3E-07 | 3.2E-08 | 1.6E-06 | 4.9E-07 | 3.4E-06 |
| Pentachlorophenol | 4.1E-04 | 0.03 | 0.12 | 1 | 2.5E-09 | 3.0E-10 | 2.5E-09 | 8.3E-08 | 0.65 | 1 | 7.4E-08 | 8.8E-09 | 7.4E-08 | 2.5E-06 | 9.1E-09 | 2.5E-06 |
| Total | | | | | | 3.0E-10 | | 8.3E-08 | | | | 8.8E-09 | | 2.5E-06 | 9.1E-09 | 2.5E-06 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium
All PAHs were non-detect in this area: 0.0025 mg/L is 1.2 the detection limit for PAHs

**Area 2**
**Human Health Risk Calculations**
**Using AMEC's Exposure Assumptions**

**Evaluation of Potential Risk to Child Recreational Visitor from Sediment using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (15-16) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Sediment (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Sediment) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 3133 |
| AF: Adherence Factor (mg/cm2) | 0.18 |
| AAF: Absorption Adjustment Factor (Dermal-Sediment) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 6 |
| BW: Body Weight (kg) | 56 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 2190 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment Concentration (mg/kg) | Oral-Sediment RAF (noncancer) Chronic | Dermal-Sediment RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Sediment HQ | Oral-Sediment AAF (cancer) | Dermal-Sediment AAF | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Sediment Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 4.0E-02 | NA | NA | NA | 1 | 0.04 | 1.4E-14 | 1.5E+05 | 2.1E-09 |
| Acenaphthene | 9.3E+01 | 1 | 1.0E-01 | 4.8E-07 | 6.0E-02 | 8.1E-06 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 1.0E-01 | 1.0E-08 | 2.0E-02 | 5.2E-07 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 1.0E-01 | 7.3E-07 | 3.0E-01 | 2.4E-06 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 2.0E-02 | 1.3E-07 | 2.0E-02 | 6.4E-06 | 1 | 0.02 | 1.1E-08 | 7.3E-01 | 8.1E-09 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 2.0E-02 | 4.2E-08 | 2.0E-02 | 2.1E-06 | 1 | 0.02 | 3.6E-09 | 7.3E+00 | 2.6E-08 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 2.0E-02 | 5.7E-08 | 2.0E-02 | 2.8E-06 | 1 | 0.02 | 4.9E-09 | 7.3E-01 | 3.6E-09 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 1.0E-01 | 3.1E-08 | 2.0E-02 | 1.6E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 2.0E-02 | 2.2E-08 | 2.0E-02 | 1.1E-06 | 1 | 0.02 | 1.9E-09 | 7.3E-02 | 1.4E-10 |
| Chrysene | 6.0E+01 | 1 | 2.0E-02 | 1.8E-07 | 2.0E-02 | 9.0E-06 | 1 | 0.02 | 1.5E-08 | 7.3E-03 | 1.1E-10 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 2.0E-02 | 4.8E-09 | 2.0E-02 | 2.4E-07 | 1 | 0.02 | 4.1E-10 | 7.3E+00 | 3.0E-09 |
| Fluoranthene | 1.8E+02 | 1 | 1.0E-01 | 9.4E-07 | 4.0E-02 | 2.3E-05 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 1.0E-01 | 4.4E-07 | 4.0E-02 | 1.1E-05 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 2.0E-02 | 1.6E-08 | 2.0E-02 | 8.2E-07 | 1 | 0.02 | 1.4E-09 | 7.3E-01 | 1.0E-09 |
| Naphthalene | 1.4E+02 | 1 | 1.0E-01 | 7.3E-07 | 2.0E-02 | 3.6E-05 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 1.0E-01 | 1.2E-06 | 2.0E-02 | 6.2E-05 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 1.0E-01 | 6.8E-07 | 3.0E-02 | 2.3E-05 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 2.0E-02 | 6.7E-08 | 2.0E-02 | 3.4E-06 | 1 | 0.02 | 5.8E-09 | 7.3E+00 | 4.2E-08 |
| Pentachlorophenol | 5.0E-01 | 1 | 3.0E-02 | 1.6E-09 | 3.0E-02 | 5.5E-08 | 1 | 0.03 | 1.4E-10 | 1.2E-01 | 1.7E-11 |
| Total Risks | | | | | | 1.9E-04 | | | | | 4.4E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Recreational Visitor from Sediment using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Sediment Ingestion and Dermal Contact |

$$\text{ADD (mg/kg-day)} = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Sediment (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Sediment) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 3341 |
| AF: Adherence Factor (mg/cm2) | 0.18 |
| AAF: Absorption Adjustment Factor (Dermal-Sediment) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment Concentration (mg/kg) | Oral-Sediment RAF (noncancer) Chronic | Dermal-Sediment RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Sediment HQ | Oral-Sediment AAF (cancer) | Dermal-Sediment AAF | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Sediment Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 4.0E-02 | NA | NA | NA | 1 | 0.04 | 4.5E-14 | 1.5E+05 | 6.7E-09 |
| Acenaphthene | 9.3E+01 | 1 | 1.0E-01 | 3.9E-07 | 6.0E-02 | 6.5E-06 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 1.0E-01 | 8.4E-09 | 2.0E-02 | 4.2E-07 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 1.0E-01 | 5.9E-07 | 3.0E-01 | 2.0E-06 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 2.0E-02 | 1.0E-07 | 2.0E-02 | 5.1E-06 | 1 | 0.02 | 3.5E-08 | 7.3E-01 | 2.5E-08 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 2.0E-02 | 3.3E-08 | 2.0E-02 | 1.7E-06 | 1 | 0.02 | 1.1E-08 | 7.3E+00 | 8.3E-08 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 2.0E-02 | 4.5E-08 | 2.0E-02 | 2.2E-06 | 1 | 0.02 | 1.5E-08 | 7.3E-01 | 1.1E-08 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 1.0E-01 | 2.5E-08 | 2.0E-02 | 1.3E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 2.0E-02 | 1.7E-08 | 2.0E-02 | 8.5E-07 | 1 | 0.02 | 5.8E-09 | 7.3E-02 | 4.3E-10 |
| Chrysene | 6.0E+01 | 1 | 2.0E-02 | 1.4E-07 | 2.0E-02 | 7.1E-06 | 1 | 0.02 | 4.9E-08 | 7.3E-03 | 3.6E-10 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 2.0E-02 | 3.8E-09 | 2.0E-02 | 1.9E-07 | 1 | 0.02 | 1.3E-09 | 7.3E+00 | 9.5E-09 |
| Fluoranthene | 1.8E+02 | 1 | 1.0E-01 | 7.6E-07 | 4.0E-02 | 1.9E-05 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 1.0E-01 | 3.5E-07 | 4.0E-02 | 8.8E-06 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 2.0E-02 | 1.3E-08 | 2.0E-02 | 6.5E-07 | 1 | 0.02 | 4.5E-09 | 7.3E-01 | 3.3E-09 |
| Naphthalene | 1.4E+02 | 1 | 1.0E-01 | 5.9E-07 | 2.0E-02 | 2.9E-05 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 1.0E-01 | 1.0E-06 | 2.0E-02 | 5.0E-05 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 1.0E-01 | 5.5E-07 | 3.0E-02 | 1.8E-05 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 2.0E-02 | 5.3E-08 | 2.0E-02 | 2.7E-06 | 1 | 0.02 | 1.8E-08 | 7.3E+00 | 1.3E-07 |
| Pentachlorophenol | 5.0E-01 | 1 | 3.0E-02 | 1.3E-09 | 3.0E-02 | 4.3E-08 | 1 | 0.03 | 4.5E-10 | 1.2E-01 | 5.3E-11 |
| Total Risks | | | | | | 1.5E-04 | | | | | 1.4E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Hunter from Sediment using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (15-16) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Sediment Ingestion and Dermal Contact |

$$\text{ADD (mg/kg-day)} = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Sediment (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Sediment) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.02 |
| SA: Skin Surface Area (cm2/event) | 928 |
| AF: Adherence Factor (mg/cm2) | 0.2 |
| AAF: Absorption Adjustment Factor (Dermal-Sediment) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.02 |
| EF: Exposure Frequency (days/year) | 16 |
| ED: Exposure Duration (years) | 6 |
| BW: Body Weight (kg) | 56 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 2190 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| Compound | Sediment Concentration (mg/kg) | Noncancer Hazard Quotient: Oral-Sediment RAF (noncancer) Chronic | Dermal-Sediment RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Sediment HQ | Excess Lifetime Cancer Risk: Oral-Sediment AAF (cancer) | Dermal-Sediment AAF | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Sediment Risk (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 4.0E-02 | NA | NA | NA | 1 | 0.04 | 3.7E-15 | 1.5E+05 | 5.5E-10 |
| Acenaphthene | 9.3E+01 | 1 | 1.0E-01 | 1.0E-07 | 6.0E-02 | 1.7E-06 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 1.0E-01 | 2.2E-09 | 2.0E-02 | 1.1E-07 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 1.0E-01 | 1.6E-07 | 3.0E-01 | 5.2E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 2.0E-02 | 3.8E-08 | 2.0E-02 | 1.9E-06 | 1 | 0.02 | 3.2E-09 | 7.3E-01 | 2.4E-09 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 2.0E-02 | 1.2E-08 | 2.0E-02 | 6.1E-07 | 1 | 0.02 | 1.1E-09 | 7.3E+00 | 7.7E-09 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 2.0E-02 | 1.7E-08 | 2.0E-02 | 8.3E-07 | 1 | 0.02 | 1.4E-09 | 7.3E-01 | 1.0E-09 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 1.0E-01 | 6.7E-09 | 2.0E-02 | 3.4E-07 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 2.0E-02 | 6.3E-09 | 2.0E-02 | 3.2E-07 | 1 | 0.02 | 5.4E-10 | 7.3E-02 | 3.9E-11 |
| Chrysene | 6.0E+01 | 1 | 2.0E-02 | 5.3E-08 | 2.0E-02 | 2.6E-06 | 1 | 0.02 | 4.5E-09 | 7.3E-03 | 3.3E-11 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 2.0E-02 | 1.4E-09 | 2.0E-02 | 7.0E-08 | 1 | 0.02 | 1.2E-10 | 7.3E+00 | 8.8E-10 |
| Fluoranthene | 1.8E+02 | 1 | 1.0E-01 | 2.0E-07 | 4.0E-02 | 5.0E-06 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 1.0E-01 | 9.4E-08 | 4.0E-02 | 2.3E-06 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 2.0E-02 | 4.8E-09 | 2.0E-02 | 2.4E-07 | 1 | 0.02 | 4.1E-10 | 7.3E-01 | 3.0E-10 |
| Naphthalene | 1.4E+02 | 1 | 1.0E-01 | 1.6E-07 | 2.0E-02 | 7.8E-06 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 1.0E-01 | 2.7E-07 | 2.0E-02 | 1.3E-05 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 1.0E-01 | 1.5E-07 | 3.0E-02 | 4.8E-06 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 2.0E-02 | 2.0E-08 | 2.0E-02 | 9.8E-07 | 1 | 0.02 | 1.7E-09 | 7.3E+00 | 1.2E-08 |
| Pentachlorophenol | 5.0E-01 | 1 | 3.0E-02 | 4.5E-10 | 3.0E-02 | 1.5E-08 | 1 | 0.03 | 3.9E-11 | 1.2E-01 | 4.7E-12 |
| Total Risks | | | | | | 4.3E-05 | | | | | 1.3E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Hunter from Sediment using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Sediment (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Sediment) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.02 |
| SA: Skin Surface Area (cm2/event) | 904 |
| AF: Adherence Factor (mg/cm2) | 0.2 |
| AAF: Absorption Adjustment Factor (Dermal-Sediment) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.02 |
| EF: Exposure Frequency (days/year) | 16 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment Concentration (mg/kg) | Oral-Sediment RAF (noncancer) Chronic | Dermal-Sediment RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Sediment HQ | Oral-Sediment AAF (cancer) | Dermal-Sediment AAF | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Sediment Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 4.0E-02 | NA | NA | NA | 1 | 0.04 | 1.1E-14 | 1.5E+05 | 1.7E-09 |
| Acenaphthene | 9.3E+01 | 1 | 1.0E-01 | 8.1E-08 | 6.0E-02 | 1.3E-06 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 1.0E-01 | 1.7E-09 | 2.0E-02 | 8.7E-08 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 1.0E-01 | 1.2E-07 | 3.0E-01 | 4.0E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 2.0E-02 | 2.9E-08 | 2.0E-02 | 1.5E-06 | 1 | 0.02 | 1.0E-08 | 7.3E-01 | 7.3E-09 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 2.0E-02 | 9.5E-09 | 2.0E-02 | 4.8E-07 | 1 | 0.02 | 3.3E-09 | 7.3E+00 | 2.4E-08 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 2.0E-02 | 1.3E-08 | 2.0E-02 | 6.5E-07 | 1 | 0.02 | 4.4E-09 | 7.3E-01 | 3.2E-09 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 1.0E-01 | 5.2E-09 | 2.0E-02 | 2.6E-07 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 2.0E-02 | 4.9E-09 | 2.0E-02 | 2.5E-07 | 1 | 0.02 | 1.7E-09 | 7.3E-02 | 1.2E-10 |
| Chrysene | 6.0E+01 | 1 | 2.0E-02 | 4.1E-08 | 2.0E-02 | 2.0E-06 | 1 | 0.02 | 1.4E-08 | 7.3E-03 | 1.0E-10 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 2.0E-02 | 1.1E-09 | 2.0E-02 | 5.5E-08 | 1 | 0.02 | 3.7E-10 | 7.3E+00 | 2.7E-09 |
| Fluoranthene | 1.8E+02 | 1 | 1.0E-01 | 1.6E-07 | 4.0E-02 | 3.9E-06 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 1.0E-01 | 7.3E-08 | 4.0E-02 | 1.8E-06 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 2.0E-02 | 3.8E-09 | 2.0E-02 | 1.9E-07 | 1 | 0.02 | 1.3E-09 | 7.3E-01 | 9.4E-10 |
| Naphthalene | 1.4E+02 | 1 | 1.0E-01 | 1.2E-07 | 2.0E-02 | 6.1E-06 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 1.0E-01 | 2.1E-07 | 2.0E-02 | 1.0E-05 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 1.0E-01 | 1.1E-07 | 3.0E-02 | 3.8E-06 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 2.0E-02 | 1.5E-08 | 2.0E-02 | 7.7E-07 | 1 | 0.02 | 5.3E-09 | 7.3E+00 | 3.8E-08 |
| Pentachlorophenol | 5.0E-01 | 1 | 3.0E-02 | 3.5E-10 | 3.0E-02 | 1.2E-08 | 1 | 0.03 | 1.2E-10 | 1.2E-01 | 1.5E-11 |
| Total Risks | | | | | | 3.3E-05 | | | | | 4.0E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Recreational Visitor from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (15-16) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Soil Ingestion and Dermal Contact |

$$\text{ADD (mg/kg-day)} = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 6 |
| BW: Body Weight (kg) | 56 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 2190 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 2.9E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 7.9E-15 | 1.5E+05 | 1.2E-09 |
| Acenaphthene | 1.5E-01 | 1 | 0.1 | 6.4E-10 | 6.0E-02 | 1.1E-08 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.7E-01 | 1 | 0.1 | 7.0E-10 | 2.0E-02 | 3.5E-08 | NA | NA | NA | NA | NA |
| Anthracene | 2.5E-01 | 1 | 0.1 | 1.0E-09 | 3.0E-01 | 3.4E-09 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.1E-01 | 1 | 0.02 | 3.1E-10 | 2.0E-02 | 1.6E-08 | 1 | 0.02 | 2.7E-11 | 7.3E-01 | 2.0E-11 |
| Benzo(a)pyrene | 2.1E-01 | 1 | 0.02 | 5.8E-10 | 2.0E-02 | 2.9E-08 | 1 | 0.02 | 5.0E-11 | 7.3E+00 | 3.6E-10 |
| Benzo(b)fluoranthene | 2.7E-01 | 1 | 0.02 | 7.5E-10 | 2.0E-02 | 3.8E-08 | 1 | 0.02 | 6.4E-11 | 7.3E-01 | 4.7E-11 |
| Benzo(g,h,i)perylene | 4.4E-01 | 1 | 0.1 | 1.8E-09 | 2.0E-02 | 9.0E-08 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E-01 | 1 | 0.02 | 3.1E-10 | 2.0E-02 | 1.5E-08 | 1 | 0.02 | 2.6E-11 | 7.3E-02 | 1.9E-12 |
| Chrysene | 2.2E-01 | 1 | 0.02 | 6.2E-10 | 2.0E-02 | 3.1E-08 | 1 | 0.02 | 5.3E-11 | 7.3E-03 | 3.9E-13 |
| Dibenz(a,h)anthracene | 1.5E-01 | 1 | 0.02 | 4.0E-10 | 2.0E-02 | 2.0E-08 | 1 | 0.02 | 3.5E-11 | 7.3E+00 | 2.5E-10 |
| Fluoranthene | 1.2E-01 | 1 | 0.1 | 5.0E-10 | 4.0E-02 | 1.2E-08 | NA | NA | NA | NA | NA |
| Fluorene | 1.3E-01 | 1 | 0.1 | 5.3E-10 | 4.0E-02 | 1.3E-08 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 3.8E-01 | 1 | 0.02 | 1.1E-09 | 2.0E-02 | 5.3E-08 | 1 | 0.02 | 9.1E-11 | 7.3E-01 | 6.6E-11 |
| Naphthalene | 1.3E-01 | 1 | 0.1 | 5.5E-10 | 2.0E-02 | 2.7E-08 | NA | NA | NA | NA | NA |
| Phenanthrene | 9.6E-02 | 1 | 0.1 | 4.0E-10 | 2.0E-02 | 2.0E-08 | NA | NA | NA | NA | NA |
| Pyrene | 1.2E-01 | 1 | 0.1 | 4.9E-10 | 3.0E-02 | 1.6E-08 | NA | NA | NA | NA | NA |
| BAP-TEQ | 3.5E-01 | 1 | 0.02 | 9.8E-10 | 2.0E-02 | 4.9E-08 | 1 | 0.02 | 8.4E-11 | 7.3E+00 | 6.1E-10 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.03 | 4.1E-09 | 3.0E-02 | 1.4E-07 | 1 | 0.03 | 3.5E-10 | 1.2E-01 | 4.2E-11 |
| Risk Total | | | | | | 5.7E-07 | | | | | 2.0E-09 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Recreational Visitor from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Soil Ingestion and Dermal Contact |

$$\text{ADD (mg/kg-day)} = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 2.9E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 2.5E-14 | 1.5E+05 | 3.7E-09 |
| Acenaphthene | 1.5E-01 | 1 | 0.1 | 5.0E-10 | 6.0E-02 | 8.4E-09 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.7E-01 | 1 | 0.1 | 5.5E-10 | 2.0E-02 | 2.8E-08 | NA | NA | NA | NA | NA |
| Anthracene | 2.5E-01 | 1 | 0.1 | 8.0E-10 | 3.0E-01 | 2.7E-09 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.1E-01 | 1 | 0.02 | 2.4E-10 | 2.0E-02 | 1.2E-08 | 1 | 0.02 | 8.4E-11 | 7.3E-01 | 6.1E-11 |
| Benzo(a)pyrene | 2.1E-01 | 1 | 0.02 | 4.5E-10 | 2.0E-02 | 2.3E-08 | 1 | 0.02 | 1.6E-10 | 7.3E+00 | 1.1E-09 |
| Benzo(b)fluoranthene | 2.7E-01 | 1 | 0.02 | 5.9E-10 | 2.0E-02 | 2.9E-08 | 1 | 0.02 | 2.0E-10 | 7.3E-01 | 1.5E-10 |
| Benzo(g,h,i)perylene | 4.4E-01 | 1 | 0.1 | 1.4E-09 | 2.0E-02 | 7.1E-08 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E-01 | 1 | 0.02 | 2.4E-10 | 2.0E-02 | 1.2E-08 | 1 | 0.02 | 8.2E-11 | 7.3E-02 | 6.0E-12 |
| Chrysene | 2.2E-01 | 1 | 0.02 | 4.9E-10 | 2.0E-02 | 2.4E-08 | 1 | 0.02 | 1.7E-10 | 7.3E-03 | 1.2E-12 |
| Dibenz(a,h)anthracene | 1.5E-01 | 1 | 0.02 | 3.2E-10 | 2.0E-02 | 1.6E-08 | 1 | 0.02 | 1.1E-10 | 7.3E+00 | 7.9E-10 |
| Fluoranthene | 1.2E-01 | 1 | 0.1 | 4.0E-10 | 4.0E-02 | 9.9E-09 | NA | NA | NA | NA | NA |
| Fluorene | 1.3E-01 | 1 | 0.1 | 4.2E-10 | 4.0E-02 | 1.0E-08 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 3.8E-01 | 1 | 0.02 | 8.3E-10 | 2.0E-02 | 4.2E-08 | 1 | 0.02 | 2.9E-10 | 7.3E-01 | 2.1E-10 |
| Naphthalene | 1.3E-01 | 1 | 0.1 | 4.3E-10 | 2.0E-02 | 2.2E-08 | NA | NA | NA | NA | NA |
| Phenanthrene | 9.6E-02 | 1 | 0.1 | 3.1E-10 | 2.0E-02 | 1.6E-08 | NA | NA | NA | NA | NA |
| Pyrene | 1.2E-01 | 1 | 0.1 | 3.9E-10 | 3.0E-02 | 1.3E-08 | NA | NA | NA | NA | NA |
| BAP-TEQ | 3.5E-01 | 1 | 0.02 | 7.7E-10 | 2.0E-02 | 3.8E-08 | 1 | 0.02 | 2.6E-10 | 7.3E+00 | 1.9E-09 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.03 | 3.2E-09 | 3.0E-02 | 1.1E-07 | 1 | 0.03 | 1.1E-09 | 1.2E-01 | 1.3E-10 |
| Risk Total | | | | | | 4.4E-07 | | | | | 6.2E-09 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Hunter from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (15-16) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.17 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.17 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 6 |
| BW: Body Weight (kg) | 56 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 2190 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.3E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 2.3E-14 | 1.5E+05 | 3.5E-09 |
| Acenaphthene | 1.6E-01 | 1 | 0.1 | 1.3E-09 | 6.0E-02 | 2.2E-08 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.3E-01 | 1 | 0.1 | 1.9E-09 | 2.0E-02 | 9.3E-08 | NA | NA | NA | NA | NA |
| Anthracene | 3.4E-01 | 1 | 0.1 | 2.8E-09 | 3.0E-01 | 9.2E-09 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.5E-01 | 1 | 0.02 | 8.1E-10 | 2.0E-02 | 4.0E-08 | 1 | 0.02 | 6.9E-11 | 7.3E-01 | 5.1E-11 |
| Benzo(a)pyrene | 2.8E-01 | 1 | 0.02 | 1.6E-09 | 2.0E-02 | 7.9E-08 | 1 | 0.02 | 1.4E-10 | 7.3E+00 | 9.9E-10 |
| Benzo(b)fluoranthene | 3.6E-01 | 1 | 0.02 | 2.0E-09 | 2.0E-02 | 1.0E-07 | 1 | 0.02 | 1.7E-10 | 7.3E-01 | 1.3E-10 |
| Benzo(g,h,i)perylene | 6.1E-01 | 1 | 0.1 | 5.0E-09 | 2.0E-02 | 2.5E-07 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.5E-01 | 1 | 0.02 | 8.2E-10 | 2.0E-02 | 4.1E-08 | 1 | 0.02 | 7.0E-11 | 7.3E-02 | 5.1E-12 |
| Chrysene | 3.3E-01 | 1 | 0.02 | 1.9E-09 | 2.0E-02 | 9.3E-08 | 1 | 0.02 | 1.6E-10 | 7.3E-03 | 1.2E-12 |
| Dibenz(a,h)anthracene | 1.9E-01 | 1 | 0.02 | 1.0E-09 | 2.0E-02 | 5.2E-08 | 1 | 0.02 | 8.9E-11 | 7.3E+00 | 6.5E-10 |
| Fluoranthene | 1.5E-01 | 1 | 0.1 | 1.3E-09 | 4.0E-02 | 3.1E-08 | NA | NA | NA | NA | NA |
| Fluorene | 1.7E-01 | 1 | 0.1 | 1.4E-09 | 4.0E-02 | 3.5E-08 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.4E-01 | 1 | 0.02 | 3.0E-09 | 2.0E-02 | 1.5E-07 | 1 | 0.02 | 2.6E-10 | 7.3E-01 | 1.9E-10 |
| Naphthalene | 1.6E-01 | 1 | 0.1 | 1.3E-09 | 2.0E-02 | 6.6E-08 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.3E-01 | 1 | 0.1 | 1.1E-09 | 2.0E-02 | 5.5E-08 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E-01 | 1 | 0.1 | 1.3E-09 | 3.0E-02 | 4.2E-08 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E-01 | 1 | 0.02 | 2.7E-09 | 2.0E-02 | 1.4E-07 | 1 | 0.02 | 2.3E-10 | 7.3E+00 | 1.7E-09 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.03 | 8.4E-09 | 3.0E-02 | 2.8E-07 | 1 | 0.03 | 7.2E-10 | 1.2E-01 | 8.7E-11 |
| Risk Total | | | | | | 1.4E-06 | | | | | 5.6E-09 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Hunter from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Soil Ingestion and Dermal Contact |

$$\text{ADD (mg/kg-day)} = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.17 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.17 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.3E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 7.3E-14 | 1.5E+05 | 1.1E-08 |
| Acenaphthene | 1.6E-01 | 1 | 0.1 | 1.0E-09 | 6.0E-02 | 1.7E-08 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.3E-01 | 1 | 0.1 | 1.5E-09 | 2.0E-02 | 7.4E-08 | NA | NA | NA | NA | NA |
| Anthracene | 3.4E-01 | 1 | 0.1 | 2.2E-09 | 3.0E-01 | 7.3E-09 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.5E-01 | 1 | 0.02 | 6.3E-10 | 2.0E-02 | 3.2E-08 | 1 | 0.02 | 2.2E-10 | 7.3E-01 | 1.6E-10 |
| Benzo(a)pyrene | 2.8E-01 | 1 | 0.02 | 1.2E-09 | 2.0E-02 | 6.2E-08 | 1 | 0.02 | 4.3E-10 | 7.3E+00 | 3.1E-09 |
| Benzo(b)fluoranthene | 3.6E-01 | 1 | 0.02 | 1.6E-09 | 2.0E-02 | 7.9E-08 | 1 | 0.02 | 5.4E-10 | 7.3E-01 | 4.0E-10 |
| Benzo(g,h,i)perylene | 6.1E-01 | 1 | 0.1 | 4.0E-09 | 2.0E-02 | 2.0E-07 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.5E-01 | 1 | 0.02 | 6.4E-10 | 2.0E-02 | 3.2E-08 | 1 | 0.02 | 2.2E-10 | 7.3E-02 | 1.6E-11 |
| Chrysene | 3.3E-01 | 1 | 0.02 | 1.5E-09 | 2.0E-02 | 7.3E-08 | 1 | 0.02 | 5.0E-10 | 7.3E-03 | 3.6E-12 |
| Dibenz(a,h)anthracene | 1.9E-01 | 1 | 0.02 | 8.1E-10 | 2.0E-02 | 4.1E-08 | 1 | 0.02 | 2.8E-10 | 7.3E+00 | 2.0E-09 |
| Fluoranthene | 1.5E-01 | 1 | 0.1 | 9.9E-10 | 4.0E-02 | 2.5E-08 | NA | NA | NA | NA | NA |
| Fluorene | 1.7E-01 | 1 | 0.1 | 1.1E-09 | 4.0E-02 | 2.8E-08 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.4E-01 | 1 | 0.02 | 2.4E-09 | 2.0E-02 | 1.2E-07 | 1 | 0.02 | 8.1E-10 | 7.3E-01 | 5.9E-10 |
| Naphthalene | 1.6E-01 | 1 | 0.1 | 1.0E-09 | 2.0E-02 | 5.2E-08 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.3E-01 | 1 | 0.1 | 8.7E-10 | 2.0E-02 | 4.4E-08 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E-01 | 1 | 0.1 | 1.0E-09 | 3.0E-02 | 3.3E-08 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E-01 | 1 | 0.02 | 2.1E-09 | 2.0E-02 | 1.1E-07 | 1 | 0.02 | 7.4E-10 | 7.3E+00 | 5.4E-09 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.03 | 6.6E-09 | 3.0E-02 | 2.2E-07 | 1 | 0.03 | 2.3E-09 | 1.2E-01 | 2.7E-10 |
| Risk Total | | | | | | 1.1E-06 | | | | | 1.8E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Recreational Visitor from Surface Water using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (15-16) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 2 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3133 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 12 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 6 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 2190 | |
| BW: Body Weight | kg | 56 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | EPC | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Risk(SW) | HI(SW) |
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 5.9E-09 | 9.8E-08 | 0.04 | 1 | NA | NA | 7.4E-08 | 1.2E-06 | NA | 1.3E-06 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 5.9E-09 | 2.9E-07 | 0.04 | 1 | NA | NA | 7.4E-08 | 3.7E-06 | NA | 4.0E-06 |
| Anthracene | 1.3E-04 | 0.3 | NA | 1 | NA | NA | 7.8E-10 | 2.6E-09 | 0.04 | 1 | NA | NA | 9.8E-09 | 3.3E-08 | NA | 3.5E-08 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 5.9E-11 | 4.3E-11 | 5.9E-11 | 2.9E-09 | 0.02 | 1 | 3.7E-10 | 2.7E-10 | 3.7E-10 | 1.8E-08 | 3.1E-10 | 2.1E-08 |
| Benzo(a)pyrene | 8.3E-05 | 0.02 | 7.3 | 1 | 4.9E-10 | 3.6E-09 | 4.9E-10 | 2.4E-08 | 0.02 | 1 | 3.1E-09 | 2.2E-08 | 3.1E-09 | 1.5E-07 | 2.6E-08 | 1.8E-07 |
| Benzo(b)fluoranthene | 2.4E-04 | 0.02 | 0.73 | 1 | 1.4E-09 | 1.0E-09 | 1.4E-09 | 6.9E-08 | 0.02 | 1 | 8.7E-09 | 6.3E-09 | 8.7E-09 | 4.3E-07 | 7.3E-09 | 5.0E-07 |
| Benzo(g,h,i)perylene | 3.0E-05 | 0.02 | NA | 1 | NA | NA | 1.8E-10 | 8.8E-09 | 0.04 | 1 | NA | NA | 2.2E-09 | 1.1E-07 | NA | 1.2E-07 |
| Benzo(k)fluoranthene | 6.0E-05 | 0.02 | 0.073 | 1 | 3.5E-10 | 2.6E-11 | 3.5E-10 | 1.8E-08 | 0.02 | 1 | 2.2E-09 | 1.6E-10 | 2.2E-09 | 1.1E-07 | 1.9E-10 | 1.3E-07 |
| Chrysene | 8.0E-05 | 0.02 | 0.0073 | 1 | 4.7E-10 | 3.4E-12 | 4.7E-10 | 2.3E-08 | 0.02 | 1 | 2.9E-09 | 2.1E-11 | 2.9E-09 | 1.5E-07 | 2.5E-11 | 1.7E-07 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 8.8E-11 | 6.4E-10 | 8.8E-11 | 4.4E-09 | 0.02 | 1 | 5.5E-10 | 4.0E-09 | 5.5E-10 | 2.8E-08 | 4.7E-09 | 3.2E-08 |
| Fluoranthene | 2.0E-04 | 0.04 | NA | 1 | NA | NA | 1.2E-09 | 2.9E-08 | 0.04 | 1 | NA | NA | 1.5E-08 | 3.7E-07 | NA | 3.9E-07 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 5.9E-10 | 1.5E-08 | 0.04 | 1 | NA | NA | 7.4E-09 | 1.8E-07 | NA | 2.0E-07 |
| Indeno(1,2,3-cd)pyrene | 5.7E-05 | 0.02 | 0.73 | 1 | 3.4E-10 | 2.5E-10 | 3.4E-10 | 1.7E-08 | 0.02 | 1 | 2.1E-09 | 1.5E-09 | 2.1E-09 | 1.1E-07 | 1.8E-09 | 1.2E-07 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 5.9E-09 | 2.9E-07 | 0.04 | 1 | NA | NA | 7.4E-08 | 3.7E-06 | NA | 4.0E-06 |
| Phenanthrene | 3.0E-04 | 0.02 | NA | 1 | NA | NA | 1.8E-09 | 8.8E-08 | 0.04 | 1 | NA | NA | 2.2E-08 | 1.1E-06 | NA | 1.2E-06 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 5.9E-10 | 2.0E-08 | 0.04 | 1 | NA | NA | 7.4E-09 | 2.5E-07 | NA | 2.6E-07 |
| BAP-TEQ | 3.3E-03 | 0.02 | 7.3 | 1 | 1.9E-08 | 1.4E-07 | 1.9E-08 | 9.6E-07 | 0.02 | 1 | 1.2E-07 | 8.7E-07 | 1.2E-07 | 6.0E-06 | 1.0E-06 | 6.9E-06 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 1.5E-09 | 1.8E-10 | 1.5E-09 | 4.9E-08 | 0.65 | 1 | 3.0E-07 | 3.6E-08 | 3.0E-07 | 1.0E-05 | 3.6E-08 | 1.0E-05 |
| Total | | | | | | 5.7E-09 | | 1.1E-06 | | | | 7.1E-08 | | 2.2E-05 | 7.6E-08 | 2.3E-05 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Adult Recreational Visitor from Surface Water using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 2 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3341 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 12 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | Incidental Ingestion RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Dermal Contact Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Total Risk(SW) | HI(SW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 4.6E-09 | 7.6E-08 | 0.04 | 1 | NA | NA | 6.1E-08 | 1.0E-06 | NA | 1.1E-06 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 4.6E-09 | 2.3E-07 | 0.04 | 1 | NA | NA | 6.1E-08 | 3.1E-06 | NA | 3.3E-06 |
| Anthracene | 1.3E-04 | 0.3 | NA | 1 | NA | NA | 6.1E-10 | 2.0E-09 | 0.04 | 1 | NA | NA | 8.2E-09 | 2.7E-08 | NA | 2.9E-08 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 4.6E-11 | 3.3E-11 | 4.6E-11 | 2.3E-09 | 0.02 | 1 | 3.1E-10 | 2.2E-10 | 3.1E-10 | 1.5E-08 | 2.6E-10 | 1.8E-08 |
| Benzo(a)pyrene | 8.3E-05 | 0.02 | 7.3 | 1 | 3.8E-10 | 2.8E-09 | 3.8E-10 | 1.9E-08 | 0.02 | 1 | 2.5E-09 | 1.9E-08 | 2.5E-09 | 1.3E-07 | 2.1E-08 | 1.5E-07 |
| Benzo(b)fluoranthene | 2.4E-04 | 0.02 | 0.73 | 1 | 1.1E-09 | 7.9E-10 | 1.1E-09 | 5.4E-08 | 0.02 | 1 | 7.2E-09 | 5.3E-09 | 7.2E-09 | 3.6E-07 | 6.0E-09 | 4.1E-07 |
| Benzo(g,h,i)perylene | 3.0E-05 | 0.02 | NA | 1 | NA | NA | 1.4E-10 | 6.9E-09 | 0.04 | 1 | NA | NA | 1.8E-09 | 9.2E-08 | NA | 9.9E-08 |
| Benzo(k)fluoranthene | 6.0E-05 | 0.02 | 0.073 | 1 | 2.7E-10 | 2.0E-11 | 2.7E-10 | 1.4E-08 | 0.02 | 1 | 1.8E-09 | 1.3E-10 | 1.8E-09 | 9.1E-08 | 1.5E-10 | 1.1E-07 |
| Chrysene | 8.0E-05 | 0.02 | 0.0073 | 1 | 3.7E-10 | 2.7E-12 | 3.7E-10 | 1.8E-08 | 0.02 | 1 | 2.4E-09 | 1.8E-11 | 2.4E-09 | 1.2E-07 | 2.1E-11 | 1.4E-07 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 6.9E-11 | 5.0E-10 | 6.9E-11 | 3.4E-09 | 0.02 | 1 | 4.6E-10 | 3.4E-09 | 4.6E-10 | 2.3E-08 | 3.9E-09 | 2.6E-08 |
| Fluoranthene | 2.0E-04 | 0.04 | NA | 1 | NA | NA | 9.1E-10 | 2.3E-08 | 0.04 | 1 | NA | NA | 1.2E-08 | 3.0E-07 | NA | 3.3E-07 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 4.6E-10 | 1.1E-08 | 0.04 | 1 | NA | NA | 6.1E-09 | 1.5E-07 | NA | 1.6E-07 |
| Indeno(1,2,3-cd)pyrene | 5.7E-05 | 0.02 | 0.73 | 1 | 2.6E-10 | 1.9E-10 | 2.6E-10 | 1.3E-08 | 0.02 | 1 | 1.8E-09 | 1.3E-09 | 1.8E-09 | 8.8E-08 | 1.5E-09 | 1.0E-07 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 4.6E-09 | 2.3E-07 | 0.04 | 1 | NA | NA | 6.1E-08 | 3.1E-06 | NA | 3.3E-06 |
| Phenanthrene | 3.0E-04 | 0.02 | NA | 1 | NA | NA | 1.4E-09 | 6.9E-08 | 0.04 | 1 | NA | NA | 1.8E-08 | 9.2E-07 | NA | 9.9E-07 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 4.6E-10 | 1.5E-08 | 0.04 | 1 | NA | NA | 6.1E-09 | 2.0E-07 | NA | 2.2E-07 |
| BAP-TEQ | 3.3E-03 | 0.02 | 7.3 | 1 | 1.5E-08 | 1.1E-07 | 1.5E-08 | 7.5E-07 | 0.02 | 1 | 1.0E-07 | 7.3E-07 | 1.0E-07 | 5.0E-06 | 8.4E-07 | 5.7E-06 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 1.1E-09 | 1.4E-10 | 1.1E-09 | 3.8E-08 | 0.65 | 1 | 2.5E-07 | 3.0E-08 | 2.5E-07 | 8.3E-06 | 3.0E-08 | 8.3E-06 |
| Total | | | | | | 4.5E-09 | | 8.2E-07 | | | | 5.9E-08 | | 1.8E-05 | 6.3E-08 | 1.9E-05 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Child Hunter from Surface Water using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (15-16) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 2 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 928 | |
| ET: Surface Water Exposure Time | h/d | 0.5 | |
| EF: Surface Water Exposure Frequency | d/y | 16 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 6 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 2190 | |
| BW: Body Weight | kg | 56 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | Incidental Ingestion RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Dermal Contact Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Total Risk(SW) | HI(SW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 7.8E-09 | 1.3E-07 | 0.04 | 1 | NA | NA | 1.5E-08 | 2.4E-07 | NA | 3.7E-07 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 7.8E-09 | 3.9E-07 | 0.04 | 1 | NA | NA | 1.5E-08 | 7.3E-07 | NA | 1.1E-06 |
| Anthracene | 1.3E-04 | 0.3 | NA | 1 | NA | NA | 1.0E-09 | 3.5E-09 | 0.04 | 1 | NA | NA | 1.9E-09 | 6.5E-09 | NA | 1.0E-08 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 7.8E-11 | 5.7E-11 | 7.8E-11 | 3.9E-09 | 0.02 | 1 | 7.3E-11 | 5.3E-11 | 7.3E-11 | 3.6E-09 | 1.1E-10 | 7.5E-09 |
| Benzo(a)pyrene | 8.3E-05 | 0.02 | 7.3 | 1 | 6.5E-10 | 4.8E-09 | 6.5E-10 | 3.3E-08 | 0.02 | 1 | 6.0E-10 | 4.4E-09 | 6.0E-10 | 3.0E-08 | 9.2E-09 | 6.3E-08 |
| Benzo(b)fluoranthene | 2.4E-04 | 0.02 | 0.73 | 1 | 1.8E-09 | 1.3E-09 | 1.8E-09 | 9.2E-08 | 0.02 | 1 | 1.7E-09 | 1.2E-09 | 1.7E-09 | 8.6E-08 | 2.6E-09 | 1.8E-07 |
| Benzo(g,h,i)perylene | 3.0E-05 | 0.02 | NA | 1 | NA | NA | 2.3E-10 | 1.2E-08 | 0.04 | 1 | NA | NA | 4.4E-10 | 2.2E-08 | NA | 3.4E-08 |
| Benzo(k)fluoranthene | 6.0E-05 | 0.02 | 0.073 | 1 | 4.7E-10 | 3.4E-11 | 4.7E-10 | 2.3E-08 | 0.02 | 1 | 4.3E-10 | 3.2E-11 | 4.3E-10 | 2.2E-08 | 6.6E-11 | 4.5E-08 |
| Chrysene | 8.0E-05 | 0.02 | 0.0073 | 1 | 6.3E-10 | 4.6E-12 | 6.3E-10 | 3.1E-08 | 0.02 | 1 | 5.8E-10 | 4.2E-12 | 5.8E-10 | 2.9E-08 | 8.8E-12 | 6.0E-08 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 1.2E-10 | 8.6E-10 | 1.2E-10 | 5.9E-09 | 0.02 | 1 | 1.1E-10 | 8.0E-10 | 1.1E-10 | 5.4E-09 | 1.7E-09 | 1.1E-08 |
| Fluoranthene | 2.0E-04 | 0.04 | NA | 1 | NA | NA | 1.6E-09 | 3.9E-08 | 0.04 | 1 | NA | NA | 2.9E-09 | 7.2E-08 | NA | 1.1E-07 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 7.8E-10 | 2.0E-08 | 0.04 | 1 | NA | NA | 1.5E-09 | 3.6E-08 | NA | 5.6E-08 |
| Indeno(1,2,3-cd)pyrene | 5.7E-05 | 0.02 | 0.73 | 1 | 4.5E-10 | 3.3E-10 | 4.5E-10 | 2.2E-08 | 0.02 | 1 | 4.2E-10 | 3.0E-10 | 4.2E-10 | 2.1E-08 | 6.3E-10 | 4.3E-08 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 7.8E-09 | 3.9E-07 | 0.04 | 1 | NA | NA | 1.5E-08 | 7.3E-07 | NA | 1.1E-06 |
| Phenanthrene | 3.0E-04 | 0.02 | NA | 1 | NA | NA | 2.3E-09 | 1.2E-07 | 0.04 | 1 | NA | NA | 4.4E-09 | 2.2E-07 | NA | 3.4E-07 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 7.8E-10 | 2.6E-08 | 0.04 | 1 | NA | NA | 1.5E-09 | 4.8E-08 | NA | 7.5E-08 |
| BAP-TEQ | 3.3E-03 | 0.02 | 7.3 | 1 | 2.5E-08 | 1.9E-07 | 2.5E-08 | 1.3E-06 | 0.02 | 1 | 2.4E-08 | 1.7E-07 | 2.4E-08 | 1.2E-06 | 3.6E-07 | 2.5E-06 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 2.0E-09 | 2.3E-10 | 2.0E-09 | 6.5E-08 | 0.65 | 1 | 5.9E-08 | 7.1E-09 | 5.9E-08 | 2.0E-06 | 7.3E-09 | 2.0E-06 |
| Total | | | | | | 7.6E-09 | | 1.4E-06 | | | | 1.4E-08 | | 4.3E-06 | 2.2E-08 | 5.7E-06 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Adult Hunter from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 2 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 904 | |
| ET: Surface Water Exposure Time | h/d | 0.5 | |
| EF: Surface Water Exposure Frequency | d/y | 16 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | Incidental Ingestion RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Dermal Contact Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Total Risk(SW) | HI(SW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 6.1E-09 | 1.0E-07 | 0.04 | 1 | NA | NA | 1.1E-08 | 1.8E-07 | NA | 2.9E-07 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 6.1E-09 | 3.1E-07 | 0.04 | 1 | NA | NA | 1.1E-08 | 5.5E-07 | NA | 8.6E-07 |
| Anthracene | 1.3E-04 | 0.3 | NA | 1 | NA | NA | 8.2E-10 | 2.7E-09 | 0.04 | 1 | NA | NA | 1.5E-09 | 4.9E-09 | NA | 7.6E-09 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 6.1E-11 | 4.5E-11 | 6.1E-11 | 3.1E-09 | 0.02 | 1 | 5.5E-11 | 4.0E-11 | 5.5E-11 | 2.8E-09 | 8.5E-11 | 5.8E-09 |
| Benzo(a)pyrene | 8.3E-05 | 0.02 | 7.3 | 1 | 5.1E-10 | 3.7E-09 | 5.1E-10 | 2.5E-08 | 0.02 | 1 | 4.6E-10 | 3.4E-09 | 4.6E-10 | 2.3E-08 | 7.1E-09 | 4.8E-08 |
| Benzo(b)fluoranthene | 2.4E-04 | 0.02 | 0.73 | 1 | 1.4E-09 | 1.0E-09 | 1.4E-09 | 7.2E-08 | 0.02 | 1 | 1.3E-09 | 9.5E-10 | 1.3E-09 | 6.5E-08 | 2.0E-09 | 1.4E-07 |
| Benzo(g,h,i)perylene | 3.0E-05 | 0.02 | NA | 1 | NA | NA | 1.8E-10 | 9.2E-09 | 0.04 | 1 | NA | NA | 3.3E-10 | 1.7E-08 | NA | 2.6E-08 |
| Benzo(k)fluoranthene | 6.0E-05 | 0.02 | 0.073 | 1 | 3.6E-10 | 2.7E-11 | 3.6E-10 | 1.8E-08 | 0.02 | 1 | 3.3E-10 | 2.4E-11 | 3.3E-10 | 1.6E-08 | 5.1E-11 | 3.5E-08 |
| Chrysene | 8.0E-05 | 0.02 | 0.0073 | 1 | 4.9E-10 | 3.6E-12 | 4.9E-10 | 2.4E-08 | 0.02 | 1 | 4.4E-10 | 3.2E-12 | 4.4E-10 | 2.2E-08 | 6.8E-12 | 4.6E-08 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 9.2E-11 | 6.7E-10 | 9.2E-11 | 4.6E-09 | 0.02 | 1 | 8.3E-11 | 6.0E-10 | 8.3E-11 | 4.1E-09 | 1.3E-09 | 8.7E-09 |
| Fluoranthene | 2.0E-04 | 0.04 | NA | 1 | NA | NA | 1.2E-09 | 3.0E-08 | 0.04 | 1 | NA | NA | 2.2E-09 | 5.5E-08 | NA | 8.5E-08 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 6.1E-10 | 1.5E-08 | 0.04 | 1 | NA | NA | 1.1E-09 | 2.8E-08 | NA | 4.3E-08 |
| Indeno(1,2,3-cd)pyrene | 5.7E-05 | 0.02 | 0.73 | 1 | 3.5E-10 | 2.6E-10 | 3.5E-10 | 1.8E-08 | 0.02 | 1 | 3.2E-10 | 2.3E-10 | 3.2E-10 | 1.6E-08 | 4.9E-10 | 3.3E-08 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 6.1E-09 | 3.1E-07 | 0.04 | 1 | NA | NA | 1.1E-08 | 5.5E-07 | NA | 8.6E-07 |
| Phenanthrene | 3.0E-04 | 0.02 | NA | 1 | NA | NA | 1.8E-09 | 9.2E-08 | 0.04 | 1 | NA | NA | 3.3E-09 | 1.7E-07 | NA | 2.6E-07 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 6.1E-10 | 2.0E-08 | 0.04 | 1 | NA | NA | 1.1E-09 | 3.7E-08 | NA | 5.7E-08 |
| BAP-TEQ | 3.3E-03 | 0.02 | 7.3 | 1 | 2.0E-08 | 1.5E-07 | 2.0E-08 | 9.9E-07 | 0.02 | 1 | 1.8E-08 | 1.3E-07 | 1.8E-08 | 9.0E-07 | 2.8E-07 | 1.9E-06 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 1.5E-09 | 1.8E-10 | 1.5E-09 | 5.1E-08 | 0.65 | 1 | 4.5E-08 | 5.4E-09 | 4.5E-08 | 1.5E-06 | 5.6E-09 | 1.5E-06 |
| Total | | | | | | 5.9E-09 | | 1.1E-06 | | | | 1.1E-08 | | 3.2E-06 | 1.7E-08 | 4.3E-06 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Area 3**
**Human Health Risk Calculations**
**Using AMEC's Exposure Assumptions**

**Evaluation of Potential Risk to Child Recreational Visitor from Sediment using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (15-16) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Sediment (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Sediment) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 3133 |
| AF: Adherence Factor (mg/cm2) | 0.18 |
| AAF: Absorption Adjustment Factor (Dermal-Sediment) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 6 |
| BW: Body Weight (kg) | 56 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 2190 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| Compound | Sediment Concentration (mg/kg) | Noncancer Hazard Quotient: Oral-Sediment RAF (noncancer) Chronic | Dermal-Sediment RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Sediment HQ | Excess Lifetime Cancer Risk: Oral-Sediment AAF (cancer) | Dermal-Sediment AAF | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Sediment Risk (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD TEQ | 5.7E-05 | 1 | 4.0E-02 | NA | NA | NA | 1 | 0.04 | 1.7E-14 | 1.5E+05 | 2.6E-09 |
| Acenaphthene | 3.2E+01 | 1 | 1.0E-01 | 1.7E-07 | 6.0E-02 | 2.8E-06 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.5E+00 | 1 | 1.0E-01 | 1.3E-08 | 2.0E-02 | 6.4E-07 | NA | NA | NA | NA | NA |
| Anthracene | 6.4E+01 | 1 | 1.0E-01 | 3.3E-07 | 3.0E-01 | 1.1E-06 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.6E+01 | 1 | 2.0E-02 | 1.4E-07 | 2.0E-02 | 6.8E-06 | 1 | 0.02 | 1.2E-08 | 7.3E-01 | 8.6E-09 |
| Benzo(a)pyrene | 1.9E+01 | 1 | 2.0E-02 | 5.7E-08 | 2.0E-02 | 2.8E-06 | 1 | 0.02 | 4.9E-09 | 7.3E+00 | 3.6E-08 |
| Benzo(b)fluoranthene | 2.5E+01 | 1 | 2.0E-02 | 7.6E-08 | 2.0E-02 | 3.8E-06 | 1 | 0.02 | 6.5E-09 | 7.3E-01 | 4.8E-09 |
| Benzo(g,h,i)perylene | 7.2E+00 | 1 | 1.0E-01 | 3.7E-08 | 2.0E-02 | 1.9E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E+01 | 1 | 2.0E-02 | 3.3E-08 | 2.0E-02 | 1.6E-06 | 1 | 0.02 | 2.8E-09 | 7.3E-02 | 2.0E-10 |
| Chrysene | 4.9E+01 | 1 | 2.0E-02 | 1.5E-07 | 2.0E-02 | 7.4E-06 | 1 | 0.02 | 1.3E-08 | 7.3E-03 | 9.2E-11 |
| Dibenz(a,h)anthracene | 2.1E+00 | 1 | 2.0E-02 | 6.2E-09 | 2.0E-02 | 3.1E-07 | 1 | 0.02 | 5.3E-10 | 7.3E+00 | 3.9E-09 |
| Fluoranthene | 1.9E+02 | 1 | 1.0E-01 | 9.8E-07 | 4.0E-02 | 2.5E-05 | NA | NA | NA | NA | NA |
| Fluorene | 3.3E+01 | 1 | 1.0E-01 | 1.7E-07 | 4.0E-02 | 4.3E-06 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 6.8E+00 | 1 | 2.0E-02 | 2.0E-08 | 2.0E-02 | 1.0E-06 | 1 | 0.02 | 1.7E-09 | 7.3E-01 | 1.3E-09 |
| Naphthalene | 2.2E+00 | 1 | 1.0E-01 | 1.1E-08 | 2.0E-02 | 5.7E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.5E+02 | 1 | 1.0E-01 | 7.5E-07 | 2.0E-02 | 3.8E-05 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E+02 | 1 | 1.0E-01 | 7.6E-07 | 3.0E-02 | 2.5E-05 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.9E+01 | 1 | 2.0E-02 | 8.7E-08 | 2.0E-02 | 4.3E-06 | 1 | 0.02 | 7.4E-09 | 7.3E+00 | 5.4E-08 |
| Pentachlorophenol | 5.0E-01 | 1 | 3.0E-02 | 1.6E-09 | 3.0E-02 | 5.5E-08 | 1 | 0.03 | 1.4E-10 | 1.2E-01 | 1.7E-11 |
| Total Risks | | | | | | 1.2E-04 | | | | | 5.7E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Recreational Visitor from Sediment using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Sediment (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Sediment) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 3341 |
| AF: Adherence Factor (mg/cm2) | 0.18 |
| AAF: Absorption Adjustment Factor (Dermal-Sediment) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment Concentration (mg/kg) | Oral-Sediment RAF (noncancer) Chronic | Dermal-Sediment RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Sediment HQ | Oral-Sediment AAF (cancer) | Dermal-Sediment AAF | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Sediment Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 5.7E-05 | 1 | 4.0E-02 | NA | NA | NA | 1 | 0.04 | 5.5E-14 | 1.5E+05 | 8.3E-09 |
| Acenaphthene | 3.2E+01 | 1 | 1.0E-01 | 1.3E-07 | 6.0E-02 | 2.2E-06 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.5E+00 | 1 | 1.0E-01 | 1.0E-08 | 2.0E-02 | 5.2E-07 | NA | NA | NA | NA | NA |
| Anthracene | 6.4E+01 | 1 | 1.0E-01 | 2.7E-07 | 3.0E-01 | 9.0E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.6E+01 | 1 | 2.0E-02 | 1.1E-07 | 2.0E-02 | 5.4E-06 | 1 | 0.02 | 3.7E-08 | 7.3E-01 | 2.7E-08 |
| Benzo(a)pyrene | 1.9E+01 | 1 | 2.0E-02 | 4.5E-08 | 2.0E-02 | 2.2E-06 | 1 | 0.02 | 1.5E-08 | 7.3E+00 | 1.1E-07 |
| Benzo(b)fluoranthene | 2.5E+01 | 1 | 2.0E-02 | 6.0E-08 | 2.0E-02 | 3.0E-06 | 1 | 0.02 | 2.1E-08 | 7.3E-01 | 1.5E-08 |
| Benzo(g,h,i)perylene | 7.2E+00 | 1 | 1.0E-01 | 3.0E-08 | 2.0E-02 | 1.5E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E+01 | 1 | 2.0E-02 | 2.6E-08 | 2.0E-02 | 1.3E-06 | 1 | 0.02 | 8.9E-09 | 7.3E-02 | 6.5E-10 |
| Chrysene | 4.9E+01 | 1 | 2.0E-02 | 1.2E-07 | 2.0E-02 | 5.8E-06 | 1 | 0.02 | 4.0E-08 | 7.3E-03 | 2.9E-10 |
| Dibenz(a,h)anthracene | 2.1E+00 | 1 | 2.0E-02 | 4.9E-09 | 2.0E-02 | 2.4E-07 | 1 | 0.02 | 1.7E-09 | 7.3E+00 | 1.2E-08 |
| Fluoranthene | 1.9E+02 | 1 | 1.0E-01 | 7.9E-07 | 4.0E-02 | 2.0E-05 | NA | NA | NA | NA | NA |
| Fluorene | 3.3E+01 | 1 | 1.0E-01 | 1.4E-07 | 4.0E-02 | 3.5E-06 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 6.8E+00 | 1 | 2.0E-02 | 1.6E-08 | 2.0E-02 | 8.0E-07 | 1 | 0.02 | 5.5E-09 | 7.3E-01 | 4.0E-09 |
| Naphthalene | 2.2E+00 | 1 | 1.0E-01 | 9.2E-09 | 2.0E-02 | 4.6E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.5E+02 | 1 | 1.0E-01 | 6.1E-07 | 2.0E-02 | 3.0E-05 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E+02 | 1 | 1.0E-01 | 6.1E-07 | 3.0E-02 | 2.0E-05 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.9E+01 | 1 | 2.0E-02 | 6.9E-08 | 2.0E-02 | 3.4E-06 | 1 | 0.02 | 2.4E-08 | 7.3E+00 | 1.7E-07 |
| Pentachlorophenol | 5.0E-01 | 1 | 3.0E-02 | 1.3E-09 | 3.0E-02 | 4.3E-08 | 1 | 0.03 | 4.5E-10 | 1.2E-01 | 5.3E-11 |
| Total Risks | | | | | | 9.9E-05 | | | | | 1.8E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Hunter from Sediment using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (15-16) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Sediment (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Sediment) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.02 |
| SA: Skin Surface Area (cm2/event) | 928 |
| AF: Adherence Factor (mg/cm2) | 0.2 |
| AAF: Absorption Adjustment Factor (Dermal-Sediment) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.02 |
| EF: Exposure Frequency (days/year) | 16 |
| ED: Exposure Duration (years) | 6 |
| BW: Body Weight (kg) | 56 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 2190 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| Compound | Sediment Concentration (mg/kg) | Noncancer Hazard Quotient: Oral-Sediment RAF (noncancer) Chronic | Dermal-Sediment RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Sediment HQ | Excess Lifetime Cancer Risk: Oral-Sediment AAF (cancer) | Dermal-Sediment AAF | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Sediment Risk (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD TEQ | 5.7E-05 | 1 | 4.0E-02 | NA | NA | NA | 1 | 0.04 | 4.6E-15 | 1.5E+05 | 6.8E-10 |
| Acenaphthene | 3.2E+01 | 1 | 1.0E-01 | 3.6E-08 | 6.0E-02 | 5.9E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.5E+00 | 1 | 1.0E-01 | 2.8E-09 | 2.0E-02 | 1.4E-07 | NA | NA | NA | NA | NA |
| Anthracene | 6.4E+01 | 1 | 1.0E-01 | 7.1E-08 | 3.0E-01 | 2.4E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.6E+01 | 1 | 2.0E-02 | 4.0E-08 | 2.0E-02 | 2.0E-06 | 1 | 0.02 | 3.4E-09 | 7.3E-01 | 2.5E-09 |
| Benzo(a)pyrene | 1.9E+01 | 1 | 2.0E-02 | 1.7E-08 | 2.0E-02 | 8.3E-07 | 1 | 0.02 | 1.4E-09 | 7.3E+00 | 1.0E-08 |
| Benzo(b)fluoranthene | 2.5E+01 | 1 | 2.0E-02 | 2.2E-08 | 2.0E-02 | 1.1E-06 | 1 | 0.02 | 1.9E-09 | 7.3E-01 | 1.4E-09 |
| Benzo(g,h,i)perylene | 7.2E+00 | 1 | 1.0E-01 | 8.0E-09 | 2.0E-02 | 4.0E-07 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E+01 | 1 | 2.0E-02 | 9.6E-09 | 2.0E-02 | 4.8E-07 | 1 | 0.02 | 8.2E-10 | 7.3E-02 | 6.0E-11 |
| Chrysene | 4.9E+01 | 1 | 2.0E-02 | 4.3E-08 | 2.0E-02 | 2.1E-06 | 1 | 0.02 | 3.7E-09 | 7.3E-03 | 2.7E-11 |
| Dibenz(a,h)anthracene | 2.1E+00 | 1 | 2.0E-02 | 1.8E-09 | 2.0E-02 | 9.0E-08 | 1 | 0.02 | 1.5E-10 | 7.3E+00 | 1.1E-09 |
| Fluoranthene | 1.9E+02 | 1 | 1.0E-01 | 2.1E-07 | 4.0E-02 | 5.3E-06 | NA | NA | NA | NA | NA |
| Fluorene | 3.3E+01 | 1 | 1.0E-01 | 3.7E-08 | 4.0E-02 | 9.3E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 6.8E+00 | 1 | 2.0E-02 | 6.0E-09 | 2.0E-02 | 3.0E-07 | 1 | 0.02 | 5.1E-10 | 7.3E-01 | 3.7E-10 |
| Naphthalene | 2.2E+00 | 1 | 1.0E-01 | 2.5E-09 | 2.0E-02 | 1.2E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.5E+02 | 1 | 1.0E-01 | 1.6E-07 | 2.0E-02 | 8.1E-06 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E+02 | 1 | 1.0E-01 | 1.6E-07 | 3.0E-02 | 5.4E-06 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.9E+01 | 1 | 2.0E-02 | 2.5E-08 | 2.0E-02 | 1.3E-06 | 1 | 0.02 | 2.2E-09 | 7.3E+00 | 1.6E-08 |
| Pentachlorophenol | 5.0E-01 | 1 | 3.0E-02 | 4.5E-10 | 3.0E-02 | 1.5E-08 | 1 | 0.03 | 3.9E-11 | 1.2E-01 | 4.7E-12 |
| Total Risks | | | | | | 2.8E-05 | | | | | 1.7E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Hunter from Sediment using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Sediment (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Sediment) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.02 |
| SA: Skin Surface Area (cm2/event) | 904 |
| AF: Adherence Factor (mg/cm2) | 0.2 |
| AAF: Absorption Adjustment Factor (Dermal-Sediment) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.02 |
| EF: Exposure Frequency (days/year) | 16 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| Compound | Sediment Concentration (mg/kg) | Noncancer Hazard Quotient: Oral-Sediment RAF (noncancer) Chronic | Dermal-Sediment RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Sediment HQ | Excess Lifetime Cancer Risk: Oral-Sediment AAF (cancer) | Dermal-Sediment AAF | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Sediment Risk (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD TEQ | 5.7E-05 | 1 | 4.0E-02 | NA | NA | NA | 1 | 0.04 | 1.4E-14 | 1.5E+05 | 2.1E-09 |
| Acenaphthene | 3.2E+01 | 1 | 1.0E-01 | 2.8E-08 | 6.0E-02 | 4.6E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.5E+00 | 1 | 1.0E-01 | 2.1E-09 | 2.0E-02 | 1.1E-07 | NA | NA | NA | NA | NA |
| Anthracene | 6.4E+01 | 1 | 1.0E-01 | 5.5E-08 | 3.0E-01 | 1.8E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.6E+01 | 1 | 2.0E-02 | 3.1E-08 | 2.0E-02 | 1.6E-06 | 1 | 0.02 | 1.1E-08 | 7.3E-01 | 7.8E-09 |
| Benzo(a)pyrene | 1.9E+01 | 1 | 2.0E-02 | 1.3E-08 | 2.0E-02 | 6.5E-07 | 1 | 0.02 | 4.4E-09 | 7.3E+00 | 3.2E-08 |
| Benzo(b)fluoranthene | 2.5E+01 | 1 | 2.0E-02 | 1.7E-08 | 2.0E-02 | 8.7E-07 | 1 | 0.02 | 6.0E-09 | 7.3E-01 | 4.3E-09 |
| Benzo(g,h,i)perylene | 7.2E+00 | 1 | 1.0E-01 | 6.2E-09 | 2.0E-02 | 3.1E-07 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E+01 | 1 | 2.0E-02 | 7.4E-09 | 2.0E-02 | 3.7E-07 | 1 | 0.02 | 2.6E-09 | 7.3E-02 | 1.9E-10 |
| Chrysene | 4.9E+01 | 1 | 2.0E-02 | 3.3E-08 | 2.0E-02 | 1.7E-06 | 1 | 0.02 | 1.1E-08 | 7.3E-03 | 8.4E-11 |
| Dibenz(a,h)anthracene | 2.1E+00 | 1 | 2.0E-02 | 1.4E-09 | 2.0E-02 | 7.0E-08 | 1 | 0.02 | 4.8E-10 | 7.3E+00 | 3.5E-09 |
| Fluoranthene | 1.9E+02 | 1 | 1.0E-01 | 1.6E-07 | 4.0E-02 | 4.1E-06 | NA | NA | NA | NA | NA |
| Fluorene | 3.3E+01 | 1 | 1.0E-01 | 2.9E-08 | 4.0E-02 | 7.2E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 6.8E+00 | 1 | 2.0E-02 | 4.6E-09 | 2.0E-02 | 2.3E-07 | 1 | 0.02 | 1.6E-09 | 7.3E-01 | 1.2E-09 |
| Naphthalene | 2.2E+00 | 1 | 1.0E-01 | 1.9E-09 | 2.0E-02 | 9.5E-08 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.5E+02 | 1 | 1.0E-01 | 1.3E-07 | 2.0E-02 | 6.3E-06 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E+02 | 1 | 1.0E-01 | 1.3E-07 | 3.0E-02 | 4.2E-06 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.9E+01 | 1 | 2.0E-02 | 2.0E-08 | 2.0E-02 | 9.9E-07 | 1 | 0.02 | 6.8E-09 | 7.3E+00 | 4.9E-08 |
| Pentachlorophenol | 5.0E-01 | 1 | 3.0E-02 | 3.5E-10 | 3.0E-02 | 1.2E-08 | 1 | 0.03 | 1.2E-10 | 1.2E-01 | 1.5E-11 |
| Total Risks | | | | | | 2.2E-05 | | | | | 5.2E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Recreational Visitor from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (15-16) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 6 |
| BW: Body Weight (kg) | 56 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 2190 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 2.9E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 7.9E-15 | 1.5E+05 | 1.2E-09 |
| Acenaphthene | 1.5E-01 | 1 | 0.1 | 6.4E-10 | 6.0E-02 | 1.1E-08 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.7E-01 | 1 | 0.1 | 7.0E-10 | 2.0E-02 | 3.5E-08 | NA | NA | NA | NA | NA |
| Anthracene | 2.5E-01 | 1 | 0.1 | 1.0E-09 | 3.0E-01 | 3.4E-09 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.1E-01 | 1 | 0.02 | 3.1E-10 | 2.0E-02 | 1.6E-08 | 1 | 0.02 | 2.7E-11 | 7.3E-01 | 2.0E-11 |
| Benzo(a)pyrene | 2.1E-01 | 1 | 0.02 | 5.8E-10 | 2.0E-02 | 2.9E-08 | 1 | 0.02 | 5.0E-11 | 7.3E+00 | 3.6E-10 |
| Benzo(b)fluoranthene | 2.7E-01 | 1 | 0.02 | 7.5E-10 | 2.0E-02 | 3.8E-08 | 1 | 0.02 | 6.4E-11 | 7.3E-01 | 4.7E-11 |
| Benzo(g,h,i)perylene | 4.4E-01 | 1 | 0.1 | 1.8E-09 | 2.0E-02 | 9.0E-08 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E-01 | 1 | 0.02 | 3.1E-10 | 2.0E-02 | 1.5E-08 | 1 | 0.02 | 2.6E-11 | 7.3E-02 | 1.9E-12 |
| Chrysene | 2.2E-01 | 1 | 0.02 | 6.2E-10 | 2.0E-02 | 3.1E-08 | 1 | 0.02 | 5.3E-11 | 7.3E-03 | 3.9E-13 |
| Dibenz(a,h)anthracene | 1.5E-01 | 1 | 0.02 | 4.0E-10 | 2.0E-02 | 2.0E-08 | 1 | 0.02 | 3.5E-11 | 7.3E+00 | 2.5E-10 |
| Fluoranthene | 1.2E-01 | 1 | 0.1 | 5.0E-10 | 4.0E-02 | 1.2E-08 | NA | NA | NA | NA | NA |
| Fluorene | 1.3E-01 | 1 | 0.1 | 5.3E-10 | 4.0E-02 | 1.3E-08 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 3.8E-01 | 1 | 0.02 | 1.1E-09 | 2.0E-02 | 5.3E-08 | 1 | 0.02 | 9.1E-11 | 7.3E-01 | 6.6E-11 |
| Naphthalene | 1.3E-01 | 1 | 0.1 | 5.5E-10 | 2.0E-02 | 2.7E-08 | NA | NA | NA | NA | NA |
| Phenanthrene | 9.6E-02 | 1 | 0.1 | 4.0E-10 | 2.0E-02 | 2.0E-08 | NA | NA | NA | NA | NA |
| Pyrene | 1.2E-01 | 1 | 0.1 | 4.9E-10 | 3.0E-02 | 1.6E-08 | NA | NA | NA | NA | NA |
| BAP-TEQ | 3.5E-01 | 1 | 0.02 | 9.8E-10 | 2.0E-02 | 4.9E-08 | 1 | 0.02 | 8.4E-11 | 7.3E+00 | 6.1E-10 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.03 | 4.1E-09 | 3.0E-02 | 1.4E-07 | 1 | 0.03 | 3.5E-10 | 1.2E-01 | 4.2E-11 |
| Risk Total | | | | | | 5.7E-07 | | | | | 2.0E-09 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Recreational Visitor from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 2.9E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 2.5E-14 | 1.5E+05 | 3.7E-09 |
| Acenaphthene | 1.5E-01 | 1 | 0.1 | 5.0E-10 | 6.0E-02 | 8.4E-09 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.7E-01 | 1 | 0.1 | 5.5E-10 | 2.0E-02 | 2.8E-08 | NA | NA | NA | NA | NA |
| Anthracene | 2.5E-01 | 1 | 0.1 | 8.0E-10 | 3.0E-01 | 2.7E-09 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.1E-01 | 1 | 0.02 | 2.4E-10 | 2.0E-02 | 1.2E-08 | 1 | 0.02 | 8.4E-11 | 7.3E-01 | 6.1E-11 |
| Benzo(a)pyrene | 2.1E-01 | 1 | 0.02 | 4.5E-10 | 2.0E-02 | 2.3E-08 | 1 | 0.02 | 1.6E-10 | 7.3E+00 | 1.1E-09 |
| Benzo(b)fluoranthene | 2.7E-01 | 1 | 0.02 | 5.9E-10 | 2.0E-02 | 2.9E-08 | 1 | 0.02 | 2.0E-10 | 7.3E-01 | 1.5E-10 |
| Benzo(g,h,i)perylene | 4.4E-01 | 1 | 0.1 | 1.4E-09 | 2.0E-02 | 7.1E-08 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E-01 | 1 | 0.02 | 2.4E-10 | 2.0E-02 | 1.2E-08 | 1 | 0.02 | 8.2E-11 | 7.3E-02 | 6.0E-12 |
| Chrysene | 2.2E-01 | 1 | 0.02 | 4.9E-10 | 2.0E-02 | 2.4E-08 | 1 | 0.02 | 1.7E-10 | 7.3E-03 | 1.2E-12 |
| Dibenz(a,h)anthracene | 1.5E-01 | 1 | 0.02 | 3.2E-10 | 2.0E-02 | 1.6E-08 | 1 | 0.02 | 1.1E-10 | 7.3E+00 | 7.9E-10 |
| Fluoranthene | 1.2E-01 | 1 | 0.1 | 4.0E-10 | 4.0E-02 | 9.9E-09 | NA | NA | NA | NA | NA |
| Fluorene | 1.3E-01 | 1 | 0.1 | 4.2E-10 | 4.0E-02 | 1.0E-08 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 3.8E-01 | 1 | 0.02 | 8.3E-10 | 2.0E-02 | 4.2E-08 | 1 | 0.02 | 2.9E-10 | 7.3E-01 | 2.1E-10 |
| Naphthalene | 1.3E-01 | 1 | 0.1 | 4.3E-10 | 2.0E-02 | 2.2E-08 | NA | NA | NA | NA | NA |
| Phenanthrene | 9.6E-02 | 1 | 0.1 | 3.1E-10 | 2.0E-02 | 1.6E-08 | NA | NA | NA | NA | NA |
| Pyrene | 1.2E-01 | 1 | 0.1 | 3.9E-10 | 3.0E-02 | 1.3E-08 | NA | NA | NA | NA | NA |
| BAP-TEQ | 3.5E-01 | 1 | 0.02 | 7.7E-10 | 2.0E-02 | 3.8E-08 | 1 | 0.02 | 2.6E-10 | 7.3E+00 | 1.9E-09 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.03 | 3.2E-09 | 3.0E-02 | 1.1E-07 | 1 | 0.03 | 1.1E-09 | 1.2E-01 | 1.3E-10 |
| Risk Total | | | | | | 4.4E-07 | | | | | 6.2E-09 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Hunter from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (15-16) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.17 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.17 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 6 |
| BW: Body Weight (kg) | 56 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 2190 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.3E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 2.3E-14 | 1.5E+05 | 3.5E-09 |
| Acenaphthene | 1.6E-01 | 1 | 0.1 | 1.3E-09 | 6.0E-02 | 2.2E-08 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.3E-01 | 1 | 0.1 | 1.9E-09 | 2.0E-02 | 9.3E-08 | NA | NA | NA | NA | NA |
| Anthracene | 3.4E-01 | 1 | 0.1 | 2.8E-09 | 3.0E-01 | 9.2E-09 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.5E-01 | 1 | 0.02 | 8.1E-10 | 2.0E-02 | 4.0E-08 | 1 | 0.02 | 6.9E-11 | 7.3E-01 | 5.1E-11 |
| Benzo(a)pyrene | 2.8E-01 | 1 | 0.02 | 1.6E-09 | 2.0E-02 | 7.9E-08 | 1 | 0.02 | 1.4E-10 | 7.3E+00 | 9.9E-10 |
| Benzo(b)fluoranthene | 3.6E-01 | 1 | 0.02 | 2.0E-09 | 2.0E-02 | 1.0E-07 | 1 | 0.02 | 1.7E-10 | 7.3E-01 | 1.3E-10 |
| Benzo(g,h,i)perylene | 6.1E-01 | 1 | 0.1 | 5.0E-09 | 2.0E-02 | 2.5E-07 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.5E-01 | 1 | 0.02 | 8.2E-10 | 2.0E-02 | 4.1E-08 | 1 | 0.02 | 7.0E-11 | 7.3E-02 | 5.1E-12 |
| Chrysene | 3.3E-01 | 1 | 0.02 | 1.9E-09 | 2.0E-02 | 9.3E-08 | 1 | 0.02 | 1.6E-10 | 7.3E-03 | 1.2E-12 |
| Dibenz(a,h)anthracene | 1.9E-01 | 1 | 0.02 | 1.0E-09 | 2.0E-02 | 5.2E-08 | 1 | 0.02 | 8.9E-11 | 7.3E+00 | 6.5E-10 |
| Fluoranthene | 1.5E-01 | 1 | 0.1 | 1.3E-09 | 4.0E-02 | 3.1E-08 | NA | NA | NA | NA | NA |
| Fluorene | 1.7E-01 | 1 | 0.1 | 1.4E-09 | 4.0E-02 | 3.5E-08 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.4E-01 | 1 | 0.02 | 3.0E-09 | 2.0E-02 | 1.5E-07 | 1 | 0.02 | 2.6E-10 | 7.3E-01 | 1.9E-10 |
| Naphthalene | 1.6E-01 | 1 | 0.1 | 1.3E-09 | 2.0E-02 | 6.6E-08 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.3E-01 | 1 | 0.1 | 1.1E-09 | 2.0E-02 | 5.5E-08 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E-01 | 1 | 0.1 | 1.3E-09 | 3.0E-02 | 4.2E-08 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E-01 | 1 | 0.02 | 2.7E-09 | 2.0E-02 | 1.4E-07 | 1 | 0.02 | 2.3E-10 | 7.3E+00 | 1.7E-09 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.03 | 8.4E-09 | 3.0E-02 | 2.8E-07 | 1 | 0.03 | 7.2E-10 | 1.2E-01 | 8.7E-11 |
| Risk Total | | | | | | 1.4E-06 | | | | | 5.6E-09 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Hunter from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.17 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.17 |
| EF: Exposure Frequency (days/year) | 12 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (75 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil RAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.3E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 7.3E-14 | 1.5E+05 | 1.1E-08 |
| Acenaphthene | 1.6E-01 | 1 | 0.1 | 1.0E-09 | 6.0E-02 | 1.7E-08 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.3E-01 | 1 | 0.1 | 1.5E-09 | 2.0E-02 | 7.4E-08 | NA | NA | NA | NA | NA |
| Anthracene | 3.4E-01 | 1 | 0.1 | 2.2E-09 | 3.0E-01 | 7.3E-09 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.5E-01 | 1 | 0.02 | 6.3E-10 | 2.0E-02 | 3.2E-08 | 1 | 0.02 | 2.2E-10 | 7.3E-01 | 1.6E-10 |
| Benzo(a)pyrene | 2.8E-01 | 1 | 0.02 | 1.2E-09 | 2.0E-02 | 6.2E-08 | 1 | 0.02 | 4.3E-10 | 7.3E+00 | 3.1E-09 |
| Benzo(b)fluoranthene | 3.6E-01 | 1 | 0.02 | 1.6E-09 | 2.0E-02 | 7.9E-08 | 1 | 0.02 | 5.4E-10 | 7.3E-01 | 4.0E-10 |
| Benzo(g,h,i)perylene | 6.1E-01 | 1 | 0.1 | 4.0E-09 | 2.0E-02 | 2.0E-07 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.5E-01 | 1 | 0.02 | 6.4E-10 | 2.0E-02 | 3.2E-08 | 1 | 0.02 | 2.2E-10 | 7.3E-02 | 1.6E-11 |
| Chrysene | 3.3E-01 | 1 | 0.02 | 1.5E-09 | 2.0E-02 | 7.3E-08 | 1 | 0.02 | 5.0E-10 | 7.3E-03 | 3.6E-12 |
| Dibenz(a,h)anthracene | 1.9E-01 | 1 | 0.02 | 8.1E-10 | 2.0E-02 | 4.1E-08 | 1 | 0.02 | 2.8E-10 | 7.3E+00 | 2.0E-09 |
| Fluoranthene | 1.5E-01 | 1 | 0.1 | 9.9E-10 | 4.0E-02 | 2.5E-08 | NA | NA | NA | NA | NA |
| Fluorene | 1.7E-01 | 1 | 0.1 | 1.1E-09 | 4.0E-02 | 2.8E-08 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.4E-01 | 1 | 0.02 | 2.4E-09 | 2.0E-02 | 1.2E-07 | 1 | 0.02 | 8.1E-10 | 7.3E-01 | 5.9E-10 |
| Naphthalene | 1.6E-01 | 1 | 0.1 | 1.0E-09 | 2.0E-02 | 5.2E-08 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.3E-01 | 1 | 0.1 | 8.7E-10 | 2.0E-02 | 4.4E-08 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E-01 | 1 | 0.1 | 1.0E-09 | 3.0E-02 | 3.3E-08 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E-01 | 1 | 0.02 | 2.1E-09 | 2.0E-02 | 1.1E-07 | 1 | 0.02 | 7.4E-10 | 7.3E+00 | 5.4E-09 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.03 | 6.6E-09 | 3.0E-02 | 2.2E-07 | 1 | 0.03 | 2.3E-09 | 1.2E-01 | 2.7E-10 |
| Risk Total | | | | | | 1.1E-06 | | | | | 1.8E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Recreational Visitor from Surface Water using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (15-16) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 3 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3133 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 12 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 6 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 2190 | |
| BW: Body Weight | kg | 56 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Risk(SW) | HI(SW) |
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 5.9E-09 | 9.8E-08 | 0.04 | 1 | NA | NA | 7.4E-08 | 1.2E-06 | NA | 1.3E-06 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 5.9E-09 | 2.9E-07 | 0.04 | 1 | NA | NA | 7.4E-08 | 3.7E-06 | NA | 4.0E-06 |
| Anthracene | 5.0E-05 | 0.3 | NA | 1 | NA | NA | 2.9E-10 | 9.8E-10 | 0.04 | 1 | NA | NA | 3.7E-09 | 1.2E-08 | NA | 1.3E-08 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 5.9E-11 | 4.3E-11 | 5.9E-11 | 2.9E-09 | 0.02 | 1 | 3.7E-10 | 2.7E-10 | 3.7E-10 | 1.8E-08 | 3.1E-10 | 2.1E-08 |
| Benzo(a)pyrene | 1.0E-05 | 0.02 | 7.3 | 1 | 5.9E-11 | 4.3E-10 | 5.9E-11 | 2.9E-09 | 0.02 | 1 | 3.7E-10 | 2.7E-09 | 3.7E-10 | 1.8E-08 | 3.1E-09 | 2.1E-08 |
| Benzo(b)fluoranthene | 2.7E-05 | 0.02 | 0.73 | 1 | 1.6E-10 | 1.2E-10 | 1.6E-10 | 7.9E-09 | 0.02 | 1 | 9.9E-10 | 7.3E-10 | 9.9E-10 | 5.0E-08 | 8.4E-10 | 5.8E-08 |
| Benzo(g,h,i)perylene | 2.8E-05 | 0.02 | NA | 1 | NA | NA | 1.6E-10 | 8.1E-09 | 0.04 | 1 | NA | NA | 2.0E-09 | 1.0E-07 | NA | 1.1E-07 |
| Benzo(k)fluoranthene | 1.0E-05 | 0.02 | 0.073 | 1 | 5.9E-11 | 4.3E-12 | 5.9E-11 | 2.9E-09 | 0.02 | 1 | 3.7E-10 | 2.7E-11 | 3.7E-10 | 1.8E-08 | 3.1E-11 | 2.1E-08 |
| Chrysene | 7.8E-05 | 0.02 | 0.0073 | 1 | 4.5E-10 | 3.3E-12 | 4.5E-10 | 2.3E-08 | 0.02 | 1 | 2.9E-09 | 2.1E-11 | 2.9E-09 | 1.4E-07 | 2.4E-11 | 1.7E-07 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 8.8E-11 | 6.4E-10 | 8.8E-11 | 4.4E-09 | 0.02 | 1 | 5.5E-10 | 4.0E-09 | 5.5E-10 | 2.8E-08 | 4.7E-09 | 3.2E-08 |
| Fluoranthene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 5.9E-10 | 1.5E-08 | 0.04 | 1 | NA | NA | 7.4E-09 | 1.8E-07 | NA | 2.0E-07 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 5.9E-10 | 1.5E-08 | 0.04 | 1 | NA | NA | 7.4E-09 | 1.8E-07 | NA | 2.0E-07 |
| Indeno(1,2,3-cd)pyrene | 2.8E-05 | 0.02 | 0.73 | 1 | 1.6E-10 | 1.2E-10 | 1.6E-10 | 8.1E-09 | 0.02 | 1 | 1.0E-09 | 7.4E-10 | 1.0E-09 | 5.1E-08 | 8.6E-10 | 5.9E-08 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 5.9E-09 | 2.9E-07 | 0.04 | 1 | NA | NA | 7.4E-08 | 3.7E-06 | NA | 4.0E-06 |
| Phenanthrene | 2.8E-04 | 0.02 | NA | 1 | NA | NA | 1.6E-09 | 8.1E-08 | 0.04 | 1 | NA | NA | 2.0E-08 | 1.0E-06 | NA | 1.1E-06 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 5.9E-10 | 2.0E-08 | 0.04 | 1 | NA | NA | 7.4E-09 | 2.5E-07 | NA | 2.6E-07 |
| BAP-TEQ | 1.9E-03 | 0.02 | 7.3 | 1 | 1.1E-08 | 8.3E-08 | 1.1E-08 | 5.7E-07 | 0.02 | 1 | 7.2E-08 | 5.2E-07 | 7.2E-08 | 3.6E-06 | 6.1E-07 | 4.2E-06 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 1.5E-09 | 1.8E-10 | 1.5E-09 | 4.9E-08 | 0.65 | 1 | 3.0E-07 | 3.6E-08 | 3.0E-07 | 1.0E-05 | 3.6E-08 | 1.0E-05 |
| Total | | | | | | 1.5E-09 | | 9.2E-07 | | | | 4.4E-08 | | 2.1E-05 | 4.6E-08 | 2.2E-05 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Adult Recreational Visitor from Surface Water using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 3 - Incidental Surface Water Ingestion and Dermal Contact |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3341 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 12 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

| | EPC | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Risk(SW) | HI(SW) |
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 4.6E-09 | 7.6E-08 | 0.04 | 1 | NA | NA | 6.1E-08 | 1.0E-06 | NA | 1.1E-06 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 4.6E-09 | 2.3E-07 | 0.04 | 1 | NA | NA | 6.1E-08 | 3.1E-06 | NA | 3.3E-06 |
| Anthracene | 5.0E-05 | 0.3 | NA | 1 | NA | NA | 2.3E-10 | 7.6E-10 | 0.04 | 1 | NA | NA | 3.1E-09 | 1.0E-08 | NA | 1.1E-08 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 4.6E-11 | 3.3E-11 | 4.6E-11 | 2.3E-09 | 0.02 | 1 | 3.1E-10 | 2.2E-10 | 3.1E-10 | 1.5E-08 | 2.6E-10 | 1.8E-08 |
| Benzo(a)pyrene | 1.0E-05 | 0.02 | 7.3 | 1 | 4.6E-11 | 3.3E-10 | 4.6E-11 | 2.3E-09 | 0.02 | 1 | 3.1E-10 | 2.2E-09 | 3.1E-10 | 1.5E-08 | 2.6E-09 | 1.8E-08 |
| Benzo(b)fluoranthene | 2.7E-05 | 0.02 | 0.73 | 1 | 1.2E-10 | 9.0E-11 | 1.2E-10 | 6.2E-09 | 0.02 | 1 | 8.3E-10 | 6.0E-10 | 8.3E-10 | 4.1E-08 | 6.9E-10 | 4.7E-08 |
| Benzo(g,h,i)perylene | 2.8E-05 | 0.02 | NA | 1 | NA | NA | 1.3E-10 | 6.3E-09 | 0.04 | 1 | NA | NA | 1.7E-09 | 8.4E-08 | NA | 9.0E-08 |
| Benzo(k)fluoranthene | 1.0E-05 | 0.02 | 0.073 | 1 | 4.6E-11 | 3.3E-12 | 4.6E-11 | 2.3E-09 | 0.02 | 1 | 3.1E-10 | 2.2E-11 | 3.1E-10 | 1.5E-08 | 2.6E-11 | 1.8E-08 |
| Chrysene | 7.8E-05 | 0.02 | 0.0073 | 1 | 3.5E-10 | 2.6E-12 | 3.5E-10 | 1.8E-08 | 0.02 | 1 | 2.4E-09 | 1.7E-11 | 2.4E-09 | 1.2E-07 | 2.0E-11 | 1.4E-07 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 6.9E-11 | 5.0E-10 | 6.9E-11 | 3.4E-09 | 0.02 | 1 | 4.6E-10 | 3.4E-09 | 4.6E-10 | 2.3E-08 | 3.9E-09 | 2.6E-08 |
| Fluoranthene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 4.6E-10 | 1.1E-08 | 0.04 | 1 | NA | NA | 6.1E-09 | 1.5E-07 | NA | 1.6E-07 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 4.6E-10 | 1.1E-08 | 0.04 | 1 | NA | NA | 6.1E-09 | 1.5E-07 | NA | 1.6E-07 |
| Indeno(1,2,3-cd)pyrene | 2.8E-05 | 0.02 | 0.73 | 1 | 1.3E-10 | 9.2E-11 | 1.3E-10 | 6.3E-09 | 0.02 | 1 | 8.4E-10 | 6.1E-10 | 8.4E-10 | 4.2E-08 | 7.1E-10 | 4.8E-08 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 4.6E-09 | 2.3E-07 | 0.04 | 1 | NA | NA | 6.1E-08 | 3.1E-06 | NA | 3.3E-06 |
| Phenanthrene | 2.8E-04 | 0.02 | NA | 1 | NA | NA | 1.3E-09 | 6.3E-08 | 0.04 | 1 | NA | NA | 1.7E-08 | 8.4E-07 | NA | 9.0E-07 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 4.6E-10 | 1.5E-08 | 0.04 | 1 | NA | NA | 6.1E-09 | 2.0E-07 | NA | 2.2E-07 |
| BAP-TEQ | 1.9E-03 | 0.02 | 7.3 | 1 | 8.9E-09 | 6.5E-08 | 8.9E-09 | 4.5E-07 | 0.02 | 1 | 6.0E-08 | 4.4E-07 | 6.0E-08 | 3.0E-06 | 5.0E-07 | 3.4E-06 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 1.1E-09 | 1.4E-10 | 1.1E-09 | 3.8E-08 | 0.65 | 1 | 2.5E-07 | 3.0E-08 | 2.5E-07 | 8.3E-06 | 3.0E-08 | 8.3E-06 |
| Total | | | | | | 1.2E-09 | | 7.2E-07 | | | | 3.7E-08 | | 1.7E-05 | 3.8E-08 | 1.8E-05 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Child Hunter from Surface Water using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (15-16) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 3 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 928 | |
| ET: Surface Water Exposure Time | h/d | 0.5 | |
| EF: Surface Water Exposure Frequency | d/y | 16 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 6 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 2190 | |
| BW: Body Weight | kg | 56 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | EPC | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Risk(SW) | HI(SW) |
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 7.8E-09 | 1.3E-07 | 0.04 | 1 | NA | NA | 1.5E-08 | 2.4E-07 | NA | 3.7E-07 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 7.8E-09 | 3.9E-07 | 0.04 | 1 | NA | NA | 1.5E-08 | 7.3E-07 | NA | 1.1E-06 |
| Anthracene | 5.0E-05 | 0.3 | NA | 1 | NA | NA | 3.9E-10 | 1.3E-09 | 0.04 | 1 | NA | NA | 7.3E-10 | 2.4E-09 | NA | 3.7E-09 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 7.8E-11 | 5.7E-11 | 7.8E-11 | 3.9E-09 | 0.02 | 1 | 7.3E-11 | 5.3E-11 | 7.3E-11 | 3.6E-09 | 1.1E-10 | 7.5E-09 |
| Benzo(a)pyrene | 1.0E-05 | 0.02 | 7.3 | 1 | 7.8E-11 | 5.7E-10 | 7.8E-11 | 3.9E-09 | 0.02 | 1 | 7.3E-11 | 5.3E-10 | 7.3E-11 | 3.6E-09 | 1.1E-09 | 7.5E-09 |
| Benzo(b)fluoranthene | 2.7E-05 | 0.02 | 0.73 | 1 | 2.1E-10 | 1.5E-10 | 2.1E-10 | 1.1E-08 | 0.02 | 1 | 2.0E-10 | 1.4E-10 | 2.0E-10 | 9.8E-09 | 3.0E-10 | 2.0E-08 |
| Benzo(g,h,i)perylene | 2.8E-05 | 0.02 | NA | 1 | NA | NA | 2.2E-10 | 1.1E-08 | 0.04 | 1 | NA | NA | 4.0E-10 | 2.0E-08 | NA | 3.1E-08 |
| Benzo(k)fluoranthene | 1.0E-05 | 0.02 | 0.073 | 1 | 7.8E-11 | 5.7E-12 | 7.8E-11 | 3.9E-09 | 0.02 | 1 | 7.3E-11 | 5.3E-12 | 7.3E-11 | 3.6E-09 | 1.1E-11 | 7.5E-09 |
| Chrysene | 7.8E-05 | 0.02 | 0.0073 | 1 | 6.1E-10 | 4.4E-12 | 6.1E-10 | 3.0E-08 | 0.02 | 1 | 5.6E-10 | 4.1E-12 | 5.6E-10 | 2.8E-08 | 8.5E-12 | 5.8E-08 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 1.2E-10 | 8.6E-10 | 1.2E-10 | 5.9E-09 | 0.02 | 1 | 1.1E-10 | 8.0E-10 | 1.1E-10 | 5.4E-09 | 1.7E-09 | 1.1E-08 |
| Fluoranthene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 7.8E-10 | 2.0E-08 | 0.04 | 1 | NA | NA | 1.5E-09 | 3.6E-08 | NA | 5.6E-08 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 7.8E-10 | 2.0E-08 | 0.04 | 1 | NA | NA | 1.5E-09 | 3.6E-08 | NA | 5.6E-08 |
| Indeno(1,2,3-cd)pyrene | 2.8E-05 | 0.02 | 0.73 | 1 | 2.2E-10 | 1.6E-10 | 2.2E-10 | 1.1E-08 | 0.02 | 1 | 2.0E-10 | 1.5E-10 | 2.0E-10 | 1.0E-08 | 3.0E-10 | 2.1E-08 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 7.8E-09 | 3.9E-07 | 0.04 | 1 | NA | NA | 1.5E-08 | 7.3E-07 | NA | 1.1E-06 |
| Phenanthrene | 2.8E-04 | 0.02 | NA | 1 | NA | NA | 2.2E-09 | 1.1E-07 | 0.04 | 1 | NA | NA | 4.0E-09 | 2.0E-07 | NA | 3.1E-07 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 7.8E-10 | 2.6E-08 | 0.04 | 1 | NA | NA | 1.5E-09 | 4.8E-08 | NA | 7.5E-08 |
| BAP-TEQ | 1.9E-03 | 0.02 | 7.3 | 1 | 1.5E-08 | 1.1E-07 | 1.5E-08 | 7.6E-07 | 0.02 | 1 | 1.4E-08 | 1.0E-07 | 1.4E-08 | 7.1E-07 | 2.1E-07 | 1.5E-06 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 2.0E-09 | 2.3E-10 | 2.0E-09 | 6.5E-08 | 0.65 | 1 | 5.9E-08 | 7.1E-09 | 5.9E-08 | 2.0E-06 | 7.3E-09 | 2.0E-06 |
| Total | | | | | | 2.0E-09 | | 1.2E-06 | | | | 8.8E-09 | | 4.1E-06 | 1.1E-08 | 5.3E-06 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Adult Hunter from Shallow Soil using AMEC's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 3 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 904 | |
| ET: Surface Water Exposure Time | h/d | 0.5 | |
| EF: Surface Water Exposure Frequency | d/y | 16 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | EPC | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Risk(SW) | HI(SW) |
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 6.1E-09 | 1.0E-07 | 0.04 | 1 | NA | NA | 1.1E-08 | 1.8E-07 | NA | 2.9E-07 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 6.1E-09 | 3.1E-07 | 0.04 | 1 | NA | NA | 1.1E-08 | 5.5E-07 | NA | 8.6E-07 |
| Anthracene | 5.0E-05 | 0.3 | NA | 1 | NA | NA | 3.1E-10 | 1.0E-09 | 0.04 | 1 | NA | NA | 5.5E-10 | 1.8E-09 | NA | 2.9E-09 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 6.1E-11 | 4.5E-11 | 6.1E-11 | 3.1E-09 | 0.02 | 1 | 5.5E-11 | 4.0E-11 | 5.5E-11 | 2.8E-09 | 8.5E-11 | 5.8E-09 |
| Benzo(a)pyrene | 1.0E-05 | 0.02 | 7.3 | 1 | 6.1E-11 | 4.5E-10 | 6.1E-11 | 3.1E-09 | 0.02 | 1 | 5.5E-11 | 4.0E-10 | 5.5E-11 | 2.8E-09 | 8.5E-10 | 5.8E-09 |
| Benzo(b)fluoranthene | 2.7E-05 | 0.02 | 0.73 | 1 | 1.6E-10 | 1.2E-10 | 1.6E-10 | 8.2E-09 | 0.02 | 1 | 1.5E-10 | 1.1E-10 | 1.5E-10 | 7.5E-09 | 2.3E-10 | 1.6E-08 |
| Benzo(g,h,i)perylene | 2.8E-05 | 0.02 | NA | 1 | NA | NA | 1.7E-10 | 8.4E-09 | 0.04 | 1 | NA | NA | 3.0E-10 | 1.5E-08 | NA | 2.4E-08 |
| Benzo(k)fluoranthene | 1.0E-05 | 0.02 | 0.073 | 1 | 6.1E-11 | 4.5E-12 | 6.1E-11 | 3.1E-09 | 0.02 | 1 | 5.5E-11 | 4.0E-12 | 5.5E-11 | 2.8E-09 | 8.5E-12 | 5.8E-09 |
| Chrysene | 7.8E-05 | 0.02 | 0.0073 | 1 | 4.7E-10 | 3.5E-12 | 4.7E-10 | 2.4E-08 | 0.02 | 1 | 4.3E-10 | 3.1E-12 | 4.3E-10 | 2.1E-08 | 6.6E-12 | 4.5E-08 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 9.2E-11 | 6.7E-10 | 9.2E-11 | 4.6E-09 | 0.02 | 1 | 8.3E-11 | 6.0E-10 | 8.3E-11 | 4.1E-09 | 1.3E-09 | 8.7E-09 |
| Fluoranthene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 6.1E-10 | 1.5E-08 | 0.04 | 1 | NA | NA | 1.1E-09 | 2.8E-08 | NA | 4.3E-08 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 6.1E-10 | 1.5E-08 | 0.04 | 1 | NA | NA | 1.1E-09 | 2.8E-08 | NA | 4.3E-08 |
| Indeno(1,2,3-cd)pyrene | 2.8E-05 | 0.02 | 0.73 | 1 | 1.7E-10 | 1.2E-10 | 1.7E-10 | 8.4E-09 | 0.02 | 1 | 1.5E-10 | 1.1E-10 | 1.5E-10 | 7.6E-09 | 2.3E-10 | 1.6E-08 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 6.1E-09 | 3.1E-07 | 0.04 | 1 | NA | NA | 1.1E-08 | 5.5E-07 | NA | 8.6E-07 |
| Phenanthrene | 2.8E-04 | 0.02 | NA | 1 | NA | NA | 1.7E-09 | 8.4E-08 | 0.04 | 1 | NA | NA | 3.0E-09 | 1.5E-07 | NA | 2.4E-07 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 6.1E-10 | 2.0E-08 | 0.04 | 1 | NA | NA | 1.1E-09 | 3.7E-08 | NA | 5.7E-08 |
| BAP-TEQ | 1.9E-03 | 0.02 | 7.3 | 1 | 1.2E-08 | 8.7E-08 | 1.2E-08 | 5.9E-07 | 0.02 | 1 | 1.1E-08 | 7.8E-08 | 1.1E-08 | 5.4E-07 | 1.7E-07 | 1.1E-06 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 1.5E-09 | 1.8E-10 | 1.5E-09 | 5.1E-08 | 0.65 | 1 | 4.5E-08 | 5.4E-09 | 4.5E-08 | 1.5E-06 | 5.6E-09 | 1.5E-06 |
| Total | | | | | | 1.6E-09 | | 9.6E-07 | | | | 6.7E-09 | | 3.1E-06 | 8.2E-09 | 4.1E-06 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Area 1**
**Human Health Risk Calculations**
**Using WDNR's Exposure Assumptions**

**Evaluation of Potential Risk to Adult Trapper from Sediment using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Trapper as per WDNR Comments (adult) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Sediment Ingestion and Dermal Contact |

$$\text{ADD (mg/kg-day)} = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 3341 |
| AF: Adherence Factor (mg/cm2) | 0.18 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 2.2E-12 | 1.5E+05 | 3.3E-07 |
| Acenaphthene | 9.3E+01 | 1 | 0.13 | 5.7E-06 | 6.0E-02 | 9.5E-05 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 0.13 | 1.2E-07 | 2.0E-02 | 6.1E-06 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 0.13 | 8.6E-06 | 3.0E-01 | 2.9E-05 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 0.13 | 2.6E-06 | 2.0E-02 | 1.3E-04 | 1 | 0.13 | 9.0E-07 | 7.3E-01 | 6.6E-07 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 0.13 | 8.6E-07 | 2.0E-02 | 4.3E-05 | 1 | 0.13 | 2.9E-07 | 7.3E+00 | 2.1E-06 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 0.13 | 1.2E-06 | 2.0E-02 | 5.8E-05 | 1 | 0.13 | 4.0E-07 | 7.3E-01 | 2.9E-07 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 0.13 | 3.7E-07 | 2.0E-02 | 1.8E-05 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 0.13 | 4.4E-07 | 2.0E-02 | 2.2E-05 | 1 | 0.13 | 1.5E-07 | 7.3E-02 | 1.1E-08 |
| Chrysene | 6.0E+01 | 1 | 0.13 | 3.7E-06 | 2.0E-02 | 1.8E-04 | 1 | 0.13 | 1.3E-06 | 7.3E-03 | 9.2E-09 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 0.13 | 9.8E-08 | 2.0E-02 | 4.9E-06 | 1 | 0.13 | 3.4E-08 | 7.3E+00 | 2.4E-07 |
| Fluoranthene | 1.8E+02 | 1 | 0.13 | 1.1E-05 | 4.0E-02 | 2.8E-04 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 0.13 | 5.1E-06 | 4.0E-02 | 1.3E-04 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 0.13 | 3.4E-07 | 2.0E-02 | 1.7E-05 | 1 | 0.13 | 1.2E-07 | 7.3E-01 | 8.4E-08 |
| Naphthalene | 1.4E+02 | 1 | 0.13 | 8.6E-06 | 2.0E-02 | 4.3E-04 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 0.13 | 1.5E-05 | 2.0E-02 | 7.3E-04 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 0.13 | 7.9E-06 | 3.0E-02 | 2.6E-04 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 0.13 | 1.4E-06 | 2.0E-02 | 6.9E-05 | 1 | 0.13 | 4.7E-07 | 7.3E+00 | 3.4E-06 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 4.8E-08 | 3.0E-02 | 1.6E-06 | 1 | 0.25 | 1.6E-08 | 1.2E-01 | 2.0E-09 |
| Risk Total | | | | | | 2.4E-03 | | | | | 3.8E-06 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Recreational Visitor from Sediment using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (7-18) as per WDNR comments |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Sediment Ingestion and Dermal Contact |

$$ADD\ (mg/kg\text{-}day) = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 100 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 3133 |
| AF: Adherence Factor (mg/cm2) | 0.18 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 11 |
| BW: Body Weight (kg) | 48 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 4015 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 1.7E-12 | 1.5E+05 | 2.5E-07 |
| Acenaphthene | 9.3E+01 | 1 | 0.13 | 1.1E-05 | 6.0E-02 | 1.9E-04 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 0.13 | 2.5E-07 | 2.0E-02 | 1.2E-05 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 0.13 | 1.7E-05 | 3.0E-01 | 5.8E-05 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 0.13 | 5.3E-06 | 2.0E-02 | 2.7E-04 | 1 | 0.13 | 8.4E-07 | 7.3E-01 | 6.1E-07 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 0.13 | 1.7E-06 | 2.0E-02 | 8.7E-05 | 1 | 0.13 | 2.7E-07 | 7.3E+00 | 2.0E-06 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 0.13 | 2.3E-06 | 2.0E-02 | 1.2E-04 | 1 | 0.13 | 3.7E-07 | 7.3E-01 | 2.7E-07 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 0.13 | 7.4E-07 | 2.0E-02 | 3.7E-05 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 0.13 | 8.9E-07 | 2.0E-02 | 4.5E-05 | 1 | 0.13 | 1.4E-07 | 7.3E-02 | 1.0E-08 |
| Chrysene | 6.0E+01 | 1 | 0.13 | 7.4E-06 | 2.0E-02 | 3.7E-04 | 1 | 0.13 | 1.2E-06 | 7.3E-03 | 8.5E-09 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 0.13 | 2.0E-07 | 2.0E-02 | 9.9E-06 | 1 | 0.13 | 3.1E-08 | 7.3E+00 | 2.3E-07 |
| Fluoranthene | 1.8E+02 | 1 | 0.13 | 2.2E-05 | 4.0E-02 | 5.6E-04 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 0.13 | 1.0E-05 | 4.0E-02 | 2.6E-04 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 0.13 | 6.8E-07 | 2.0E-02 | 3.4E-05 | 1 | 0.13 | 1.1E-07 | 7.3E-01 | 7.8E-08 |
| Naphthalene | 1.4E+02 | 1 | 0.13 | 1.7E-05 | 2.0E-02 | 8.7E-04 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 0.13 | 3.0E-05 | 2.0E-02 | 1.5E-03 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 0.13 | 1.6E-05 | 3.0E-02 | 5.4E-04 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 0.13 | 2.8E-06 | 2.0E-02 | 1.4E-04 | 1 | 0.13 | 4.4E-07 | 7.3E+00 | 3.2E-06 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 8.6E-08 | 3.0E-02 | 2.9E-06 | 1 | 0.25 | 1.4E-08 | 1.2E-01 | 1.6E-09 |
| Risk Total | | | | | | 4.9E-03 | | | | | 3.4E-06 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Recreational Visitor from Sediment using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) as per WDNR comments |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 3341 |
| AF: Adherence Factor (mg/cm2) | 0.18 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| Compound | Sediment EPC (mg/kg) | Noncancer Hazard Quotient: Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Potential Excess Lifetime Cancer Risk: Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 2.2E-12 | 1.5E+05 | 3.3E-07 |
| Acenaphthene | 9.3E+01 | 1 | 0.13 | 5.7E-06 | 6.0E-02 | 9.5E-05 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 0.13 | 1.2E-07 | 2.0E-02 | 6.1E-06 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 0.13 | 8.6E-06 | 3.0E-01 | 2.9E-05 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 0.13 | 2.6E-06 | 2.0E-02 | 1.3E-04 | 1 | 0.13 | 9.0E-07 | 7.3E-01 | 6.6E-07 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 0.13 | 8.6E-07 | 2.0E-02 | 4.3E-05 | 1 | 0.13 | 2.9E-07 | 7.3E+00 | 2.1E-06 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 0.13 | 1.2E-06 | 2.0E-02 | 5.8E-05 | 1 | 0.13 | 4.0E-07 | 7.3E-01 | 2.9E-07 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 0.13 | 3.7E-07 | 2.0E-02 | 1.8E-05 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 0.13 | 4.4E-07 | 2.0E-02 | 2.2E-05 | 1 | 0.13 | 1.5E-07 | 7.3E-02 | 1.1E-08 |
| Chrysene | 6.0E+01 | 1 | 0.13 | 3.7E-06 | 2.0E-02 | 1.8E-04 | 1 | 0.13 | 1.3E-06 | 7.3E-03 | 9.2E-09 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 0.13 | 9.8E-08 | 2.0E-02 | 4.9E-06 | 1 | 0.13 | 3.4E-08 | 7.3E+00 | 2.4E-07 |
| Fluoranthene | 1.8E+02 | 1 | 0.13 | 1.1E-05 | 4.0E-02 | 2.8E-04 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 0.13 | 5.1E-06 | 4.0E-02 | 1.3E-04 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 0.13 | 3.4E-07 | 2.0E-02 | 1.7E-05 | 1 | 0.13 | 1.2E-07 | 7.3E-01 | 8.4E-08 |
| Naphthalene | 1.4E+02 | 1 | 0.13 | 8.6E-06 | 2.0E-02 | 4.3E-04 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 0.13 | 1.5E-05 | 2.0E-02 | 7.3E-04 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 0.13 | 7.9E-06 | 3.0E-02 | 2.6E-04 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 0.13 | 1.4E-06 | 2.0E-02 | 6.9E-05 | 1 | 0.13 | 4.7E-07 | 7.3E+00 | 3.4E-06 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 4.8E-08 | 3.0E-02 | 1.6E-06 | 1 | 0.25 | 1.6E-08 | 1.2E-01 | 2.0E-09 |
| Risk Total | | | | | | 2.4E-03 | | | | | 3.8E-06 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Hunter from Sediment using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (7-18) as per WDNR comments |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 100 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.02 |
| SA: Skin Surface Area (cm2/event) | 928 |
| AF: Adherence Factor (mg/cm2) | 0.2 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.02 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 11 |
| BW: Body Weight (kg) | 48 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 4015 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 2.2E-13 | 1.5E+05 | 3.4E-08 |
| Acenaphthene | 9.3E+01 | 1 | 0.13 | 2.1E-06 | 6.0E-02 | 3.4E-05 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 0.13 | 4.4E-08 | 2.0E-02 | 2.2E-06 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 0.13 | 3.1E-06 | 3.0E-01 | 1.0E-05 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 0.13 | 9.5E-07 | 2.0E-02 | 4.8E-05 | 1 | 0.13 | 1.5E-07 | 7.3E-01 | 1.1E-07 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 0.13 | 3.1E-07 | 2.0E-02 | 1.5E-05 | 1 | 0.13 | 4.9E-08 | 7.3E+00 | 3.6E-07 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 0.13 | 4.2E-07 | 2.0E-02 | 2.1E-05 | 1 | 0.13 | 6.6E-08 | 7.3E-01 | 4.8E-08 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 0.13 | 1.3E-07 | 2.0E-02 | 6.6E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 0.13 | 1.6E-07 | 2.0E-02 | 8.0E-06 | 1 | 0.13 | 2.5E-08 | 7.3E-02 | 1.8E-09 |
| Chrysene | 6.0E+01 | 1 | 0.13 | 1.3E-06 | 2.0E-02 | 6.6E-05 | 1 | 0.13 | 2.1E-07 | 7.3E-03 | 1.5E-09 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 0.13 | 3.5E-08 | 2.0E-02 | 1.8E-06 | 1 | 0.13 | 5.6E-09 | 7.3E+00 | 4.1E-08 |
| Fluoranthene | 1.8E+02 | 1 | 0.13 | 4.0E-06 | 4.0E-02 | 1.0E-04 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 0.13 | 1.9E-06 | 4.0E-02 | 4.6E-05 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 0.13 | 1.2E-07 | 2.0E-02 | 6.1E-06 | 1 | 0.13 | 1.9E-08 | 7.3E-01 | 1.4E-08 |
| Naphthalene | 1.4E+02 | 1 | 0.13 | 3.1E-06 | 2.0E-02 | 1.5E-04 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 0.13 | 5.3E-06 | 2.0E-02 | 2.7E-04 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 0.13 | 2.9E-06 | 3.0E-02 | 9.6E-05 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 0.13 | 5.0E-07 | 2.0E-02 | 2.5E-05 | 1 | 0.13 | 7.8E-08 | 7.3E+00 | 5.7E-07 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 1.3E-08 | 3.0E-02 | 4.4E-07 | 1 | 0.25 | 2.1E-09 | 1.2E-01 | 2.5E-10 |
| Risk Total | | | | | | 8.8E-04 | | | | | 6.0E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Hunter from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) as per WDNR comments |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.02 |
| SA: Skin Surface Area (cm2/event) | 904 |
| AF: Adherence Factor (mg/cm2) | 0.2 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.02 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 2.3E-13 | 1.5E+05 | 3.4E-08 |
| Acenaphthene | 9.3E+01 | 1 | 0.13 | 8.2E-07 | 6.0E-02 | 1.4E-05 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 0.13 | 1.8E-08 | 2.0E-02 | 8.8E-07 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 0.13 | 1.2E-06 | 3.0E-01 | 4.1E-06 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 0.13 | 3.8E-07 | 2.0E-02 | 1.9E-05 | 1 | 0.13 | 1.3E-07 | 7.3E-01 | 9.4E-08 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 0.13 | 1.2E-07 | 2.0E-02 | 6.1E-06 | 1 | 0.13 | 4.2E-08 | 7.3E+00 | 3.1E-07 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 0.13 | 1.7E-07 | 2.0E-02 | 8.3E-06 | 1 | 0.13 | 5.7E-08 | 7.3E-01 | 4.2E-08 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 0.13 | 5.3E-08 | 2.0E-02 | 2.6E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 0.13 | 6.3E-08 | 2.0E-02 | 3.2E-06 | 1 | 0.13 | 2.2E-08 | 7.3E-02 | 1.6E-09 |
| Chrysene | 6.0E+01 | 1 | 0.13 | 5.3E-07 | 2.0E-02 | 2.6E-05 | 1 | 0.13 | 1.8E-07 | 7.3E-03 | 1.3E-09 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 0.13 | 1.4E-08 | 2.0E-02 | 7.0E-07 | 1 | 0.13 | 4.8E-09 | 7.3E+00 | 3.5E-08 |
| Fluoranthene | 1.8E+02 | 1 | 0.13 | 1.6E-06 | 4.0E-02 | 3.9E-05 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 0.13 | 7.4E-07 | 4.0E-02 | 1.8E-05 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 0.13 | 4.8E-08 | 2.0E-02 | 2.4E-06 | 1 | 0.13 | 1.7E-08 | 7.3E-01 | 1.2E-08 |
| Naphthalene | 1.4E+02 | 1 | 0.13 | 1.2E-06 | 2.0E-02 | 6.1E-05 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 0.13 | 2.1E-06 | 2.0E-02 | 1.1E-04 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 0.13 | 1.1E-06 | 3.0E-02 | 3.8E-05 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 0.13 | 2.0E-07 | 2.0E-02 | 9.9E-06 | 1 | 0.13 | 6.8E-08 | 7.3E+00 | 4.9E-07 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 5.7E-09 | 3.0E-02 | 1.9E-07 | 1 | 0.25 | 1.9E-09 | 1.2E-01 | 2.3E-10 |
| Risk Total | | | | | | 3.5E-04 | | | | | 5.3E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Trapper from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Trapper as per WDNR Comments (adult) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 1.8E-04 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 1.9E-12 | 1.5E+05 | 2.8E-07 |
| Acenaphthene | 7.1E-02 | 1 | 0.13 | 3.3E-09 | 6.0E-02 | 5.4E-08 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.8E+00 | 1 | 0.13 | 8.0E-08 | 2.0E-02 | 4.0E-06 | NA | NA | NA | NA | NA |
| Anthracene | 3.0E+00 | 1 | 0.13 | 1.4E-07 | 3.0E-01 | 4.6E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 6.9E-01 | 1 | 0.13 | 3.2E-08 | 2.0E-02 | 1.6E-06 | 1 | 0.13 | 1.1E-08 | 7.3E-01 | 7.9E-09 |
| Benzo(a)pyrene | 3.7E+00 | 1 | 0.13 | 1.7E-07 | 2.0E-02 | 8.4E-06 | 1 | 0.13 | 5.7E-08 | 7.3E+00 | 4.2E-07 |
| Benzo(b)fluoranthene | 3.6E+00 | 1 | 0.13 | 1.6E-07 | 2.0E-02 | 8.2E-06 | 1 | 0.13 | 5.6E-08 | 7.3E-01 | 4.1E-08 |
| Benzo(g,h,i)perylene | 2.8E+00 | 1 | 0.13 | 1.3E-07 | 2.0E-02 | 6.4E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.4E+00 | 1 | 0.13 | 6.5E-08 | 2.0E-02 | 3.3E-06 | 1 | 0.13 | 2.2E-08 | 7.3E-02 | 1.6E-09 |
| Chrysene | 4.3E+00 | 1 | 0.13 | 2.0E-07 | 2.0E-02 | 9.8E-06 | 1 | 0.13 | 6.7E-08 | 7.3E-03 | 4.9E-10 |
| Dibenz(a,h)anthracene | 5.3E-01 | 1 | 0.13 | 2.4E-08 | 2.0E-02 | 1.2E-06 | 1 | 0.13 | 8.3E-09 | 7.3E+00 | 6.1E-08 |
| Fluoranthene | 7.4E-01 | 1 | 0.13 | 3.4E-08 | 4.0E-02 | 8.5E-07 | NA | NA | NA | NA | NA |
| Fluorene | 2.4E-01 | 1 | 0.13 | 1.1E-08 | 4.0E-02 | 2.7E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 2.6E+00 | 1 | 0.13 | 1.2E-07 | 2.0E-02 | 5.9E-06 | 1 | 0.13 | 4.0E-08 | 7.3E-01 | 2.9E-08 |
| Naphthalene | 1.0E-01 | 1 | 0.13 | 4.7E-09 | 2.0E-02 | 2.3E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 4.0E-01 | 1 | 0.13 | 1.8E-08 | 2.0E-02 | 9.2E-07 | NA | NA | NA | NA | NA |
| Pyrene | 7.3E-01 | 1 | 0.13 | 3.3E-08 | 3.0E-02 | 1.1E-06 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E+00 | 1 | 0.13 | 2.2E-07 | 2.0E-02 | 1.1E-05 | 1 | 0.13 | 7.7E-08 | 7.3E+00 | 5.6E-07 |
| Pentachlorophenol | 2.8E+00 | 1 | 0.25 | 1.8E-07 | 3.0E-02 | 6.1E-06 | 1 | 0.25 | 6.3E-08 | 1.2E-01 | 7.6E-09 |
| Risk Total | | | | | | 5.9E-05 | | | | | 8.5E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Recreational Visitor from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (7-18) as per WDNR Comments |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 100 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 11 |
| BW: Body Weight (kg) | 48 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 4015 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| Compound | Soil Concentration (mg/kg) | Noncancer Hazard Quotient: Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Potential Excess Lifetime Cancer Risk: Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD TEQ | 1.8E-04 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 2.3E-12 | 1.5E+05 | 3.4E-07 |
| Acenaphthene | 7.1E-02 | 1 | 0.13 | 7.3E-09 | 6.0E-02 | 1.2E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.8E+00 | 1 | 0.13 | 1.8E-07 | 2.0E-02 | 9.0E-06 | NA | NA | NA | NA | NA |
| Anthracene | 3.0E+00 | 1 | 0.13 | 3.1E-07 | 3.0E-01 | 1.0E-06 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 6.9E-01 | 1 | 0.13 | 7.2E-08 | 2.0E-02 | 3.6E-06 | 1 | 0.13 | 1.1E-08 | 7.3E-01 | 8.2E-09 |
| Benzo(a)pyrene | 3.7E+00 | 1 | 0.13 | 3.8E-07 | 2.0E-02 | 1.9E-05 | 1 | 0.13 | 5.9E-08 | 7.3E+00 | 4.3E-07 |
| Benzo(b)fluoranthene | 3.6E+00 | 1 | 0.13 | 3.7E-07 | 2.0E-02 | 1.8E-05 | 1 | 0.13 | 5.8E-08 | 7.3E-01 | 4.2E-08 |
| Benzo(g,h,i)perylene | 2.8E+00 | 1 | 0.13 | 2.9E-07 | 2.0E-02 | 1.4E-05 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.4E+00 | 1 | 0.13 | 1.5E-07 | 2.0E-02 | 7.4E-06 | 1 | 0.13 | 2.3E-08 | 7.3E-02 | 1.7E-09 |
| Chrysene | 4.3E+00 | 1 | 0.13 | 4.4E-07 | 2.0E-02 | 2.2E-05 | 1 | 0.13 | 6.9E-08 | 7.3E-03 | 5.1E-10 |
| Dibenz(a,h)anthracene | 5.3E-01 | 1 | 0.13 | 5.5E-08 | 2.0E-02 | 2.7E-06 | 1 | 0.13 | 8.6E-09 | 7.3E+00 | 6.3E-08 |
| Fluoranthene | 7.4E-01 | 1 | 0.13 | 7.7E-08 | 4.0E-02 | 1.9E-06 | NA | NA | NA | NA | NA |
| Fluorene | 2.4E-01 | 1 | 0.13 | 2.5E-08 | 4.0E-02 | 6.2E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 2.6E+00 | 1 | 0.13 | 2.6E-07 | 2.0E-02 | 1.3E-05 | 1 | 0.13 | 4.2E-08 | 7.3E-01 | 3.0E-08 |
| Naphthalene | 1.0E-01 | 1 | 0.13 | 1.1E-08 | 2.0E-02 | 5.3E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 4.0E-01 | 1 | 0.13 | 4.1E-08 | 2.0E-02 | 2.1E-06 | NA | NA | NA | NA | NA |
| Pyrene | 7.3E-01 | 1 | 0.13 | 7.5E-08 | 3.0E-02 | 2.5E-06 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E+00 | 1 | 0.13 | 5.0E-07 | 2.0E-02 | 2.5E-05 | 1 | 0.13 | 7.9E-08 | 7.3E+00 | 5.8E-07 |
| Pentachlorophenol | 2.8E+00 | 1 | 0.25 | 3.7E-07 | 3.0E-02 | 1.2E-05 | 1 | 0.25 | 5.8E-08 | 1.2E-01 | 7.0E-09 |
| Risk Total | | | | | | 1.3E-04 | | | | | 9.3E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Recreational Visitor from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) as per WDNR Comments |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| Compound | Soil Concentration (mg/kg) | Noncancer Hazard Quotient: Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Potential Excess Lifetime Cancer Risk: Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD TEQ | 1.8E-04 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 1.9E-12 | 1.5E+05 | 2.8E-07 |
| Acenaphthene | 7.1E-02 | 1 | 0.13 | 3.3E-09 | 6.0E-02 | 5.4E-08 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.8E+00 | 1 | 0.13 | 8.0E-08 | 2.0E-02 | 4.0E-06 | NA | NA | NA | NA | NA |
| Anthracene | 3.0E+00 | 1 | 0.13 | 1.4E-07 | 3.0E-01 | 4.6E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 6.9E-01 | 1 | 0.13 | 3.2E-08 | 2.0E-02 | 1.6E-06 | 1 | 0.13 | 1.1E-08 | 7.3E-01 | 7.9E-09 |
| Benzo(a)pyrene | 3.7E+00 | 1 | 0.13 | 1.7E-07 | 2.0E-02 | 8.4E-06 | 1 | 0.13 | 5.7E-08 | 7.3E+00 | 4.2E-07 |
| Benzo(b)fluoranthene | 3.6E+00 | 1 | 0.13 | 1.6E-07 | 2.0E-02 | 8.2E-06 | 1 | 0.13 | 5.6E-08 | 7.3E-01 | 4.1E-08 |
| Benzo(g,h,i)perylene | 2.8E+00 | 1 | 0.13 | 1.3E-07 | 2.0E-02 | 6.4E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.4E+00 | 1 | 0.13 | 6.5E-08 | 2.0E-02 | 3.3E-06 | 1 | 0.13 | 2.2E-08 | 7.3E-02 | 1.6E-09 |
| Chrysene | 4.3E+00 | 1 | 0.13 | 2.0E-07 | 2.0E-02 | 9.8E-06 | 1 | 0.13 | 6.7E-08 | 7.3E-03 | 4.9E-10 |
| Dibenz(a,h)anthracene | 5.3E-01 | 1 | 0.13 | 2.4E-08 | 2.0E-02 | 1.2E-06 | 1 | 0.13 | 8.3E-09 | 7.3E+00 | 6.1E-08 |
| Fluoranthene | 7.4E-01 | 1 | 0.13 | 3.4E-08 | 4.0E-02 | 8.5E-07 | NA | NA | NA | NA | NA |
| Fluorene | 2.4E-01 | 1 | 0.13 | 1.1E-08 | 4.0E-02 | 2.7E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 2.6E+00 | 1 | 0.13 | 1.2E-07 | 2.0E-02 | 5.9E-06 | 1 | 0.13 | 4.0E-08 | 7.3E-01 | 2.9E-08 |
| Naphthalene | 1.0E-01 | 1 | 0.13 | 4.7E-09 | 2.0E-02 | 2.3E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 4.0E-01 | 1 | 0.13 | 1.8E-08 | 2.0E-02 | 9.2E-07 | NA | NA | NA | NA | NA |
| Pyrene | 7.3E-01 | 1 | 0.13 | 3.3E-08 | 3.0E-02 | 1.1E-06 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E+00 | 1 | 0.13 | 2.2E-07 | 2.0E-02 | 1.1E-05 | 1 | 0.13 | 7.7E-08 | 7.3E+00 | 5.6E-07 |
| Pentachlorophenol | 2.8E+00 | 1 | 0.25 | 1.8E-07 | 3.0E-02 | 6.1E-06 | 1 | 0.25 | 6.3E-08 | 1.2E-01 | 7.6E-09 |
| Risk Total | | | | | | 5.9E-05 | | | | | 8.5E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Hunter from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (7-18) as per WDNR Comments |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 100 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.17 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.17 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 11 |
| BW: Body Weight (kg) | 48 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 4015 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 1.8E-04 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 4.6E-12 | 1.5E+05 | 6.9E-07 |
| Acenaphthene | 7.1E-02 | 1 | 0.13 | 1.5E-08 | 6.0E-02 | 2.4E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.8E+00 | 1 | 0.13 | 3.6E-07 | 2.0E-02 | 1.8E-05 | NA | NA | NA | NA | NA |
| Anthracene | 3.0E+00 | 1 | 0.13 | 6.2E-07 | 3.0E-01 | 2.1E-06 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 6.9E-01 | 1 | 0.13 | 1.4E-07 | 2.0E-02 | 7.2E-06 | 1 | 0.13 | 2.2E-08 | 7.3E-01 | 1.6E-08 |
| Benzo(a)pyrene | 3.7E+00 | 1 | 0.13 | 7.5E-07 | 2.0E-02 | 3.8E-05 | 1 | 0.13 | 1.2E-07 | 7.3E+00 | 8.6E-07 |
| Benzo(b)fluoranthene | 3.6E+00 | 1 | 0.13 | 7.4E-07 | 2.0E-02 | 3.7E-05 | 1 | 0.13 | 1.2E-07 | 7.3E-01 | 8.5E-08 |
| Benzo(g,h,i)perylene | 2.8E+00 | 1 | 0.13 | 5.8E-07 | 2.0E-02 | 2.9E-05 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.4E+00 | 1 | 0.13 | 2.9E-07 | 2.0E-02 | 1.5E-05 | 1 | 0.13 | 4.6E-08 | 7.3E-02 | 3.4E-09 |
| Chrysene | 4.3E+00 | 1 | 0.13 | 8.8E-07 | 2.0E-02 | 4.4E-05 | 1 | 0.13 | 1.4E-07 | 7.3E-03 | 1.0E-09 |
| Dibenz(a,h)anthracene | 5.3E-01 | 1 | 0.13 | 1.1E-07 | 2.0E-02 | 5.5E-06 | 1 | 0.13 | 1.7E-08 | 7.3E+00 | 1.3E-07 |
| Fluoranthene | 7.4E-01 | 1 | 0.13 | 1.5E-07 | 4.0E-02 | 3.8E-06 | NA | NA | NA | NA | NA |
| Fluorene | 2.4E-01 | 1 | 0.13 | 5.0E-08 | 4.0E-02 | 1.2E-06 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 2.6E+00 | 1 | 0.13 | 5.3E-07 | 2.0E-02 | 2.6E-05 | 1 | 0.13 | 8.3E-08 | 7.3E-01 | 6.1E-08 |
| Naphthalene | 1.0E-01 | 1 | 0.13 | 2.1E-08 | 2.0E-02 | 1.1E-06 | NA | NA | NA | NA | NA |
| Phenanthrene | 4.0E-01 | 1 | 0.13 | 8.3E-08 | 2.0E-02 | 4.1E-06 | NA | NA | NA | NA | NA |
| Pyrene | 7.3E-01 | 1 | 0.13 | 1.5E-07 | 3.0E-02 | 5.0E-06 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E+00 | 1 | 0.13 | 1.0E-06 | 2.0E-02 | 5.0E-05 | 1 | 0.13 | 1.6E-07 | 7.3E+00 | 1.2E-06 |
| Pentachlorophenol | 2.8E+00 | 1 | 0.25 | 7.4E-07 | 3.0E-02 | 2.5E-05 | 1 | 0.25 | 1.2E-07 | 1.2E-01 | 1.4E-08 |
| Risk Total | | | | | | 2.6E-04 | | | | | 1.9E-06 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Hunter from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) as per WDNR Comments |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 1 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.17 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.17 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 1.8E-04 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 3.8E-12 | 1.5E+05 | 5.7E-07 |
| Acenaphthene | 7.1E-02 | 1 | 0.13 | 6.5E-09 | 6.0E-02 | 1.1E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.8E+00 | 1 | 0.13 | 1.6E-07 | 2.0E-02 | 8.0E-06 | NA | NA | NA | NA | NA |
| Anthracene | 3.0E+00 | 1 | 0.13 | 2.7E-07 | 3.0E-01 | 9.1E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 6.9E-01 | 1 | 0.13 | 6.4E-08 | 2.0E-02 | 3.2E-06 | 1 | 0.13 | 2.2E-08 | 7.3E-01 | 1.6E-08 |
| Benzo(a)pyrene | 3.7E+00 | 1 | 0.13 | 3.3E-07 | 2.0E-02 | 1.7E-05 | 1 | 0.13 | 1.1E-07 | 7.3E+00 | 8.4E-07 |
| Benzo(b)fluoranthene | 3.6E+00 | 1 | 0.13 | 3.3E-07 | 2.0E-02 | 1.6E-05 | 1 | 0.13 | 1.1E-07 | 7.3E-01 | 8.2E-08 |
| Benzo(g,h,i)perylene | 2.8E+00 | 1 | 0.13 | 2.6E-07 | 2.0E-02 | 1.3E-05 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.4E+00 | 1 | 0.13 | 1.3E-07 | 2.0E-02 | 6.5E-06 | 1 | 0.13 | 4.5E-08 | 7.3E-02 | 3.3E-09 |
| Chrysene | 4.3E+00 | 1 | 0.13 | 3.9E-07 | 2.0E-02 | 2.0E-05 | 1 | 0.13 | 1.3E-07 | 7.3E-03 | 9.8E-10 |
| Dibenz(a,h)anthracene | 5.3E-01 | 1 | 0.13 | 4.9E-08 | 2.0E-02 | 2.4E-06 | 1 | 0.13 | 1.7E-08 | 7.3E+00 | 1.2E-07 |
| Fluoranthene | 7.4E-01 | 1 | 0.13 | 6.8E-08 | 4.0E-02 | 1.7E-06 | NA | NA | NA | NA | NA |
| Fluorene | 2.4E-01 | 1 | 0.13 | 2.2E-08 | 4.0E-02 | 5.5E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 2.6E+00 | 1 | 0.13 | 2.4E-07 | 2.0E-02 | 1.2E-05 | 1 | 0.13 | 8.1E-08 | 7.3E-01 | 5.9E-08 |
| Naphthalene | 1.0E-01 | 1 | 0.13 | 9.3E-09 | 2.0E-02 | 4.7E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 4.0E-01 | 1 | 0.13 | 3.7E-08 | 2.0E-02 | 1.8E-06 | NA | NA | NA | NA | NA |
| Pyrene | 7.3E-01 | 1 | 0.13 | 6.6E-08 | 3.0E-02 | 2.2E-06 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E+00 | 1 | 0.13 | 4.5E-07 | 2.0E-02 | 2.2E-05 | 1 | 0.13 | 1.5E-07 | 7.3E+00 | 1.1E-06 |
| Pentachlorophenol | 2.8E+00 | 1 | 0.25 | 3.7E-07 | 3.0E-02 | 1.2E-05 | 1 | 0.25 | 1.3E-07 | 1.2E-01 | 1.5E-08 |
| Risk Total | | | | | | 1.2E-04 | | | | | 1.7E-06 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Trapper from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Trapper as per WDNR Comments (adult) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 1 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3341 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 150 | 150 days in 5 month trapping season |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | EPC | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Risk(SW) | HI(SW) |
| Acenaphthene | 0.0E+00 | 0.06 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Acenaphthylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Anthracene | 0.0E+00 | 0.3 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(a)anthracene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(a)pyrene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(g,h,i)perylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(k)fluoranthene | 0.0E+00 | 0.02 | 0.073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 0.0E+00 | 0.02 | 0.0073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Dibenz(a,h)anthracene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Fluoranthene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Fluorene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Indeno(1,2,3-cd)pyrene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Naphthalene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Phenanthrene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Pyrene | 0.0E+00 | 0.03 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| BAP-TEQ | 5.8E-03 | 0.02 | 7.3 | 1 | 3.3E-07 | 2.4E-06 | 3.3E-07 | 1.7E-05 | 0.02 | 1 | 2.2E-06 | 1.6E-05 | 2.2E-06 | 1.1E-04 | 1.9E-05 | 1.3E-04 |
| Pentachlorophenol | 4.1E-04 | 0.03 | 0.12 | 1 | 2.3E-08 | 2.8E-09 | 2.3E-08 | 7.8E-07 | 0.65 | 1 | 5.1E-06 | 6.1E-07 | 5.1E-06 | 1.7E-04 | 6.1E-07 | 1.7E-04 |
| Total | | | | | | 2.8E-09 | | 7.8E-07 | | | | 6.1E-07 | | 1.7E-04 | 6.1E-07 | 1.7E-04 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium
PAH EPCs: Only 1 sample was collected in Area 1. The results were non-detect, but the detection limits for all PAHs were elevated (5mg/L), therefore concentration assumed to be zero for PAHs in Area 1.

**Evaluation of Potential Risk to Child Recreational Visitor from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (7-18) as per WDNR comments |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 1 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3133 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 365 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 11 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 4015 | |
| BW: Body Weight | kg | 48 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | Incidental Ingestion RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Dermal Contact Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Total Risk(SW) | HI(SW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 0.0E+00 | 0.06 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Acenaphthylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Anthracene | 0.0E+00 | 0.3 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(a)anthracene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(a)pyrene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(g,h,i)perylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(k)fluoranthene | 0.0E+00 | 0.02 | 0.073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 0.0E+00 | 0.02 | 0.0073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Dibenz(a,h)anthracene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Fluoranthene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Fluorene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Indeno(1,2,3-cd)pyrene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Naphthalene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Phenanthrene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Pyrene | 0.0E+00 | 0.03 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| BAP-TEQ | 5.8E-03 | 0.02 | 7.3 | 1 | 1.2E-06 | 8.8E-06 | 1.2E-06 | 6.0E-05 | 0.02 | 1 | 7.5E-06 | 5.5E-05 | 7.5E-06 | 3.8E-04 | 6.4E-05 | 4.4E-04 |
| Pentachlorophenol | 4.1E-04 | 0.03 | 0.12 | 1 | 8.5E-08 | 1.0E-08 | 8.5E-08 | 2.8E-06 | 0.65 | 1 | 1.7E-05 | 2.1E-06 | 1.7E-05 | 5.8E-04 | 2.1E-06 | 5.8E-04 |
| Total | | | | | | 1.0E-08 | | 2.8E-06 | | | | 2.1E-06 | | 5.8E-04 | 2.1E-06 | 5.8E-04 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium
PAH EPCs: Only 1 sample was collected in Area 1. The results were non-detect, but the detection limits for all PAHs were elevated (5mg/L), therefore concentration assumed to be zero for PAHs in Area 1.

**Evaluation of Potential Risk to Adult Recreational Visitor from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) as per WDNR comments |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 1 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3341 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 120 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | EPC | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Risk(SW) | HI(SW) |
| Acenaphthene | 0.0E+00 | 0.06 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Acenaphthylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Anthracene | 0.0E+00 | 0.3 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(a)anthracene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(a)pyrene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(g,h,i)perylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(k)fluoranthene | 0.0E+00 | 0.02 | 0.073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 0.0E+00 | 0.02 | 0.0073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Dibenz(a,h)anthracene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Fluoranthene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Fluorene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Indeno(1,2,3-cd)pyrene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Naphthalene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Phenanthrene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Pyrene | 0.0E+00 | 0.03 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| BAP-TEQ | 5.8E-03 | 0.02 | 7.3 | 1 | 2.6E-07 | 1.9E-06 | 2.6E-07 | 1.3E-05 | 0.02 | 1 | 1.8E-06 | 1.3E-05 | 1.8E-06 | 8.8E-05 | 1.5E-05 | 1.0E-04 |
| Pentachlorophenol | 4.1E-04 | 0.03 | 0.12 | 1 | 1.9E-08 | 2.3E-09 | 1.9E-08 | 6.3E-07 | 0.65 | 1 | 4.1E-06 | 4.9E-07 | 4.1E-06 | 1.4E-04 | 4.9E-07 | 1.4E-04 |
| Total | | | | | | 2.3E-09 | | 6.3E-07 | | | | 4.9E-07 | | 1.4E-04 | 4.9E-07 | 1.4E-04 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium
PAH EPCs: Only 1 sample was collected in Area 1. The results were non-detect, but the detection limits for all PAHs were elevated (5mg/L), therefore concentration assumed to be zero for PAHs in Area 1.

**Evaluation of Potential Risk to Child Hunter from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (7-18) as per WDNR comments |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 1 - Incidental Surface Water Ingestion and Dermal Contact |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 928 | |
| ET: Surface Water Exposure Time | h/d | 0.5 | |
| EF: Surface Water Exposure Frequency | d/y | 16 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 11 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 4015 | |
| BW: Body Weight | kg | 48 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

| | | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Risk(SW) | HI(SW) |
| Acenaphthene | 0.0E+00 | 0.06 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Acenaphthylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Anthracene | 0.0E+00 | 0.3 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(a)anthracene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(a)pyrene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(g,h,i)perylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(k)fluoranthene | 0.0E+00 | 0.02 | 0.073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 0.0E+00 | 0.02 | 0.0073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Dibenz(a,h)anthracene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Fluoranthene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Fluorene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Indeno(1,2,3-cd)pyrene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Naphthalene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Phenanthrene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Pyrene | 0.0E+00 | 0.03 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| BAP-TEQ | 5.8E-03 | 0.02 | 7.3 | 1 | 5.3E-08 | 3.9E-07 | 5.3E-08 | 2.6E-06 | 0.02 | 1 | 4.9E-08 | 3.6E-07 | 4.9E-08 | 2.4E-06 | 7.4E-07 | 5.1E-06 |
| Pentachlorophenol | 4.1E-04 | 0.03 | 0.12 | 1 | 3.7E-09 | 4.5E-10 | 3.7E-09 | 1.2E-07 | 0.65 | 1 | 1.1E-07 | 1.4E-08 | 1.1E-07 | 3.8E-06 | 1.4E-08 | 3.9E-06 |
| Total | | | | | | 4.5E-10 | | 1.2E-07 | | | | 1.4E-08 | | 3.8E-06 | 1.4E-08 | 3.9E-06 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium
PAH EPCs: Only 1 sample was collected in Area 1. The results were non-detect, but the detection limits for all PAHs were elevated (5mg/L), therefore concentration assumed to be zero for PAHs in Area 1.

**Evaluation of Potential Risk to Adult Hunter from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) as per WDNR comments |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 1 - Incidental Surface Water Ingestion and Dermal Contact |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 904 | |
| ET: Surface Water Exposure Time | h/d | 0.5 | |
| EF: Surface Water Exposure Frequency | d/y | 16 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

| | EPC | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Risk(SW) | HI(SW) |
| Acenaphthene | 0.0E+00 | 0.06 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Acenaphthylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Anthracene | 0.0E+00 | 0.3 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(a)anthracene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(a)pyrene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(g,h,i)perylene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Benzo(k)fluoranthene | 0.0E+00 | 0.02 | 0.073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 0.0E+00 | 0.02 | 0.0073 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Dibenz(a,h)anthracene | 0.0E+00 | 0.02 | 7.3 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Fluoranthene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Fluorene | 0.0E+00 | 0.04 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Indeno(1,2,3-cd)pyrene | 0.0E+00 | 0.02 | 0.73 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.02 | 1 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Naphthalene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Phenanthrene | 0.0E+00 | 0.02 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| Pyrene | 0.0E+00 | 0.03 | NA | 1 | NA | NA | 0.0E+00 | 0.0E+00 | 0.04 | 1 | NA | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| BAP-TEQ | 5.8E-03 | 0.02 | 7.3 | 1 | 3.5E-08 | 2.6E-07 | 3.5E-08 | 1.8E-06 | 0.02 | 1 | 3.2E-08 | 2.3E-07 | 3.2E-08 | 1.6E-06 | 4.9E-07 | 3.4E-06 |
| Pentachlorophenol | 4.1E-04 | 0.03 | 0.12 | 1 | 2.5E-09 | 3.0E-10 | 2.5E-09 | 8.3E-08 | 0.65 | 1 | 7.4E-08 | 8.8E-09 | 7.4E-08 | 2.5E-06 | 9.1E-09 | 2.5E-06 |
| Total | | | | | | 3.0E-10 | | 8.3E-08 | | | | 8.8E-09 | | 2.5E-06 | 9.1E-09 | 2.5E-06 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium
PAH EPCs: Only 1 sample was collected in Area 1. The results were non-detect, but the detection limits for all PAHs were elevated (5mg/L), therefore concentration assumed to be zero for PAHs in Area 1.

**Area 2**
**Human Health Risk Calculations**
**Using WDNR's Exposure Assumptions**

**Evaluation of Potential Risk to Adult Trapper from Sediment using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Trapper as per WDNR Comments (adult) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 3341 |
| AF: Adherence Factor (mg/cm2) | 0.18 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 2.2E-12 | 1.5E+05 | 3.3E-07 |
| Acenaphthene | 9.3E+01 | 1 | 0.13 | 5.7E-06 | 6.0E-02 | 9.5E-05 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 0.13 | 1.2E-07 | 2.0E-02 | 6.1E-06 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 0.13 | 8.6E-06 | 3.0E-01 | 2.9E-05 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 0.13 | 2.6E-06 | 2.0E-02 | 1.3E-04 | 1 | 0.13 | 9.0E-07 | 7.3E-01 | 6.6E-07 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 0.13 | 8.6E-07 | 2.0E-02 | 4.3E-05 | 1 | 0.13 | 2.9E-07 | 7.3E+00 | 2.1E-06 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 0.13 | 1.2E-06 | 2.0E-02 | 5.8E-05 | 1 | 0.13 | 4.0E-07 | 7.3E-01 | 2.9E-07 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 0.13 | 3.7E-07 | 2.0E-02 | 1.8E-05 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 0.13 | 4.4E-07 | 2.0E-02 | 2.2E-05 | 1 | 0.13 | 1.5E-07 | 7.3E-02 | 1.1E-08 |
| Chrysene | 6.0E+01 | 1 | 0.13 | 3.7E-06 | 2.0E-02 | 1.8E-04 | 1 | 0.13 | 1.3E-06 | 7.3E-03 | 9.2E-09 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 0.13 | 9.8E-08 | 2.0E-02 | 4.9E-06 | 1 | 0.13 | 3.4E-08 | 7.3E+00 | 2.4E-07 |
| Fluoranthene | 1.8E+02 | 1 | 0.13 | 1.1E-05 | 4.0E-02 | 2.8E-04 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 0.13 | 5.1E-06 | 4.0E-02 | 1.3E-04 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 0.13 | 3.4E-07 | 2.0E-02 | 1.7E-05 | 1 | 0.13 | 1.2E-07 | 7.3E-01 | 8.4E-08 |
| Naphthalene | 1.4E+02 | 1 | 0.13 | 8.6E-06 | 2.0E-02 | 4.3E-04 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 0.13 | 1.5E-05 | 2.0E-02 | 7.3E-04 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 0.13 | 7.9E-06 | 3.0E-02 | 2.6E-04 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 0.13 | 1.4E-06 | 2.0E-02 | 6.9E-05 | 1 | 0.13 | 4.7E-07 | 7.3E+00 | 3.4E-06 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 4.8E-08 | 3.0E-02 | 1.6E-06 | 1 | 0.25 | 1.6E-08 | 1.2E-01 | 2.0E-09 |
| Risk Total | | | | | | 2.4E-03 | | | | | 3.8E-06 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Recreational Visitor from Sediment using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (7-18) as per WDNR comments |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 100 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 11 |
| BW: Body Weight (kg) | 48 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 4015 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 1.2E-12 | 1.5E+05 | 1.8E-07 |
| Acenaphthene | 9.3E+01 | 1 | 0.13 | 9.6E-06 | 6.0E-02 | 1.6E-04 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 0.13 | 2.1E-07 | 2.0E-02 | 1.0E-05 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 0.13 | 1.4E-05 | 3.0E-01 | 4.8E-05 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 0.13 | 4.4E-06 | 2.0E-02 | 2.2E-04 | 1 | 0.13 | 7.0E-07 | 7.3E-01 | 5.1E-07 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 0.13 | 1.4E-06 | 2.0E-02 | 7.2E-05 | 1 | 0.13 | 2.3E-07 | 7.3E+00 | 1.7E-06 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 0.13 | 2.0E-06 | 2.0E-02 | 9.8E-05 | 1 | 0.13 | 3.1E-07 | 7.3E-01 | 2.2E-07 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 0.13 | 6.2E-07 | 2.0E-02 | 3.1E-05 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 0.13 | 7.4E-07 | 2.0E-02 | 3.7E-05 | 1 | 0.13 | 1.2E-07 | 7.3E-02 | 8.5E-09 |
| Chrysene | 6.0E+01 | 1 | 0.13 | 6.2E-06 | 2.0E-02 | 3.1E-04 | 1 | 0.13 | 9.7E-07 | 7.3E-03 | 7.1E-09 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 0.13 | 1.6E-07 | 2.0E-02 | 8.2E-06 | 1 | 0.13 | 2.6E-08 | 7.3E+00 | 1.9E-07 |
| Fluoranthene | 1.8E+02 | 1 | 0.13 | 1.9E-05 | 4.0E-02 | 4.6E-04 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 0.13 | 8.6E-06 | 4.0E-02 | 2.2E-04 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 0.13 | 5.7E-07 | 2.0E-02 | 2.8E-05 | 1 | 0.13 | 8.9E-08 | 7.3E-01 | 6.5E-08 |
| Naphthalene | 1.4E+02 | 1 | 0.13 | 1.4E-05 | 2.0E-02 | 7.2E-04 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 0.13 | 2.5E-05 | 2.0E-02 | 1.2E-03 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 0.13 | 1.3E-05 | 3.0E-02 | 4.5E-04 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 0.13 | 2.3E-06 | 2.0E-02 | 1.2E-04 | 1 | 0.13 | 3.6E-07 | 7.3E+00 | 2.7E-06 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 6.6E-08 | 3.0E-02 | 2.2E-06 | 1 | 0.25 | 1.0E-08 | 1.2E-01 | 1.2E-09 |
| Risk Total | | | | | | 4.1E-03 | | | | | 2.8E-06 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Recreational Visitor from Sediment using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) as per WDNR comments |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 3341 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 1.8E-12 | 1.5E+05 | 2.7E-07 |
| Acenaphthene | 9.3E+01 | 1 | 0.13 | 4.9E-06 | 6.0E-02 | 8.2E-05 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 0.13 | 1.1E-07 | 2.0E-02 | 5.3E-06 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 0.13 | 7.4E-06 | 3.0E-01 | 2.5E-05 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 0.13 | 2.3E-06 | 2.0E-02 | 1.1E-04 | 1 | 0.13 | 7.8E-07 | 7.3E-01 | 5.7E-07 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 0.13 | 7.4E-07 | 2.0E-02 | 3.7E-05 | 1 | 0.13 | 2.5E-07 | 7.3E+00 | 1.9E-06 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 0.13 | 1.0E-06 | 2.0E-02 | 5.0E-05 | 1 | 0.13 | 3.4E-07 | 7.3E-01 | 2.5E-07 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 0.13 | 3.2E-07 | 2.0E-02 | 1.6E-05 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 0.13 | 3.8E-07 | 2.0E-02 | 1.9E-05 | 1 | 0.13 | 1.3E-07 | 7.3E-02 | 9.5E-09 |
| Chrysene | 6.0E+01 | 1 | 0.13 | 3.2E-06 | 2.0E-02 | 1.6E-04 | 1 | 0.13 | 1.1E-06 | 7.3E-03 | 7.9E-09 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 0.13 | 8.5E-08 | 2.0E-02 | 4.2E-06 | 1 | 0.13 | 2.9E-08 | 7.3E+00 | 2.1E-07 |
| Fluoranthene | 1.8E+02 | 1 | 0.13 | 9.5E-06 | 4.0E-02 | 2.4E-04 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 0.13 | 4.4E-06 | 4.0E-02 | 1.1E-04 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 0.13 | 2.9E-07 | 2.0E-02 | 1.5E-05 | 1 | 0.13 | 1.0E-07 | 7.3E-01 | 7.3E-08 |
| Naphthalene | 1.4E+02 | 1 | 0.13 | 7.4E-06 | 2.0E-02 | 3.7E-04 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 0.13 | 1.3E-05 | 2.0E-02 | 6.3E-04 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 0.13 | 6.9E-06 | 3.0E-02 | 2.3E-04 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 0.13 | 1.2E-06 | 2.0E-02 | 5.9E-05 | 1 | 0.13 | 4.1E-07 | 7.3E+00 | 3.0E-06 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 4.0E-08 | 3.0E-02 | 1.3E-06 | 1 | 0.25 | 1.4E-08 | 1.2E-01 | 1.6E-09 |
| Risk Total | | | | | | 2.1E-03 | | | | | 3.2E-06 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Hunter from Sediment using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (7-18) as per WDNR comments |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 100 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.02 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.02 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 11 |
| BW: Body Weight (kg) | 48 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 4015 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 3.0E-13 | 1.5E+05 | 4.6E-08 |
| Acenaphthene | 9.3E+01 | 1 | 0.13 | 2.4E-06 | 6.0E-02 | 4.0E-05 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 0.13 | 5.1E-08 | 2.0E-02 | 2.6E-06 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 0.13 | 3.6E-06 | 3.0E-01 | 1.2E-05 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 0.13 | 1.1E-06 | 2.0E-02 | 5.5E-05 | 1 | 0.13 | 1.7E-07 | 7.3E-01 | 1.3E-07 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 0.13 | 3.6E-07 | 2.0E-02 | 1.8E-05 | 1 | 0.13 | 5.7E-08 | 7.3E+00 | 4.1E-07 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 0.13 | 4.9E-07 | 2.0E-02 | 2.4E-05 | 1 | 0.13 | 7.7E-08 | 7.3E-01 | 5.6E-08 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 0.13 | 1.5E-07 | 2.0E-02 | 7.7E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 0.13 | 1.9E-07 | 2.0E-02 | 9.3E-06 | 1 | 0.13 | 2.9E-08 | 7.3E-02 | 2.1E-09 |
| Chrysene | 6.0E+01 | 1 | 0.13 | 1.5E-06 | 2.0E-02 | 7.7E-05 | 1 | 0.13 | 2.4E-07 | 7.3E-03 | 1.8E-09 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 0.13 | 4.1E-08 | 2.0E-02 | 2.1E-06 | 1 | 0.13 | 6.5E-09 | 7.3E+00 | 4.7E-08 |
| Fluoranthene | 1.8E+02 | 1 | 0.13 | 4.6E-06 | 4.0E-02 | 1.2E-04 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 0.13 | 2.2E-06 | 4.0E-02 | 5.4E-05 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 0.13 | 1.4E-07 | 2.0E-02 | 7.1E-06 | 1 | 0.13 | 2.2E-08 | 7.3E-01 | 1.6E-08 |
| Naphthalene | 1.4E+02 | 1 | 0.13 | 3.6E-06 | 2.0E-02 | 1.8E-04 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 0.13 | 6.2E-06 | 2.0E-02 | 3.1E-04 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 0.13 | 3.3E-06 | 3.0E-02 | 1.1E-04 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 0.13 | 5.8E-07 | 2.0E-02 | 2.9E-05 | 1 | 0.13 | 9.1E-08 | 7.3E+00 | 6.6E-07 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 1.7E-08 | 3.0E-02 | 5.5E-07 | 1 | 0.25 | 2.6E-09 | 1.2E-01 | 3.1E-10 |
| Risk Total | | | | | | 1.0E-03 | | | | | 7.1E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Hunter from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) as per WDNR comments |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.02 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.02 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.6E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 3.6E-13 | 1.5E+05 | 5.4E-08 |
| Acenaphthene | 9.3E+01 | 1 | 0.13 | 1.1E-06 | 6.0E-02 | 1.8E-05 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.0E+00 | 1 | 0.13 | 2.3E-08 | 2.0E-02 | 1.1E-06 | NA | NA | NA | NA | NA |
| Anthracene | 1.4E+02 | 1 | 0.13 | 1.6E-06 | 3.0E-01 | 5.3E-06 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.3E+01 | 1 | 0.13 | 4.9E-07 | 2.0E-02 | 2.5E-05 | 1 | 0.13 | 1.7E-07 | 7.3E-01 | 1.2E-07 |
| Benzo(a)pyrene | 1.4E+01 | 1 | 0.13 | 1.6E-07 | 2.0E-02 | 8.0E-06 | 1 | 0.13 | 5.5E-08 | 7.3E+00 | 4.0E-07 |
| Benzo(b)fluoranthene | 1.9E+01 | 1 | 0.13 | 2.2E-07 | 2.0E-02 | 1.1E-05 | 1 | 0.13 | 7.4E-08 | 7.3E-01 | 5.4E-08 |
| Benzo(g,h,i)perylene | 6.0E+00 | 1 | 0.13 | 6.9E-08 | 2.0E-02 | 3.4E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 7.2E+00 | 1 | 0.13 | 8.2E-08 | 2.0E-02 | 4.1E-06 | 1 | 0.13 | 2.8E-08 | 7.3E-02 | 2.1E-09 |
| Chrysene | 6.0E+01 | 1 | 0.13 | 6.9E-07 | 2.0E-02 | 3.4E-05 | 1 | 0.13 | 2.4E-07 | 7.3E-03 | 1.7E-09 |
| Dibenz(a,h)anthracene | 1.6E+00 | 1 | 0.13 | 1.8E-08 | 2.0E-02 | 9.1E-07 | 1 | 0.13 | 6.3E-09 | 7.3E+00 | 4.6E-08 |
| Fluoranthene | 1.8E+02 | 1 | 0.13 | 2.1E-06 | 4.0E-02 | 5.1E-05 | NA | NA | NA | NA | NA |
| Fluorene | 8.4E+01 | 1 | 0.13 | 9.6E-07 | 4.0E-02 | 2.4E-05 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.5E+00 | 1 | 0.13 | 6.3E-08 | 2.0E-02 | 3.1E-06 | 1 | 0.13 | 2.2E-08 | 7.3E-01 | 1.6E-08 |
| Naphthalene | 1.4E+02 | 1 | 0.13 | 1.6E-06 | 2.0E-02 | 8.0E-05 | NA | NA | NA | NA | NA |
| Phenanthrene | 2.4E+02 | 1 | 0.13 | 2.7E-06 | 2.0E-02 | 1.4E-04 | NA | NA | NA | NA | NA |
| Pyrene | 1.3E+02 | 1 | 0.13 | 1.5E-06 | 3.0E-02 | 5.0E-05 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.2E+01 | 1 | 0.13 | 2.6E-07 | 2.0E-02 | 1.3E-05 | 1 | 0.13 | 8.8E-08 | 7.3E+00 | 6.4E-07 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 8.2E-09 | 3.0E-02 | 2.7E-07 | 1 | 0.25 | 2.8E-09 | 1.2E-01 | 3.4E-10 |
| Risk Total | | | | | | 4.6E-04 | | | | | 7.0E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Trapper from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Trapper as per WDNR Comments (adult) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Soil Ingestion and Dermal Contact |

$$\text{ADD (mg/kg-day)} = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 2.9E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 3.1E-13 | 1.5E+05 | 4.6E-08 |
| Acenaphthene | 1.5E-01 | 1 | 0.13 | 7.1E-09 | 6.0E-02 | 1.2E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.7E-01 | 1 | 0.13 | 7.8E-09 | 2.0E-02 | 3.9E-07 | NA | NA | NA | NA | NA |
| Anthracene | 2.5E-01 | 1 | 0.13 | 1.1E-08 | 3.0E-01 | 3.8E-08 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.1E-01 | 1 | 0.13 | 5.1E-09 | 2.0E-02 | 2.6E-07 | 1 | 0.13 | 1.8E-09 | 7.3E-01 | 1.3E-09 |
| Benzo(a)pyrene | 2.1E-01 | 1 | 0.13 | 9.5E-09 | 2.0E-02 | 4.8E-07 | 1 | 0.13 | 3.3E-09 | 7.3E+00 | 2.4E-08 |
| Benzo(b)fluoranthene | 2.7E-01 | 1 | 0.13 | 1.2E-08 | 2.0E-02 | 6.2E-07 | 1 | 0.13 | 4.2E-09 | 7.3E-01 | 3.1E-09 |
| Benzo(g,h,i)perylene | 4.4E-01 | 1 | 0.13 | 2.0E-08 | 2.0E-02 | 1.0E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E-01 | 1 | 0.13 | 5.0E-09 | 2.0E-02 | 2.5E-07 | 1 | 0.13 | 1.7E-09 | 7.3E-02 | 1.3E-10 |
| Chrysene | 2.2E-01 | 1 | 0.13 | 1.0E-08 | 2.0E-02 | 5.1E-07 | 1 | 0.13 | 3.5E-09 | 7.3E-03 | 2.6E-11 |
| Dibenz(a,h)anthracene | 1.5E-01 | 1 | 0.13 | 6.7E-09 | 2.0E-02 | 3.3E-07 | 1 | 0.13 | 2.3E-09 | 7.3E+00 | 1.7E-08 |
| Fluoranthene | 1.2E-01 | 1 | 0.13 | 5.6E-09 | 4.0E-02 | 1.4E-07 | NA | NA | NA | NA | NA |
| Fluorene | 1.3E-01 | 1 | 0.13 | 5.9E-09 | 4.0E-02 | 1.5E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 3.8E-01 | 1 | 0.13 | 1.7E-08 | 2.0E-02 | 8.7E-07 | 1 | 0.13 | 6.0E-09 | 7.3E-01 | 4.4E-09 |
| Naphthalene | 1.3E-01 | 1 | 0.13 | 6.1E-09 | 2.0E-02 | 3.0E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 9.6E-02 | 1 | 0.13 | 4.4E-09 | 2.0E-02 | 2.2E-07 | NA | NA | NA | NA | NA |
| Pyrene | 1.2E-01 | 1 | 0.13 | 5.5E-09 | 3.0E-02 | 1.8E-07 | NA | NA | NA | NA | NA |
| BAP-TEQ | 3.5E-01 | 1 | 0.13 | 1.6E-08 | 2.0E-02 | 8.1E-07 | 1 | 0.13 | 5.5E-09 | 7.3E+00 | 4.0E-08 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.25 | 9.1E-08 | 3.0E-02 | 3.0E-06 | 1 | 0.25 | 3.1E-08 | 1.2E-01 | 3.7E-09 |
| Risk Total | | | | | | 8.9E-06 | | | | | 9.9E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Recreational Visitor from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (7-18) as per WDNR Comments |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Soil Ingestion and Dermal Contact |

$$\text{ADD (mg/kg-day)} = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 100 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 11 |
| BW: Body Weight (kg) | 48 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 4015 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| Compound | Soil Concentration (mg/kg) | Noncancer Hazard Quotient: Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Potential Excess Lifetime Cancer Risk: Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD TEQ | 2.9E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 3.8E-13 | 1.5E+05 | 5.6E-08 |
| Acenaphthene | 1.5E-01 | 1 | 0.13 | 1.6E-08 | 6.0E-02 | 2.7E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.7E-01 | 1 | 0.13 | 1.7E-08 | 2.0E-02 | 8.7E-07 | NA | NA | NA | NA | NA |
| Anthracene | 2.5E-01 | 1 | 0.13 | 2.5E-08 | 3.0E-01 | 8.5E-08 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.1E-01 | 1 | 0.13 | 1.2E-08 | 2.0E-02 | 5.8E-07 | 1 | 0.13 | 1.8E-09 | 7.3E-01 | 1.3E-09 |
| Benzo(a)pyrene | 2.1E-01 | 1 | 0.13 | 2.1E-08 | 2.0E-02 | 1.1E-06 | 1 | 0.13 | 3.4E-09 | 7.3E+00 | 2.5E-08 |
| Benzo(b)fluoranthene | 2.7E-01 | 1 | 0.13 | 2.8E-08 | 2.0E-02 | 1.4E-06 | 1 | 0.13 | 4.4E-09 | 7.3E-01 | 3.2E-09 |
| Benzo(g,h,i)perylene | 4.4E-01 | 1 | 0.13 | 4.5E-08 | 2.0E-02 | 2.3E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E-01 | 1 | 0.13 | 1.1E-08 | 2.0E-02 | 5.7E-07 | 1 | 0.13 | 1.8E-09 | 7.3E-02 | 1.3E-10 |
| Chrysene | 2.2E-01 | 1 | 0.13 | 2.3E-08 | 2.0E-02 | 1.2E-06 | 1 | 0.13 | 3.6E-09 | 7.3E-03 | 2.6E-11 |
| Dibenz(a,h)anthracene | 1.5E-01 | 1 | 0.13 | 1.5E-08 | 2.0E-02 | 7.5E-07 | 1 | 0.13 | 2.4E-09 | 7.3E+00 | 1.7E-08 |
| Fluoranthene | 1.2E-01 | 1 | 0.13 | 1.3E-08 | 4.0E-02 | 3.1E-07 | NA | NA | NA | NA | NA |
| Fluorene | 1.3E-01 | 1 | 0.13 | 1.3E-08 | 4.0E-02 | 3.3E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 3.8E-01 | 1 | 0.13 | 3.9E-08 | 2.0E-02 | 2.0E-06 | 1 | 0.13 | 6.2E-09 | 7.3E-01 | 4.5E-09 |
| Naphthalene | 1.3E-01 | 1 | 0.13 | 1.4E-08 | 2.0E-02 | 6.9E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 9.6E-02 | 1 | 0.13 | 9.9E-09 | 2.0E-02 | 4.9E-07 | NA | NA | NA | NA | NA |
| Pyrene | 1.2E-01 | 1 | 0.13 | 1.2E-08 | 3.0E-02 | 4.1E-07 | NA | NA | NA | NA | NA |
| BAP-TEQ | 3.5E-01 | 1 | 0.13 | 3.6E-08 | 2.0E-02 | 1.8E-06 | 1 | 0.13 | 5.7E-09 | 7.3E+00 | 4.2E-08 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.25 | 1.8E-07 | 3.0E-02 | 6.1E-06 | 1 | 0.25 | 2.9E-08 | 1.2E-01 | 3.4E-09 |
| Risk Total | | | | | | 1.9E-05 | | | | | 1.1E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Recreational Visitor from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) as per WDNR Comments |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| Compound | Soil Concentration (mg/kg) | Noncancer Hazard Quotient<br>Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Potential Excess Lifetime Cancer Risk<br>Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD TEQ | 2.9E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 3.1E-13 | 1.5E+05 | 4.6E-08 |
| Acenaphthene | 1.5E-01 | 1 | 0.13 | 7.1E-09 | 6.0E-02 | 1.2E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.7E-01 | 1 | 0.13 | 7.8E-09 | 2.0E-02 | 3.9E-07 | NA | NA | NA | NA | NA |
| Anthracene | 2.5E-01 | 1 | 0.13 | 1.1E-08 | 3.0E-01 | 3.8E-08 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.1E-01 | 1 | 0.13 | 5.1E-09 | 2.0E-02 | 2.6E-07 | 1 | 0.13 | 1.8E-09 | 7.3E-01 | 1.3E-09 |
| Benzo(a)pyrene | 2.1E-01 | 1 | 0.13 | 9.5E-09 | 2.0E-02 | 4.8E-07 | 1 | 0.13 | 3.3E-09 | 7.3E+00 | 2.4E-08 |
| Benzo(b)fluoranthene | 2.7E-01 | 1 | 0.13 | 1.2E-08 | 2.0E-02 | 6.2E-07 | 1 | 0.13 | 4.2E-09 | 7.3E-01 | 3.1E-09 |
| Benzo(g,h,i)perylene | 4.4E-01 | 1 | 0.13 | 2.0E-08 | 2.0E-02 | 1.0E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E-01 | 1 | 0.13 | 5.0E-09 | 2.0E-02 | 2.5E-07 | 1 | 0.13 | 1.7E-09 | 7.3E-02 | 1.3E-10 |
| Chrysene | 2.2E-01 | 1 | 0.13 | 1.0E-08 | 2.0E-02 | 5.1E-07 | 1 | 0.13 | 3.5E-09 | 7.3E-03 | 2.6E-11 |
| Dibenz(a,h)anthracene | 1.5E-01 | 1 | 0.13 | 6.7E-09 | 2.0E-02 | 3.3E-07 | 1 | 0.13 | 2.3E-09 | 7.3E+00 | 1.7E-08 |
| Fluoranthene | 1.2E-01 | 1 | 0.13 | 5.6E-09 | 4.0E-02 | 1.4E-07 | NA | NA | NA | NA | NA |
| Fluorene | 1.3E-01 | 1 | 0.13 | 5.9E-09 | 4.0E-02 | 1.5E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 3.8E-01 | 1 | 0.13 | 1.7E-08 | 2.0E-02 | 8.7E-07 | 1 | 0.13 | 6.0E-09 | 7.3E-01 | 4.4E-09 |
| Naphthalene | 1.3E-01 | 1 | 0.13 | 6.1E-09 | 2.0E-02 | 3.0E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 9.6E-02 | 1 | 0.13 | 4.4E-09 | 2.0E-02 | 2.2E-07 | NA | NA | NA | NA | NA |
| Pyrene | 1.2E-01 | 1 | 0.13 | 5.5E-09 | 3.0E-02 | 1.8E-07 | NA | NA | NA | NA | NA |
| BAP-TEQ | 3.5E-01 | 1 | 0.13 | 1.6E-08 | 2.0E-02 | 8.1E-07 | 1 | 0.13 | 5.5E-09 | 7.3E+00 | 4.0E-08 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.25 | 9.1E-08 | 3.0E-02 | 3.0E-06 | 1 | 0.25 | 3.1E-08 | 1.2E-01 | 3.7E-09 |
| Risk Total | | | | | | 8.9E-06 | | | | | 9.9E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Hunter from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (7-18) as per WDNR Comments |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 100 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.17 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.17 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 11 |
| BW: Body Weight (kg) | 48 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 4015 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| Compound | Soil Concentration (mg/kg) | Noncancer Hazard Quotient: Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Potential Excess Lifetime Cancer Risk: Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD TEQ | 4.3E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 1.1E-12 | 1.5E+05 | 1.7E-07 |
| Acenaphthene | 1.6E-01 | 1 | 0.13 | 3.3E-08 | 6.0E-02 | 5.5E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.3E-01 | 1 | 0.13 | 4.7E-08 | 2.0E-02 | 2.3E-06 | NA | NA | NA | NA | NA |
| Anthracene | 3.4E-01 | 1 | 0.13 | 6.9E-08 | 3.0E-01 | 2.3E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.5E-01 | 1 | 0.13 | 3.0E-08 | 2.0E-02 | 1.5E-06 | 1 | 0.13 | 4.7E-09 | 7.3E-01 | 3.4E-09 |
| Benzo(a)pyrene | 2.8E-01 | 1 | 0.13 | 5.9E-08 | 2.0E-02 | 2.9E-06 | 1 | 0.13 | 9.2E-09 | 7.3E+00 | 6.7E-08 |
| Benzo(b)fluoranthene | 3.6E-01 | 1 | 0.13 | 7.5E-08 | 2.0E-02 | 3.7E-06 | 1 | 0.13 | 1.2E-08 | 7.3E-01 | 8.6E-09 |
| Benzo(g,h,i)perylene | 6.1E-01 | 1 | 0.13 | 1.3E-07 | 2.0E-02 | 6.3E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.5E-01 | 1 | 0.13 | 3.0E-08 | 2.0E-02 | 1.5E-06 | 1 | 0.13 | 4.8E-09 | 7.3E-02 | 3.5E-10 |
| Chrysene | 3.3E-01 | 1 | 0.13 | 6.9E-08 | 2.0E-02 | 3.4E-06 | 1 | 0.13 | 1.1E-08 | 7.3E-03 | 7.9E-11 |
| Dibenz(a,h)anthracene | 1.9E-01 | 1 | 0.13 | 3.9E-08 | 2.0E-02 | 1.9E-06 | 1 | 0.13 | 6.1E-09 | 7.3E+00 | 4.4E-08 |
| Fluoranthene | 1.5E-01 | 1 | 0.13 | 3.1E-08 | 4.0E-02 | 7.9E-07 | NA | NA | NA | NA | NA |
| Fluorene | 1.7E-01 | 1 | 0.13 | 3.5E-08 | 4.0E-02 | 8.8E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.4E-01 | 1 | 0.13 | 1.1E-07 | 2.0E-02 | 5.6E-06 | 1 | 0.13 | 1.7E-08 | 7.3E-01 | 1.3E-08 |
| Naphthalene | 1.6E-01 | 1 | 0.13 | 3.3E-08 | 2.0E-02 | 1.6E-06 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.3E-01 | 1 | 0.13 | 2.8E-08 | 2.0E-02 | 1.4E-06 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E-01 | 1 | 0.13 | 3.2E-08 | 3.0E-02 | 1.1E-06 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E-01 | 1 | 0.13 | 1.0E-07 | 2.0E-02 | 5.1E-06 | 1 | 0.13 | 1.6E-08 | 7.3E+00 | 1.2E-07 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.25 | 3.8E-07 | 3.0E-02 | 1.3E-05 | 1 | 0.25 | 5.9E-08 | 1.2E-01 | 7.1E-09 |
| Risk Total | | | | | | 4.8E-05 | | | | | 3.1E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Hunter from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Kuppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) as per WDNR Comments |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 2 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.17 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.17 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.3E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 9.1E-13 | 1.5E+05 | 1.4E-07 |
| Acenaphthene | 1.6E-01 | 1 | 0.13 | 1.5E-08 | 6.0E-02 | 2.5E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.3E-01 | 1 | 0.13 | 2.1E-08 | 2.0E-02 | 1.0E-06 | NA | NA | NA | NA | NA |
| Anthracene | 3.4E-01 | 1 | 0.13 | 3.1E-08 | 3.0E-01 | 1.0E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.5E-01 | 1 | 0.13 | 1.3E-08 | 2.0E-02 | 6.6E-07 | 1 | 0.13 | 4.6E-09 | 7.3E-01 | 3.3E-09 |
| Benzo(a)pyrene | 2.8E-01 | 1 | 0.13 | 2.6E-08 | 2.0E-02 | 1.3E-06 | 1 | 0.13 | 8.9E-09 | 7.3E+00 | 6.5E-08 |
| Benzo(b)fluoranthene | 3.6E-01 | 1 | 0.13 | 3.3E-08 | 2.0E-02 | 1.7E-06 | 1 | 0.13 | 1.1E-08 | 7.3E-01 | 8.3E-09 |
| Benzo(g,h,i)perylene | 6.1E-01 | 1 | 0.13 | 5.6E-08 | 2.0E-02 | 2.8E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.5E-01 | 1 | 0.13 | 1.3E-08 | 2.0E-02 | 6.7E-07 | 1 | 0.13 | 4.6E-09 | 7.3E-02 | 3.4E-10 |
| Chrysene | 3.3E-01 | 1 | 0.13 | 3.1E-08 | 2.0E-02 | 1.5E-06 | 1 | 0.13 | 1.0E-08 | 7.3E-03 | 7.6E-11 |
| Dibenz(a,h)anthracene | 1.9E-01 | 1 | 0.13 | 1.7E-08 | 2.0E-02 | 8.6E-07 | 1 | 0.13 | 5.9E-09 | 7.3E+00 | 4.3E-08 |
| Fluoranthene | 1.5E-01 | 1 | 0.13 | 1.4E-08 | 4.0E-02 | 3.5E-07 | NA | NA | NA | NA | NA |
| Fluorene | 1.7E-01 | 1 | 0.13 | 1.6E-08 | 4.0E-02 | 3.9E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.4E-01 | 1 | 0.13 | 4.9E-08 | 2.0E-02 | 2.5E-06 | 1 | 0.13 | 1.7E-08 | 7.3E-01 | 1.2E-08 |
| Naphthalene | 1.6E-01 | 1 | 0.13 | 1.5E-08 | 2.0E-02 | 7.3E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.3E-01 | 1 | 0.13 | 1.2E-08 | 2.0E-02 | 6.1E-07 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E-01 | 1 | 0.13 | 1.4E-08 | 3.0E-02 | 4.7E-07 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E-01 | 1 | 0.13 | 4.5E-08 | 2.0E-02 | 2.3E-06 | 1 | 0.13 | 1.5E-08 | 7.3E+00 | 1.1E-07 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.25 | 1.9E-07 | 3.0E-02 | 6.3E-06 | 1 | 0.25 | 6.5E-08 | 1.2E-01 | 7.8E-09 |
| Risk Total | | | | | | 2.2E-05 | | | | | 2.8E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Trapper from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Trapper as per WDNR Comments (adult) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 2 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3341 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 150 | 150 days in 5 month trapping season |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | Incidental Ingestion RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Dermal Contact Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Total Risk(SW) | HI(SW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 5.7E-08 | 9.5E-07 | 0.04 | 1 | NA | NA | 7.6E-07 | 1.3E-05 | NA | 1.4E-05 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 5.7E-08 | 2.9E-06 | 0.04 | 1 | NA | NA | 7.6E-07 | 3.8E-05 | NA | 4.1E-05 |
| Anthracene | 1.3E-04 | 0.3 | NA | 1 | NA | NA | 7.6E-09 | 2.5E-08 | 0.04 | 1 | NA | NA | 1.0E-07 | 3.4E-07 | NA | 3.7E-07 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 5.7E-10 | 4.2E-10 | 5.7E-10 | 2.9E-08 | 0.02 | 1 | 3.8E-09 | 2.8E-09 | 3.8E-09 | 1.9E-07 | 3.2E-09 | 2.2E-07 |
| Benzo(a)pyrene | 8.3E-05 | 0.02 | 7.3 | 1 | 4.8E-09 | 3.5E-08 | 4.8E-09 | 2.4E-07 | 0.02 | 1 | 3.2E-08 | 2.3E-07 | 3.2E-08 | 1.6E-06 | 2.7E-07 | 1.8E-06 |
| Benzo(b)fluoranthene | 2.4E-04 | 0.02 | 0.73 | 1 | 1.3E-08 | 9.8E-09 | 1.3E-08 | 6.7E-07 | 0.02 | 1 | 9.0E-08 | 6.6E-08 | 9.0E-08 | 4.5E-06 | 7.6E-08 | 5.2E-06 |
| Benzo(g,h,i)perylene | 3.0E-05 | 0.02 | NA | 1 | NA | NA | 1.7E-09 | 8.6E-08 | 0.04 | 1 | NA | NA | 2.3E-08 | 1.1E-06 | NA | 1.2E-06 |
| Benzo(k)fluoranthene | 6.0E-05 | 0.02 | 0.073 | 1 | 3.4E-09 | 2.5E-10 | 3.4E-09 | 1.7E-07 | 0.02 | 1 | 2.3E-08 | 1.7E-09 | 2.3E-08 | 1.1E-06 | 1.9E-09 | 1.3E-06 |
| Chrysene | 8.0E-05 | 0.02 | 0.0073 | 1 | 4.6E-09 | 3.3E-11 | 4.6E-09 | 2.3E-07 | 0.02 | 1 | 3.1E-08 | 2.2E-10 | 3.1E-08 | 1.5E-06 | 2.6E-10 | 1.8E-06 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 8.6E-10 | 6.3E-09 | 8.6E-10 | 4.3E-08 | 0.02 | 1 | 5.7E-09 | 4.2E-08 | 5.7E-09 | 2.9E-07 | 4.8E-08 | 3.3E-07 |
| Fluoranthene | 2.0E-04 | 0.04 | NA | 1 | NA | NA | 1.1E-08 | 2.8E-07 | 0.04 | 1 | NA | NA | 1.5E-07 | 3.8E-06 | NA | 4.1E-06 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 5.7E-09 | 1.4E-07 | 0.04 | 1 | NA | NA | 7.6E-08 | 1.9E-06 | NA | 2.1E-06 |
| Indeno(1,2,3-cd)pyrene | 5.7E-05 | 0.02 | 0.73 | 1 | 3.3E-09 | 2.4E-09 | 3.3E-09 | 1.6E-07 | 0.02 | 1 | 2.2E-08 | 1.6E-08 | 2.2E-08 | 1.1E-06 | 1.8E-08 | 1.3E-06 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 5.7E-08 | 2.9E-06 | 0.04 | 1 | NA | NA | 7.6E-07 | 3.8E-05 | NA | 4.1E-05 |
| Phenanthrene | 3.0E-04 | 0.02 | NA | 1 | NA | NA | 1.7E-08 | 8.6E-07 | 0.04 | 1 | NA | NA | 2.3E-07 | 1.1E-05 | NA | 1.2E-05 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 5.7E-09 | 1.9E-07 | 0.04 | 1 | NA | NA | 7.6E-08 | 2.5E-06 | NA | 2.7E-06 |
| BAP-TEQ | 3.3E-03 | 0.02 | 7.3 | 1 | 1.9E-07 | 1.4E-06 | 1.9E-07 | 9.3E-06 | 0.02 | 1 | 1.2E-06 | 9.1E-06 | 1.2E-06 | 6.2E-05 | 1.0E-05 | 7.2E-05 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 1.4E-08 | 1.7E-09 | 1.4E-08 | 4.8E-07 | 0.65 | 1 | 3.1E-06 | 3.7E-07 | 3.1E-06 | 1.0E-04 | 3.7E-07 | 1.0E-04 |
| Total | | | | | | 5.6E-08 | | 1.0E-05 | | | | 7.3E-07 | | 2.2E-04 | 7.9E-07 | 2.3E-04 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Child Recreational Visitor from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (7-18) as per WDNR comments |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 2 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3133 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 365 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 11 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 4015 | |
| BW: Body Weight | kg | 48 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | EPC | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Risk(SW) | HI(SW) |
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 2.1E-07 | 3.5E-06 | 0.04 | 1 | NA | NA | 2.6E-06 | 4.4E-05 | NA | 4.7E-05 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 2.1E-07 | 1.0E-05 | 0.04 | 1 | NA | NA | 2.6E-06 | 1.3E-04 | NA | 1.4E-04 |
| Anthracene | 1.3E-04 | 0.3 | NA | 1 | NA | NA | 2.8E-08 | 9.3E-08 | 0.04 | 1 | NA | NA | 3.5E-07 | 1.2E-06 | NA | 1.3E-06 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 2.1E-09 | 1.5E-09 | 2.1E-09 | 1.0E-07 | 0.02 | 1 | 1.3E-08 | 9.5E-09 | 1.3E-08 | 6.5E-07 | 1.1E-08 | 7.6E-07 |
| Benzo(a)pyrene | 8.3E-05 | 0.02 | 7.3 | 1 | 1.7E-08 | 1.3E-07 | 1.7E-08 | 8.7E-07 | 0.02 | 1 | 1.1E-07 | 7.9E-07 | 1.1E-07 | 5.4E-06 | 9.2E-07 | 6.3E-06 |
| Benzo(b)fluoranthene | 2.4E-04 | 0.02 | 0.73 | 1 | 4.9E-08 | 3.6E-08 | 4.9E-08 | 2.5E-06 | 0.02 | 1 | 3.1E-07 | 2.2E-07 | 3.1E-07 | 1.5E-05 | 2.6E-07 | 1.8E-05 |
| Benzo(g,h,i)perylene | 3.0E-05 | 0.02 | NA | 1 | NA | NA | 6.3E-09 | 3.1E-07 | 0.04 | 1 | NA | NA | 7.8E-08 | 3.9E-06 | NA | 4.2E-06 |
| Benzo(k)fluoranthene | 6.0E-05 | 0.02 | 0.073 | 1 | 1.2E-08 | 9.1E-10 | 1.2E-08 | 6.2E-07 | 0.02 | 1 | 7.8E-08 | 5.7E-09 | 7.8E-08 | 3.9E-06 | 6.6E-09 | 4.5E-06 |
| Chrysene | 8.0E-05 | 0.02 | 0.0073 | 1 | 1.7E-08 | 1.2E-10 | 1.7E-08 | 8.3E-07 | 0.02 | 1 | 1.0E-07 | 7.6E-10 | 1.0E-07 | 5.2E-06 | 8.8E-10 | 6.1E-06 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 3.1E-09 | 2.3E-08 | 3.1E-09 | 1.6E-07 | 0.02 | 1 | 2.0E-08 | 1.4E-07 | 2.0E-08 | 9.8E-07 | 1.7E-07 | 1.1E-06 |
| Fluoranthene | 2.0E-04 | 0.04 | NA | 1 | NA | NA | 4.1E-08 | 1.0E-06 | 0.04 | 1 | NA | NA | 5.2E-07 | 1.3E-05 | NA | 1.4E-05 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 2.1E-08 | 5.2E-07 | 0.04 | 1 | NA | NA | 2.6E-07 | 6.5E-06 | NA | 7.0E-06 |
| Indeno(1,2,3-cd)pyrene | 5.7E-05 | 0.02 | 0.73 | 1 | 1.2E-08 | 8.7E-09 | 1.2E-08 | 6.0E-07 | 0.02 | 1 | 7.5E-08 | 5.5E-08 | 7.5E-08 | 3.7E-06 | 6.3E-08 | 4.3E-06 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 2.1E-07 | 1.0E-05 | 0.04 | 1 | NA | NA | 2.6E-06 | 1.3E-04 | NA | 1.4E-04 |
| Phenanthrene | 3.0E-04 | 0.02 | NA | 1 | NA | NA | 6.3E-08 | 3.1E-06 | 0.04 | 1 | NA | NA | 7.8E-07 | 3.9E-05 | NA | 4.2E-05 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 2.1E-08 | 6.9E-07 | 0.04 | 1 | NA | NA | 2.6E-07 | 8.7E-06 | NA | 9.4E-06 |
| BAP-TEQ | 3.3E-03 | 0.02 | 7.3 | 1 | 6.8E-07 | 5.0E-06 | 6.8E-07 | 3.4E-05 | 0.02 | 1 | 4.3E-06 | 3.1E-05 | 4.3E-06 | 2.1E-04 | 3.6E-05 | 2.5E-04 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 5.2E-08 | 6.2E-09 | 5.2E-08 | 1.7E-06 | 0.65 | 1 | 1.1E-05 | 1.3E-06 | 1.1E-05 | 3.5E-04 | 1.3E-06 | 3.6E-04 |
| Total | | | | | | 2.0E-07 | | 3.7E-05 | | | | 2.5E-06 | | 7.7E-04 | 2.7E-06 | 8.0E-04 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Adult Recreational Visitor from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) as per WDNR comments |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 2 - Incidental Surface Water Ingestion and Dermal Contact |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3341 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 120 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | Incidental Ingestion RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Dermal Contact Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Total Risk(SW) | HI(SW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 4.6E-08 | 7.6E-07 | 0.04 | 1 | NA | NA | 6.1E-07 | 1.0E-05 | NA | 1.1E-05 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 4.6E-08 | 2.3E-06 | 0.04 | 1 | NA | NA | 6.1E-07 | 3.1E-05 | NA | 3.3E-05 |
| Anthracene | 1.3E-04 | 0.3 | NA | 1 | NA | NA | 6.1E-09 | 2.0E-08 | 0.04 | 1 | NA | NA | 8.2E-08 | 2.7E-07 | NA | 2.9E-07 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 4.6E-10 | 3.3E-10 | 4.6E-10 | 2.3E-08 | 0.02 | 1 | 3.1E-09 | 2.2E-09 | 3.1E-09 | 1.5E-07 | 2.6E-09 | 1.8E-07 |
| Benzo(a)pyrene | 8.3E-05 | 0.02 | 7.3 | 1 | 3.8E-09 | 2.8E-08 | 3.8E-09 | 1.9E-07 | 0.02 | 1 | 2.5E-08 | 1.9E-07 | 2.5E-08 | 1.3E-06 | 2.1E-07 | 1.5E-06 |
| Benzo(b)fluoranthene | 2.4E-04 | 0.02 | 0.73 | 1 | 1.1E-08 | 7.9E-09 | 1.1E-08 | 5.4E-07 | 0.02 | 1 | 7.2E-08 | 5.3E-08 | 7.2E-08 | 3.6E-06 | 6.0E-08 | 4.1E-06 |
| Benzo(g,h,i)perylene | 3.0E-05 | 0.02 | NA | 1 | NA | NA | 1.4E-09 | 6.9E-08 | 0.04 | 1 | NA | NA | 1.8E-08 | 9.2E-07 | NA | 9.9E-07 |
| Benzo(k)fluoranthene | 6.0E-05 | 0.02 | 0.073 | 1 | 2.7E-09 | 2.0E-10 | 2.7E-09 | 1.4E-07 | 0.02 | 1 | 1.8E-08 | 1.3E-09 | 1.8E-08 | 9.1E-07 | 1.5E-09 | 1.1E-06 |
| Chrysene | 8.0E-05 | 0.02 | 0.0073 | 1 | 3.7E-09 | 2.7E-11 | 3.7E-09 | 1.8E-07 | 0.02 | 1 | 2.4E-08 | 1.8E-10 | 2.4E-08 | 1.2E-06 | 2.1E-10 | 1.4E-06 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 6.9E-10 | 5.0E-09 | 6.9E-10 | 3.4E-08 | 0.02 | 1 | 4.6E-09 | 3.4E-08 | 4.6E-09 | 2.3E-07 | 3.9E-08 | 2.6E-07 |
| Fluoranthene | 2.0E-04 | 0.04 | NA | 1 | NA | NA | 9.1E-09 | 2.3E-07 | 0.04 | 1 | NA | NA | 1.2E-07 | 3.0E-06 | NA | 3.3E-06 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 4.6E-09 | 1.1E-07 | 0.04 | 1 | NA | NA | 6.1E-08 | 1.5E-06 | NA | 1.6E-06 |
| Indeno(1,2,3-cd)pyrene | 5.7E-05 | 0.02 | 0.73 | 1 | 2.6E-09 | 1.9E-09 | 2.6E-09 | 1.3E-07 | 0.02 | 1 | 1.8E-08 | 1.3E-08 | 1.8E-08 | 8.8E-07 | 1.5E-08 | 1.0E-06 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 4.6E-08 | 2.3E-06 | 0.04 | 1 | NA | NA | 6.1E-07 | 3.1E-05 | NA | 3.3E-05 |
| Phenanthrene | 3.0E-04 | 0.02 | NA | 1 | NA | NA | 1.4E-08 | 6.9E-07 | 0.04 | 1 | NA | NA | 1.8E-07 | 9.2E-06 | NA | 9.9E-06 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 4.6E-09 | 1.5E-07 | 0.04 | 1 | NA | NA | 6.1E-08 | 2.0E-06 | NA | 2.2E-06 |
| BAP-TEQ | 3.3E-03 | 0.02 | 7.3 | 1 | 1.5E-07 | 1.1E-06 | 1.5E-07 | 7.5E-06 | 0.02 | 1 | 1.0E-06 | 7.3E-06 | 1.0E-06 | 5.0E-05 | 8.4E-06 | 5.7E-05 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 1.1E-08 | 1.4E-09 | 1.1E-08 | 3.8E-07 | 0.65 | 1 | 2.5E-06 | 3.0E-07 | 2.5E-06 | 8.3E-05 | 3.0E-07 | 8.3E-05 |
| Total | | | | | | 4.5E-08 | | 8.2E-06 | | | | 5.9E-07 | | 1.8E-04 | 6.3E-07 | 1.9E-04 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Child Hunter from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (7-18) as per WDNR comments |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 2 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 928 | |
| ET: Surface Water Exposure Time | h/d | 0.5 | |
| EF: Surface Water Exposure Frequency | d/y | 16 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 11 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 4015 | |
| BW: Body Weight | kg | 48 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | Incidental Ingestion RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Dermal Contact Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Total Risk(SW) | HI(SW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 9.1E-09 | 1.5E-07 | 0.04 | 1 | NA | NA | 1.7E-08 | 2.8E-07 | NA | 4.3E-07 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 9.1E-09 | 4.6E-07 | 0.04 | 1 | NA | NA | 1.7E-08 | 8.5E-07 | NA | 1.3E-06 |
| Anthracene | 1.3E-04 | 0.3 | NA | 1 | NA | NA | 1.2E-09 | 4.1E-09 | 0.04 | 1 | NA | NA | 2.3E-09 | 7.5E-09 | NA | 1.2E-08 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 9.1E-11 | 6.7E-11 | 9.1E-11 | 4.6E-09 | 0.02 | 1 | 8.5E-11 | 6.2E-11 | 8.5E-11 | 4.2E-09 | 1.3E-10 | 8.8E-09 |
| Benzo(a)pyrene | 8.3E-05 | 0.02 | 7.3 | 1 | 7.6E-10 | 5.5E-09 | 7.6E-10 | 3.8E-08 | 0.02 | 1 | 7.1E-10 | 5.1E-09 | 7.1E-10 | 3.5E-08 | 1.1E-08 | 7.3E-08 |
| Benzo(b)fluoranthene | 2.4E-04 | 0.02 | 0.73 | 1 | 2.2E-09 | 1.6E-09 | 2.2E-09 | 1.1E-07 | 0.02 | 1 | 2.0E-09 | 1.5E-09 | 2.0E-09 | 1.0E-07 | 3.0E-09 | 2.1E-07 |
| Benzo(g,h,i)perylene | 3.0E-05 | 0.02 | NA | 1 | NA | NA | 2.7E-10 | 1.4E-08 | 0.04 | 1 | NA | NA | 5.1E-10 | 2.5E-08 | NA | 3.9E-08 |
| Benzo(k)fluoranthene | 6.0E-05 | 0.02 | 0.073 | 1 | 5.5E-10 | 4.0E-11 | 5.5E-10 | 2.7E-08 | 0.02 | 1 | 5.1E-10 | 3.7E-11 | 5.1E-10 | 2.5E-08 | 7.7E-11 | 5.3E-08 |
| Chrysene | 8.0E-05 | 0.02 | 0.0073 | 1 | 7.3E-10 | 5.3E-12 | 7.3E-10 | 3.7E-08 | 0.02 | 1 | 6.8E-10 | 4.9E-12 | 6.8E-10 | 3.4E-08 | 1.0E-11 | 7.0E-08 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 1.4E-10 | 1.0E-09 | 1.4E-10 | 6.8E-09 | 0.02 | 1 | 1.3E-10 | 9.3E-10 | 1.3E-10 | 6.4E-09 | 1.9E-09 | 1.3E-08 |
| Fluoranthene | 2.0E-04 | 0.04 | NA | 1 | NA | NA | 1.8E-09 | 4.5E-08 | 0.04 | 1 | NA | NA | 3.4E-09 | 8.4E-08 | NA | 1.3E-07 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 9.1E-10 | 2.3E-08 | 0.04 | 1 | NA | NA | 1.7E-09 | 4.2E-08 | NA | 6.5E-08 |
| Indeno(1,2,3-cd)pyrene | 5.7E-05 | 0.02 | 0.73 | 1 | 5.2E-10 | 3.8E-10 | 5.2E-10 | 2.6E-08 | 0.02 | 1 | 4.9E-10 | 3.5E-10 | 4.9E-10 | 2.4E-08 | 7.4E-10 | 5.0E-08 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 9.1E-09 | 4.6E-07 | 0.04 | 1 | NA | NA | 1.7E-08 | 8.5E-07 | NA | 1.3E-06 |
| Phenanthrene | 3.0E-04 | 0.02 | NA | 1 | NA | NA | 2.7E-09 | 1.4E-07 | 0.04 | 1 | NA | NA | 5.1E-09 | 2.5E-07 | NA | 3.9E-07 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 9.1E-10 | 3.0E-08 | 0.04 | 1 | NA | NA | 1.7E-09 | 5.6E-08 | NA | 8.7E-08 |
| BAP-TEQ | 3.3E-03 | 0.02 | 7.3 | 1 | 3.0E-08 | 2.2E-07 | 3.0E-08 | 1.5E-06 | 0.02 | 1 | 2.8E-08 | 2.0E-07 | 2.8E-08 | 1.4E-06 | 4.2E-07 | 2.9E-06 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 2.3E-09 | 2.7E-10 | 2.3E-09 | 7.6E-08 | 0.65 | 1 | 6.9E-08 | 8.3E-09 | 6.9E-08 | 2.3E-06 | 8.5E-09 | 2.4E-06 |
| Total | | | | | | 8.9E-09 | | 1.6E-06 | | | | 1.6E-08 | | 5.0E-06 | 2.5E-08 | 6.6E-06 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Adult Hunter from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) as per WDNR comments |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 2 - Incidental Surface Water Ingestion and Dermal Contact |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 904 | |
| ET: Surface Water Exposure Time | h/d | 0.5 | |
| EF: Surface Water Exposure Frequency | d/y | 16 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | Incidental Ingestion RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Dermal Contact Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Total Risk(SW) | HI(SW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 6.1E-09 | 1.0E-07 | 0.04 | 1 | NA | NA | 1.1E-08 | 1.8E-07 | NA | 2.9E-07 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 6.1E-09 | 3.1E-07 | 0.04 | 1 | NA | NA | 1.1E-08 | 5.5E-07 | NA | 8.6E-07 |
| Anthracene | 1.3E-04 | 0.3 | NA | 1 | NA | NA | 8.2E-10 | 2.7E-09 | 0.04 | 1 | NA | NA | 1.5E-09 | 4.9E-09 | NA | 7.6E-09 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 6.1E-11 | 4.5E-11 | 6.1E-11 | 3.1E-09 | 0.02 | 1 | 5.5E-11 | 4.0E-11 | 5.5E-11 | 2.8E-09 | 8.5E-11 | 5.8E-09 |
| Benzo(a)pyrene | 8.3E-05 | 0.02 | 7.3 | 1 | 5.1E-10 | 3.7E-09 | 5.1E-10 | 2.5E-08 | 0.02 | 1 | 4.6E-10 | 3.4E-09 | 4.6E-10 | 2.3E-08 | 7.1E-09 | 4.8E-08 |
| Benzo(b)fluoranthene | 2.4E-04 | 0.02 | 0.73 | 1 | 1.4E-09 | 1.0E-09 | 1.4E-09 | 7.2E-08 | 0.02 | 1 | 1.3E-09 | 9.5E-10 | 1.3E-09 | 6.5E-08 | 2.0E-09 | 1.4E-07 |
| Benzo(g,h,i)perylene | 3.0E-05 | 0.02 | NA | 1 | NA | NA | 1.8E-10 | 9.2E-09 | 0.04 | 1 | NA | NA | 3.3E-10 | 1.7E-08 | NA | 2.6E-08 |
| Benzo(k)fluoranthene | 6.0E-05 | 0.02 | 0.073 | 1 | 3.6E-10 | 2.7E-11 | 3.6E-10 | 1.8E-08 | 0.02 | 1 | 3.3E-10 | 2.4E-11 | 3.3E-10 | 1.6E-08 | 5.1E-11 | 3.5E-08 |
| Chrysene | 8.0E-05 | 0.02 | 0.0073 | 1 | 4.9E-10 | 3.6E-12 | 4.9E-10 | 2.4E-08 | 0.02 | 1 | 4.4E-10 | 3.2E-12 | 4.4E-10 | 2.2E-08 | 6.8E-12 | 4.6E-08 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 9.2E-11 | 6.7E-10 | 9.2E-11 | 4.6E-09 | 0.02 | 1 | 8.3E-11 | 6.0E-10 | 8.3E-11 | 4.1E-09 | 1.3E-09 | 8.7E-09 |
| Fluoranthene | 2.0E-04 | 0.04 | NA | 1 | NA | NA | 1.2E-09 | 3.0E-08 | 0.04 | 1 | NA | NA | 2.2E-09 | 5.5E-08 | NA | 8.5E-08 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 6.1E-10 | 1.5E-08 | 0.04 | 1 | NA | NA | 1.1E-09 | 2.8E-08 | NA | 4.3E-08 |
| Indeno(1,2,3-cd)pyrene | 5.7E-05 | 0.02 | 0.73 | 1 | 3.5E-10 | 2.6E-10 | 3.5E-10 | 1.8E-08 | 0.02 | 1 | 3.2E-10 | 2.3E-10 | 3.2E-10 | 1.6E-08 | 4.9E-10 | 3.3E-08 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 6.1E-09 | 3.1E-07 | 0.04 | 1 | NA | NA | 1.1E-08 | 5.5E-07 | NA | 8.6E-07 |
| Phenanthrene | 3.0E-04 | 0.02 | NA | 1 | NA | NA | 1.8E-09 | 9.2E-08 | 0.04 | 1 | NA | NA | 3.3E-09 | 1.7E-07 | NA | 2.6E-07 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 6.1E-10 | 2.0E-08 | 0.04 | 1 | NA | NA | 1.1E-09 | 3.7E-08 | NA | 5.7E-08 |
| BAP-TEQ | 3.3E-03 | 0.02 | 7.3 | 1 | 2.0E-08 | 1.5E-07 | 2.0E-08 | 9.9E-07 | 0.02 | 1 | 1.8E-08 | 1.3E-07 | 1.8E-08 | 9.0E-07 | 2.8E-07 | 1.9E-06 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 1.5E-09 | 1.8E-10 | 1.5E-09 | 5.1E-08 | 0.65 | 1 | 4.5E-08 | 5.4E-09 | 4.5E-08 | 1.5E-06 | 5.6E-09 | 1.5E-06 |
| Total | | | | | | 5.9E-09 | | 1.1E-06 | | | | 1.1E-08 | | 3.2E-06 | 1.7E-08 | 4.3E-06 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Area 3**
**Human Health Risk Calculations**
**Using WDNR's Exposure Assumptions**

**Evaluation of Potential Risk to Adult Trapper from Sediment using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Trapper as per WDNR Comments (adult) |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 3341 |
| AF: Adherence Factor (mg/cm2) | 0.18 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 5.7E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 2.7E-12 | 1.5E+05 | 4.1E-07 |
| Acenaphthene | 3.2E+01 | 1 | 0.13 | 1.9E-06 | 6.0E-02 | 3.2E-05 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.5E+00 | 1 | 0.13 | 1.5E-07 | 2.0E-02 | 7.5E-06 | NA | NA | NA | NA | NA |
| Anthracene | 6.4E+01 | 1 | 0.13 | 3.9E-06 | 3.0E-01 | 1.3E-05 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.6E+01 | 1 | 0.13 | 2.8E-06 | 2.0E-02 | 1.4E-04 | 1 | 0.13 | 9.6E-07 | 7.3E-01 | 7.0E-07 |
| Benzo(a)pyrene | 1.9E+01 | 1 | 0.13 | 1.2E-06 | 2.0E-02 | 5.8E-05 | 1 | 0.13 | 4.0E-07 | 7.3E+00 | 2.9E-06 |
| Benzo(b)fluoranthene | 2.5E+01 | 1 | 0.13 | 1.6E-06 | 2.0E-02 | 7.8E-05 | 1 | 0.13 | 5.3E-07 | 7.3E-01 | 3.9E-07 |
| Benzo(g,h,i)perylene | 7.2E+00 | 1 | 0.13 | 4.4E-07 | 2.0E-02 | 2.2E-05 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E+01 | 1 | 0.13 | 6.7E-07 | 2.0E-02 | 3.3E-05 | 1 | 0.13 | 2.3E-07 | 7.3E-02 | 1.7E-08 |
| Chrysene | 4.9E+01 | 1 | 0.13 | 3.0E-06 | 2.0E-02 | 1.5E-04 | 1 | 0.13 | 1.0E-06 | 7.3E-03 | 7.5E-09 |
| Dibenz(a,h)anthracene | 2.1E+00 | 1 | 0.13 | 1.3E-07 | 2.0E-02 | 6.3E-06 | 1 | 0.13 | 4.3E-08 | 7.3E+00 | 3.1E-07 |
| Fluoranthene | 1.9E+02 | 1 | 0.13 | 1.2E-05 | 4.0E-02 | 2.9E-04 | NA | NA | NA | NA | NA |
| Fluorene | 3.3E+01 | 1 | 0.13 | 2.0E-06 | 4.0E-02 | 5.1E-05 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 6.8E+00 | 1 | 0.13 | 4.2E-07 | 2.0E-02 | 2.1E-05 | 1 | 0.13 | 1.4E-07 | 7.3E-01 | 1.0E-07 |
| Naphthalene | 2.2E+00 | 1 | 0.13 | 1.3E-07 | 2.0E-02 | 6.7E-06 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.5E+02 | 1 | 0.13 | 8.9E-06 | 2.0E-02 | 4.4E-04 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E+02 | 1 | 0.13 | 8.9E-06 | 3.0E-02 | 3.0E-04 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.9E+01 | 1 | 0.13 | 1.8E-06 | 2.0E-02 | 8.9E-05 | 1 | 0.13 | 6.1E-07 | 7.3E+00 | 4.4E-06 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 4.8E-08 | 3.0E-02 | 1.6E-06 | 1 | 0.25 | 1.6E-08 | 1.2E-01 | 2.0E-09 |
| Risk Total | | | | | | 1.7E-03 | | | | | 4.8E-06 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Recreational Visitor from Sediment using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (7-18) as per WDNR comments |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\dfrac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 100 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 11 |
| BW: Body Weight (kg) | 48 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 4015 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 5.7E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 1.5E-12 | 1.5E+05 | 2.3E-07 |
| Acenaphthene | 3.2E+01 | 1 | 0.13 | 3.3E-06 | 6.0E-02 | 5.5E-05 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.5E+00 | 1 | 0.13 | 2.5E-07 | 2.0E-02 | 1.3E-05 | NA | NA | NA | NA | NA |
| Anthracene | 6.4E+01 | 1 | 0.13 | 6.6E-06 | 3.0E-01 | 2.2E-05 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.6E+01 | 1 | 0.13 | 4.7E-06 | 2.0E-02 | 2.4E-04 | 1 | 0.13 | 7.4E-07 | 7.3E-01 | 5.4E-07 |
| Benzo(a)pyrene | 1.9E+01 | 1 | 0.13 | 2.0E-06 | 2.0E-02 | 9.8E-05 | 1 | 0.13 | 3.1E-07 | 7.3E+00 | 2.2E-06 |
| Benzo(b)fluoranthene | 2.5E+01 | 1 | 0.13 | 2.6E-06 | 2.0E-02 | 1.3E-04 | 1 | 0.13 | 4.1E-07 | 7.3E-01 | 3.0E-07 |
| Benzo(g,h,i)perylene | 7.2E+00 | 1 | 0.13 | 7.4E-07 | 2.0E-02 | 3.7E-05 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E+01 | 1 | 0.13 | 1.1E-06 | 2.0E-02 | 5.6E-05 | 1 | 0.13 | 1.8E-07 | 7.3E-02 | 1.3E-08 |
| Chrysene | 4.9E+01 | 1 | 0.13 | 5.1E-06 | 2.0E-02 | 2.5E-04 | 1 | 0.13 | 7.9E-07 | 7.3E-03 | 5.8E-09 |
| Dibenz(a,h)anthracene | 2.1E+00 | 1 | 0.13 | 2.1E-07 | 2.0E-02 | 1.1E-05 | 1 | 0.13 | 3.3E-08 | 7.3E+00 | 2.4E-07 |
| Fluoranthene | 1.9E+02 | 1 | 0.13 | 1.9E-05 | 4.0E-02 | 4.9E-04 | NA | NA | NA | NA | NA |
| Fluorene | 3.3E+01 | 1 | 0.13 | 3.4E-06 | 4.0E-02 | 8.5E-05 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 6.8E+00 | 1 | 0.13 | 7.0E-07 | 2.0E-02 | 3.5E-05 | 1 | 0.13 | 1.1E-07 | 7.3E-01 | 8.0E-08 |
| Naphthalene | 2.2E+00 | 1 | 0.13 | 2.3E-07 | 2.0E-02 | 1.1E-05 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.5E+02 | 1 | 0.13 | 1.5E-05 | 2.0E-02 | 7.5E-04 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E+02 | 1 | 0.13 | 1.5E-05 | 3.0E-02 | 5.0E-04 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.9E+01 | 1 | 0.13 | 3.0E-06 | 2.0E-02 | 1.5E-04 | 1 | 0.13 | 4.7E-07 | 7.3E+00 | 3.4E-06 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 6.6E-08 | 3.0E-02 | 2.2E-06 | 1 | 0.25 | 1.0E-08 | 1.2E-01 | 1.2E-09 |
| Risk Total | | | | | | 2.8E-03 | | | | | 3.6E-06 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Recreational Visitor from Sediment using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) as per WDNR comments |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 3341 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 5.7E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 2.2E-12 | 1.5E+05 | 3.3E-07 |
| Acenaphthene | 3.2E+01 | 1 | 0.13 | 1.7E-06 | 6.0E-02 | 2.8E-05 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.5E+00 | 1 | 0.13 | 1.3E-07 | 2.0E-02 | 6.5E-06 | NA | NA | NA | NA | NA |
| Anthracene | 6.4E+01 | 1 | 0.13 | 3.4E-06 | 3.0E-01 | 1.1E-05 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.6E+01 | 1 | 0.13 | 2.4E-06 | 2.0E-02 | 1.2E-04 | 1 | 0.13 | 8.3E-07 | 7.3E-01 | 6.0E-07 |
| Benzo(a)pyrene | 1.9E+01 | 1 | 0.13 | 1.0E-06 | 2.0E-02 | 5.0E-05 | 1 | 0.13 | 3.4E-07 | 7.3E+00 | 2.5E-06 |
| Benzo(b)fluoranthene | 2.5E+01 | 1 | 0.13 | 1.3E-06 | 2.0E-02 | 6.7E-05 | 1 | 0.13 | 4.6E-07 | 7.3E-01 | 3.4E-07 |
| Benzo(g,h,i)perylene | 7.2E+00 | 1 | 0.13 | 3.8E-07 | 2.0E-02 | 1.9E-05 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E+01 | 1 | 0.13 | 5.8E-07 | 2.0E-02 | 2.9E-05 | 1 | 0.13 | 2.0E-07 | 7.3E-02 | 1.4E-08 |
| Chrysene | 4.9E+01 | 1 | 0.13 | 2.6E-06 | 2.0E-02 | 1.3E-04 | 1 | 0.13 | 8.9E-07 | 7.3E-03 | 6.5E-09 |
| Dibenz(a,h)anthracene | 2.1E+00 | 1 | 0.13 | 1.1E-07 | 2.0E-02 | 5.4E-06 | 1 | 0.13 | 3.7E-08 | 7.3E+00 | 2.7E-07 |
| Fluoranthene | 1.9E+02 | 1 | 0.13 | 1.0E-05 | 4.0E-02 | 2.5E-04 | NA | NA | NA | NA | NA |
| Fluorene | 3.3E+01 | 1 | 0.13 | 1.8E-06 | 4.0E-02 | 4.4E-05 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 6.8E+00 | 1 | 0.13 | 3.6E-07 | 2.0E-02 | 1.8E-05 | 1 | 0.13 | 1.2E-07 | 7.3E-01 | 9.0E-08 |
| Naphthalene | 2.2E+00 | 1 | 0.13 | 1.2E-07 | 2.0E-02 | 5.8E-06 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.5E+02 | 1 | 0.13 | 7.7E-06 | 2.0E-02 | 3.8E-04 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E+02 | 1 | 0.13 | 7.7E-06 | 3.0E-02 | 2.6E-04 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.9E+01 | 1 | 0.13 | 1.5E-06 | 2.0E-02 | 7.7E-05 | 1 | 0.13 | 5.3E-07 | 7.3E+00 | 3.8E-06 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 4.0E-08 | 3.0E-02 | 1.3E-06 | 1 | 0.25 | 1.4E-08 | 1.2E-01 | 1.6E-09 |
| Risk Total | | | | | | 1.4E-03 | | | | | 4.2E-06 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Hunter from Sediment using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (7-18) as per WDNR comments |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Sediment Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 100 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.02 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.02 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 11 |
| BW: Body Weight (kg) | 48 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 4015 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 5.7E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 3.8E-13 | 1.5E+05 | 5.7E-08 |
| Acenaphthene | 3.2E+01 | 1 | 0.13 | 8.2E-07 | 6.0E-02 | 1.4E-05 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.5E+00 | 1 | 0.13 | 6.3E-08 | 2.0E-02 | 3.2E-06 | NA | NA | NA | NA | NA |
| Anthracene | 6.4E+01 | 1 | 0.13 | 1.6E-06 | 3.0E-01 | 5.5E-06 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.6E+01 | 1 | 0.13 | 1.2E-06 | 2.0E-02 | 5.9E-05 | 1 | 0.13 | 1.8E-07 | 7.3E-01 | 1.3E-07 |
| Benzo(a)pyrene | 1.9E+01 | 1 | 0.13 | 4.9E-07 | 2.0E-02 | 2.4E-05 | 1 | 0.13 | 7.7E-08 | 7.3E+00 | 5.6E-07 |
| Benzo(b)fluoranthene | 2.5E+01 | 1 | 0.13 | 6.6E-07 | 2.0E-02 | 3.3E-05 | 1 | 0.13 | 1.0E-07 | 7.3E-01 | 7.5E-08 |
| Benzo(g,h,i)perylene | 7.2E+00 | 1 | 0.13 | 1.8E-07 | 2.0E-02 | 9.2E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E+01 | 1 | 0.13 | 2.8E-07 | 2.0E-02 | 1.4E-05 | 1 | 0.13 | 4.4E-08 | 7.3E-02 | 3.2E-09 |
| Chrysene | 4.9E+01 | 1 | 0.13 | 1.3E-06 | 2.0E-02 | 6.3E-05 | 1 | 0.13 | 2.0E-07 | 7.3E-03 | 1.4E-09 |
| Dibenz(a,h)anthracene | 2.1E+00 | 1 | 0.13 | 5.3E-08 | 2.0E-02 | 2.6E-06 | 1 | 0.13 | 8.3E-09 | 7.3E+00 | 6.1E-08 |
| Fluoranthene | 1.9E+02 | 1 | 0.13 | 4.9E-06 | 4.0E-02 | 1.2E-04 | NA | NA | NA | NA | NA |
| Fluorene | 3.3E+01 | 1 | 0.13 | 8.5E-07 | 4.0E-02 | 2.1E-05 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 6.8E+00 | 1 | 0.13 | 1.8E-07 | 2.0E-02 | 8.8E-06 | 1 | 0.13 | 2.8E-08 | 7.3E-01 | 2.0E-08 |
| Naphthalene | 2.2E+00 | 1 | 0.13 | 5.6E-08 | 2.0E-02 | 2.8E-06 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.5E+02 | 1 | 0.13 | 3.7E-06 | 2.0E-02 | 1.9E-04 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E+02 | 1 | 0.13 | 3.8E-06 | 3.0E-02 | 1.3E-04 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.9E+01 | 1 | 0.13 | 7.5E-07 | 2.0E-02 | 3.7E-05 | 1 | 0.13 | 1.2E-07 | 7.3E+00 | 8.6E-07 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 1.7E-08 | 3.0E-02 | 5.5E-07 | 1 | 0.25 | 2.6E-09 | 1.2E-01 | 3.1E-10 |
| Risk Total | | | | | | 6.9E-04 | | | | | 9.1E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Hunter from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) as per WDNR comments |
| **Medium:** | Sediment (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Sediment Ingestion and Dermal Contact |

$$ADD\ (mg/kg\text{-}day) = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.02 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.02 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Sediment EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 5.7E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.4 | 4.4E-13 | 1.5E+05 | 6.7E-08 |
| Acenaphthene | 3.2E+01 | 1 | 0.13 | 3.6E-07 | 6.0E-02 | 6.1E-06 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.5E+00 | 1 | 0.13 | 2.8E-08 | 2.0E-02 | 1.4E-06 | NA | NA | NA | NA | NA |
| Anthracene | 6.4E+01 | 1 | 0.13 | 7.3E-07 | 3.0E-01 | 2.4E-06 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 4.6E+01 | 1 | 0.13 | 5.2E-07 | 2.0E-02 | 2.6E-05 | 1 | 0.13 | 1.8E-07 | 7.3E-01 | 1.3E-07 |
| Benzo(a)pyrene | 1.9E+01 | 1 | 0.13 | 2.2E-07 | 2.0E-02 | 1.1E-05 | 1 | 0.13 | 7.4E-08 | 7.3E+00 | 5.4E-07 |
| Benzo(b)fluoranthene | 2.5E+01 | 1 | 0.13 | 2.9E-07 | 2.0E-02 | 1.5E-05 | 1 | 0.13 | 1.0E-07 | 7.3E-01 | 7.3E-08 |
| Benzo(g,h,i)perylene | 7.2E+00 | 1 | 0.13 | 8.2E-08 | 2.0E-02 | 4.1E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E+01 | 1 | 0.13 | 1.2E-07 | 2.0E-02 | 6.2E-06 | 1 | 0.13 | 4.3E-08 | 7.3E-02 | 3.1E-09 |
| Chrysene | 4.9E+01 | 1 | 0.13 | 5.6E-07 | 2.0E-02 | 2.8E-05 | 1 | 0.13 | 1.9E-07 | 7.3E-03 | 1.4E-09 |
| Dibenz(a,h)anthracene | 2.1E+00 | 1 | 0.13 | 2.3E-08 | 2.0E-02 | 1.2E-06 | 1 | 0.13 | 8.0E-09 | 7.3E+00 | 5.9E-08 |
| Fluoranthene | 1.9E+02 | 1 | 0.13 | 2.2E-06 | 4.0E-02 | 5.4E-05 | NA | NA | NA | NA | NA |
| Fluorene | 3.3E+01 | 1 | 0.13 | 3.8E-07 | 4.0E-02 | 9.5E-06 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 6.8E+00 | 1 | 0.13 | 7.8E-08 | 2.0E-02 | 3.9E-06 | 1 | 0.13 | 2.7E-08 | 7.3E-01 | 1.9E-08 |
| Naphthalene | 2.2E+00 | 1 | 0.13 | 2.5E-08 | 2.0E-02 | 1.3E-06 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.5E+02 | 1 | 0.13 | 1.7E-06 | 2.0E-02 | 8.3E-05 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E+02 | 1 | 0.13 | 1.7E-06 | 3.0E-02 | 5.6E-05 | NA | NA | NA | NA | NA |
| BAP-TEQ | 2.9E+01 | 1 | 0.13 | 3.3E-07 | 2.0E-02 | 1.7E-05 | 1 | 0.13 | 1.1E-07 | 7.3E+00 | 8.3E-07 |
| Pentachlorophenol | 5.0E-01 | 1 | 0.25 | 8.2E-09 | 3.0E-02 | 2.7E-07 | 1 | 0.25 | 2.8E-09 | 1.2E-01 | 3.4E-10 |
| Risk Total | | | | | | 3.1E-04 | | | | | 9.0E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Trapper from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Trapper as per WDNR Comments (adult) |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil EPC (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 2.9E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 3.1E-13 | 1.5E+05 | 4.6E-08 |
| Acenaphthene | 1.5E-01 | 1 | 0.13 | 7.1E-09 | 6.0E-02 | 1.2E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.7E-01 | 1 | 0.13 | 7.8E-09 | 2.0E-02 | 3.9E-07 | NA | NA | NA | NA | NA |
| Anthracene | 2.5E-01 | 1 | 0.13 | 1.1E-08 | 3.0E-01 | 3.8E-08 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.1E-01 | 1 | 0.13 | 5.1E-09 | 2.0E-02 | 2.6E-07 | 1 | 0.13 | 1.8E-09 | 7.3E-01 | 1.3E-09 |
| Benzo(a)pyrene | 2.1E-01 | 1 | 0.13 | 9.5E-09 | 2.0E-02 | 4.8E-07 | 1 | 0.13 | 3.3E-09 | 7.3E+00 | 2.4E-08 |
| Benzo(b)fluoranthene | 2.7E-01 | 1 | 0.13 | 1.2E-08 | 2.0E-02 | 6.2E-07 | 1 | 0.13 | 4.2E-09 | 7.3E-01 | 3.1E-09 |
| Benzo(g,h,i)perylene | 4.4E-01 | 1 | 0.13 | 2.0E-08 | 2.0E-02 | 1.0E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E-01 | 1 | 0.13 | 5.0E-09 | 2.0E-02 | 2.5E-07 | 1 | 0.13 | 1.7E-09 | 7.3E-02 | 1.3E-10 |
| Chrysene | 2.2E-01 | 1 | 0.13 | 1.0E-08 | 2.0E-02 | 5.1E-07 | 1 | 0.13 | 3.5E-09 | 7.3E-03 | 2.6E-11 |
| Dibenz(a,h)anthracene | 1.5E-01 | 1 | 0.13 | 6.7E-09 | 2.0E-02 | 3.3E-07 | 1 | 0.13 | 2.3E-09 | 7.3E+00 | 1.7E-08 |
| Fluoranthene | 1.2E-01 | 1 | 0.13 | 5.6E-09 | 4.0E-02 | 1.4E-07 | NA | NA | NA | NA | NA |
| Fluorene | 1.3E-01 | 1 | 0.13 | 5.9E-09 | 4.0E-02 | 1.5E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 3.8E-01 | 1 | 0.13 | 1.7E-08 | 2.0E-02 | 8.7E-07 | 1 | 0.13 | 6.0E-09 | 7.3E-01 | 4.4E-09 |
| Naphthalene | 1.3E-01 | 1 | 0.13 | 6.1E-09 | 2.0E-02 | 3.0E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 9.6E-02 | 1 | 0.13 | 4.4E-09 | 2.0E-02 | 2.2E-07 | NA | NA | NA | NA | NA |
| Pyrene | 1.2E-01 | 1 | 0.13 | 5.5E-09 | 3.0E-02 | 1.8E-07 | NA | NA | NA | NA | NA |
| BAP-TEQ | 3.5E-01 | 1 | 0.13 | 1.6E-08 | 2.0E-02 | 8.1E-07 | 1 | 0.13 | 5.5E-09 | 7.3E+00 | 4.0E-08 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.25 | 9.1E-08 | 3.0E-02 | 3.0E-06 | 1 | 0.25 | 3.1E-08 | 1.2E-01 | 3.7E-09 |
| Risk Total | | | | | | 8.9E-06 | | | | | 9.9E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Recreational Visitor from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (7-18) as per WDNR Comments |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Soil Ingestion and Dermal Contact |

$$ADD\ (mg/kg\text{-}day) = \frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 100 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 11 |
| BW: Body Weight (kg) | 48 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 4015 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| Compound | Soil Concentration (mg/kg) | Noncancer Hazard Quotient: Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Potential Excess Lifetime Cancer Risk: Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD TEQ | 2.9E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 3.8E-13 | 1.5E+05 | 5.6E-08 |
| Acenaphthene | 1.5E-01 | 1 | 0.13 | 1.6E-08 | 6.0E-02 | 2.7E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.7E-01 | 1 | 0.13 | 1.7E-08 | 2.0E-02 | 8.7E-07 | NA | NA | NA | NA | NA |
| Anthracene | 2.5E-01 | 1 | 0.13 | 2.5E-08 | 3.0E-01 | 8.5E-08 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.1E-01 | 1 | 0.13 | 1.2E-08 | 2.0E-02 | 5.8E-07 | 1 | 0.13 | 1.8E-09 | 7.3E-01 | 1.3E-09 |
| Benzo(a)pyrene | 2.1E-01 | 1 | 0.13 | 2.1E-08 | 2.0E-02 | 1.1E-06 | 1 | 0.13 | 3.4E-09 | 7.3E+00 | 2.5E-08 |
| Benzo(b)fluoranthene | 2.7E-01 | 1 | 0.13 | 2.8E-08 | 2.0E-02 | 1.4E-06 | 1 | 0.13 | 4.4E-09 | 7.3E-01 | 3.2E-09 |
| Benzo(g,h,i)perylene | 4.4E-01 | 1 | 0.13 | 4.5E-08 | 2.0E-02 | 2.3E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E-01 | 1 | 0.13 | 1.1E-08 | 2.0E-02 | 5.7E-07 | 1 | 0.13 | 1.8E-09 | 7.3E-02 | 1.3E-10 |
| Chrysene | 2.2E-01 | 1 | 0.13 | 2.3E-08 | 2.0E-02 | 1.2E-06 | 1 | 0.13 | 3.6E-09 | 7.3E-03 | 2.6E-11 |
| Dibenz(a,h)anthracene | 1.5E-01 | 1 | 0.13 | 1.5E-08 | 2.0E-02 | 7.5E-07 | 1 | 0.13 | 2.4E-09 | 7.3E+00 | 1.7E-08 |
| Fluoranthene | 1.2E-01 | 1 | 0.13 | 1.3E-08 | 4.0E-02 | 3.1E-07 | NA | NA | NA | NA | NA |
| Fluorene | 1.3E-01 | 1 | 0.13 | 1.3E-08 | 4.0E-02 | 3.3E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 3.8E-01 | 1 | 0.13 | 3.9E-08 | 2.0E-02 | 2.0E-06 | 1 | 0.13 | 6.2E-09 | 7.3E-01 | 4.5E-09 |
| Naphthalene | 1.3E-01 | 1 | 0.13 | 1.4E-08 | 2.0E-02 | 6.9E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 9.6E-02 | 1 | 0.13 | 9.9E-09 | 2.0E-02 | 4.9E-07 | NA | NA | NA | NA | NA |
| Pyrene | 1.2E-01 | 1 | 0.13 | 1.2E-08 | 3.0E-02 | 4.1E-07 | NA | NA | NA | NA | NA |
| BAP-TEQ | 3.5E-01 | 1 | 0.13 | 3.6E-08 | 2.0E-02 | 1.8E-06 | 1 | 0.13 | 5.7E-09 | 7.3E+00 | 4.2E-08 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.25 | 1.8E-07 | 3.0E-02 | 6.1E-06 | 1 | 0.25 | 2.9E-08 | 1.2E-01 | 3.4E-09 |
| Risk Total | | | | | | 1.9E-05 | | | | | 1.1E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Recreational Visitor from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) as per WDNR Comments |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.08 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.08 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 2.9E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 3.1E-13 | 1.5E+05 | 4.6E-08 |
| Acenaphthene | 1.5E-01 | 1 | 0.13 | 7.1E-09 | 6.0E-02 | 1.2E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 1.7E-01 | 1 | 0.13 | 7.8E-09 | 2.0E-02 | 3.9E-07 | NA | NA | NA | NA | NA |
| Anthracene | 2.5E-01 | 1 | 0.13 | 1.1E-08 | 3.0E-01 | 3.8E-08 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.1E-01 | 1 | 0.13 | 5.1E-09 | 2.0E-02 | 2.6E-07 | 1 | 0.13 | 1.8E-09 | 7.3E-01 | 1.3E-09 |
| Benzo(a)pyrene | 2.1E-01 | 1 | 0.13 | 9.5E-09 | 2.0E-02 | 4.8E-07 | 1 | 0.13 | 3.3E-09 | 7.3E+00 | 2.4E-08 |
| Benzo(b)fluoranthene | 2.7E-01 | 1 | 0.13 | 1.2E-08 | 2.0E-02 | 6.2E-07 | 1 | 0.13 | 4.2E-09 | 7.3E-01 | 3.1E-09 |
| Benzo(g,h,i)perylene | 4.4E-01 | 1 | 0.13 | 2.0E-08 | 2.0E-02 | 1.0E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.1E-01 | 1 | 0.13 | 5.0E-09 | 2.0E-02 | 2.5E-07 | 1 | 0.13 | 1.7E-09 | 7.3E-02 | 1.3E-10 |
| Chrysene | 2.2E-01 | 1 | 0.13 | 1.0E-08 | 2.0E-02 | 5.1E-07 | 1 | 0.13 | 3.5E-09 | 7.3E-03 | 2.6E-11 |
| Dibenz(a,h)anthracene | 1.5E-01 | 1 | 0.13 | 6.7E-09 | 2.0E-02 | 3.3E-07 | 1 | 0.13 | 2.3E-09 | 7.3E+00 | 1.7E-08 |
| Fluoranthene | 1.2E-01 | 1 | 0.13 | 5.6E-09 | 4.0E-02 | 1.4E-07 | NA | NA | NA | NA | NA |
| Fluorene | 1.3E-01 | 1 | 0.13 | 5.9E-09 | 4.0E-02 | 1.5E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 3.8E-01 | 1 | 0.13 | 1.7E-08 | 2.0E-02 | 8.7E-07 | 1 | 0.13 | 6.0E-09 | 7.3E-01 | 4.4E-09 |
| Naphthalene | 1.3E-01 | 1 | 0.13 | 6.1E-09 | 2.0E-02 | 3.0E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 9.6E-02 | 1 | 0.13 | 4.4E-09 | 2.0E-02 | 2.2E-07 | NA | NA | NA | NA | NA |
| Pyrene | 1.2E-01 | 1 | 0.13 | 5.5E-09 | 3.0E-02 | 1.8E-07 | NA | NA | NA | NA | NA |
| BAP-TEQ | 3.5E-01 | 1 | 0.13 | 1.6E-08 | 2.0E-02 | 8.1E-07 | 1 | 0.13 | 5.5E-09 | 7.3E+00 | 4.0E-08 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.25 | 9.1E-08 | 3.0E-02 | 3.0E-06 | 1 | 0.25 | 3.1E-08 | 1.2E-01 | 3.7E-09 |
| Risk Total | | | | | | 8.9E-06 | | | | | 9.9E-08 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Child Hunter from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (7-18) as per WDNR Comments |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 100 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.17 |
| SA: Skin Surface Area (cm2/event) | 2433 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.17 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 11 |
| BW: Body Weight (kg) | 48 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 4015 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| Compound | Soil Concentration (mg/kg) | Noncancer Hazard Quotient: Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Potential Excess Lifetime Cancer Risk: Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD TEQ | 4.3E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 1.1E-12 | 1.5E+05 | 1.7E-07 |
| Acenaphthene | 1.6E-01 | 1 | 0.13 | 3.3E-08 | 6.0E-02 | 5.5E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.3E-01 | 1 | 0.13 | 4.7E-08 | 2.0E-02 | 2.3E-06 | NA | NA | NA | NA | NA |
| Anthracene | 3.4E-01 | 1 | 0.13 | 6.9E-08 | 3.0E-01 | 2.3E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.5E-01 | 1 | 0.13 | 3.0E-08 | 2.0E-02 | 1.5E-06 | 1 | 0.13 | 4.7E-09 | 7.3E-01 | 3.4E-09 |
| Benzo(a)pyrene | 2.8E-01 | 1 | 0.13 | 5.9E-08 | 2.0E-02 | 2.9E-06 | 1 | 0.13 | 9.2E-09 | 7.3E+00 | 6.7E-08 |
| Benzo(b)fluoranthene | 3.6E-01 | 1 | 0.13 | 7.5E-08 | 2.0E-02 | 3.7E-06 | 1 | 0.13 | 1.2E-08 | 7.3E-01 | 8.6E-09 |
| Benzo(g,h,i)perylene | 6.1E-01 | 1 | 0.13 | 1.3E-07 | 2.0E-02 | 6.3E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.5E-01 | 1 | 0.13 | 3.0E-08 | 2.0E-02 | 1.5E-06 | 1 | 0.13 | 4.8E-09 | 7.3E-02 | 3.5E-10 |
| Chrysene | 3.3E-01 | 1 | 0.13 | 6.9E-08 | 2.0E-02 | 3.4E-06 | 1 | 0.13 | 1.1E-08 | 7.3E-03 | 7.9E-11 |
| Dibenz(a,h)anthracene | 1.9E-01 | 1 | 0.13 | 3.9E-08 | 2.0E-02 | 1.9E-06 | 1 | 0.13 | 6.1E-09 | 7.3E+00 | 4.4E-08 |
| Fluoranthene | 1.5E-01 | 1 | 0.13 | 3.1E-08 | 4.0E-02 | 7.9E-07 | NA | NA | NA | NA | NA |
| Fluorene | 1.7E-01 | 1 | 0.13 | 3.5E-08 | 4.0E-02 | 8.8E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.4E-01 | 1 | 0.13 | 1.1E-07 | 2.0E-02 | 5.6E-06 | 1 | 0.13 | 1.7E-08 | 7.3E-01 | 1.3E-08 |
| Naphthalene | 1.6E-01 | 1 | 0.13 | 3.3E-08 | 2.0E-02 | 1.6E-06 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.3E-01 | 1 | 0.13 | 2.8E-08 | 2.0E-02 | 1.4E-06 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E-01 | 1 | 0.13 | 3.2E-08 | 3.0E-02 | 1.1E-06 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E-01 | 1 | 0.13 | 1.0E-07 | 2.0E-02 | 5.1E-06 | 1 | 0.13 | 1.6E-08 | 7.3E+00 | 1.2E-07 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.25 | 3.8E-07 | 3.0E-02 | 1.3E-05 | 1 | 0.25 | 5.9E-08 | 1.2E-01 | 7.1E-09 |
| Risk Total | | | | | | 4.8E-05 | | | | | 3.1E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Hunter from Shallow Soil using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) as per WDNR Comments |
| **Medium:** | Shallow Soil (0-1') |
| **Exposure Pathway:** | Area 3 - Incidental Soil Ingestion and Dermal Contact |

ADD (mg/kg-day) = $\frac{CS \times [(IR \times FI \times AAF) + (SA \times AF \times FA \times AAF)] \times EF \times ED \times CF}{BW \times AT}$

Hazard Quotient (HQ) = ADD (mg/kg-day) / RfD (mg/kg-d)
Cancer Risk (ELCR) = ADD (mg/kg-day) * CSF [1/(mg/kg-day)]

| Parameter (units) | Value |
|---|---|
| ADD: Average Daily Dose (mg/kg-day) | See Below |
| CS: Chemical Concentration in Soil (mg/kg) | Chemical-Specific |
| IR: Ingestion Rate (mg/day) | 50 |
| AAF: Absorption Adjustment Factor (Oral-Soil) (unitless) | Chemical-Specific |
| FI: Fraction Ingested from Site (unitless) | 0.17 |
| SA: Skin Surface Area (cm2/event) | 2518 |
| AF: Adherence Factor (mg/cm2) | 0.14 |
| AAF: Absorption Adjustment Factor (Dermal-Soil) (unitless) | Chemical-Specific |
| FA: Fraction Absorbed from Site (unitless) | 0.17 |
| EF: Exposure Frequency (days/year) | 150 |
| ED: Exposure Duration (years) | 24 |
| BW: Body Weight (kg) | 71.8 |
| AT: Averaging Time (days) (ED x 365 days/yr, noncancer) | 8760 |
| AT: Averaging Time (days) (70 yr. x 365 days/yr, cancer) | 25550 |
| RfD: Reference Dose (mg/kg-day) | Chemical-Specific |
| CSF: Cancer Slope Factor [1/(mg/kg-day)] | Chemical-Specific |
| CF: Conversion factor (kg/mg) | 1.00E-06 |

| | | Noncancer Hazard Quotient | | | | | Potential Excess Lifetime Cancer Risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Soil Concentration (mg/kg) | Oral-Soil RAF (noncancer) Chronic | Dermal-Soil AAF (noncancer) Chronic | ADD (noncancer) (mg/kg-day) | Chronic RfD (mg/kg-day) | Soil HQ | Oral-Soil AAF (cancer) | Dermal-Soil AAF (cancer) | ADD (cancer) (mg/kg-day) | CSF [1/(mg/kg-day)] | Soil Risk (mg/kg) |
| 2,3,7,8-TCDD TEQ | 4.3E-05 | 1 | 0.04 | NA | NA | NA | 1 | 0.04 | 9.1E-13 | 1.5E+05 | 1.4E-07 |
| Acenaphthene | 1.6E-01 | 1 | 0.13 | 1.5E-08 | 6.0E-02 | 2.5E-07 | NA | NA | NA | NA | NA |
| Acenaphthylene | 2.3E-01 | 1 | 0.13 | 2.1E-08 | 2.0E-02 | 1.0E-06 | NA | NA | NA | NA | NA |
| Anthracene | 3.4E-01 | 1 | 0.13 | 3.1E-08 | 3.0E-01 | 1.0E-07 | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | 1.5E-01 | 1 | 0.13 | 1.3E-08 | 2.0E-02 | 6.6E-07 | 1 | 0.13 | 4.6E-09 | 7.3E-01 | 3.3E-09 |
| Benzo(a)pyrene | 2.8E-01 | 1 | 0.13 | 2.6E-08 | 2.0E-02 | 1.3E-06 | 1 | 0.13 | 8.9E-09 | 7.3E+00 | 6.5E-08 |
| Benzo(b)fluoranthene | 3.6E-01 | 1 | 0.13 | 3.3E-08 | 2.0E-02 | 1.7E-06 | 1 | 0.13 | 1.1E-08 | 7.3E-01 | 8.3E-09 |
| Benzo(g,h,i)perylene | 6.1E-01 | 1 | 0.13 | 5.6E-08 | 2.0E-02 | 2.8E-06 | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 1.5E-01 | 1 | 0.13 | 1.3E-08 | 2.0E-02 | 6.7E-07 | 1 | 0.13 | 4.6E-09 | 7.3E-02 | 3.4E-10 |
| Chrysene | 3.3E-01 | 1 | 0.13 | 3.1E-08 | 2.0E-02 | 1.5E-06 | 1 | 0.13 | 1.0E-08 | 7.3E-03 | 7.6E-11 |
| Dibenz(a,h)anthracene | 1.9E-01 | 1 | 0.13 | 1.7E-08 | 2.0E-02 | 8.6E-07 | 1 | 0.13 | 5.9E-09 | 7.3E+00 | 4.3E-08 |
| Fluoranthene | 1.5E-01 | 1 | 0.13 | 1.4E-08 | 4.0E-02 | 3.5E-07 | NA | NA | NA | NA | NA |
| Fluorene | 1.7E-01 | 1 | 0.13 | 1.6E-08 | 4.0E-02 | 3.9E-07 | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 5.4E-01 | 1 | 0.13 | 4.9E-08 | 2.0E-02 | 2.5E-06 | 1 | 0.13 | 1.7E-08 | 7.3E-01 | 1.2E-08 |
| Naphthalene | 1.6E-01 | 1 | 0.13 | 1.5E-08 | 2.0E-02 | 7.3E-07 | NA | NA | NA | NA | NA |
| Phenanthrene | 1.3E-01 | 1 | 0.13 | 1.2E-08 | 2.0E-02 | 6.1E-07 | NA | NA | NA | NA | NA |
| Pyrene | 1.5E-01 | 1 | 0.13 | 1.4E-08 | 3.0E-02 | 4.7E-07 | NA | NA | NA | NA | NA |
| BAP-TEQ | 4.9E-01 | 1 | 0.13 | 4.5E-08 | 2.0E-02 | 2.3E-06 | 1 | 0.13 | 1.5E-08 | 7.3E+00 | 1.1E-07 |
| Pentachlorophenol | 1.4E+00 | 1 | 0.25 | 1.9E-07 | 3.0E-02 | 6.3E-06 | 1 | 0.25 | 6.5E-08 | 1.2E-01 | 7.8E-09 |
| Risk Total | | | | | | 2.2E-05 | | | | | 2.8E-07 |

NA - Not available
NC - Not calculated
ND - Not detected

**Evaluation of Potential Risk to Adult Trapper from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Trapper as per WDNR Comments (adult) |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 3 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3341 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 150 | 150 days in 5 month trapping season |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | Incidental Ingestion RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Dermal Contact Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Total Risk(SW) | HI(SW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 5.7E-08 | 9.5E-07 | 0.04 | 1 | NA | NA | 7.6E-07 | 1.3E-05 | NA | 1.4E-05 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 5.7E-08 | 2.9E-06 | 0.04 | 1 | NA | NA | 7.6E-07 | 3.8E-05 | NA | 4.1E-05 |
| Anthracene | 5.0E-05 | 0.3 | NA | 1 | NA | NA | 2.9E-09 | 9.5E-09 | 0.04 | 1 | NA | NA | 3.8E-08 | 1.3E-07 | NA | 1.4E-07 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 5.7E-10 | 4.2E-10 | 5.7E-10 | 2.9E-08 | 0.02 | 1 | 3.8E-09 | 2.8E-09 | 3.8E-09 | 1.9E-07 | 3.2E-09 | 2.2E-07 |
| Benzo(a)pyrene | 1.0E-05 | 0.02 | 7.3 | 1 | 5.7E-10 | 4.2E-09 | 5.7E-10 | 2.9E-08 | 0.02 | 1 | 3.8E-09 | 2.8E-08 | 3.8E-09 | 1.9E-07 | 3.2E-08 | 2.2E-07 |
| Benzo(b)fluoranthene | 2.7E-05 | 0.02 | 0.73 | 1 | 1.5E-09 | 1.1E-09 | 1.5E-09 | 7.7E-08 | 0.02 | 1 | 1.0E-08 | 7.5E-09 | 1.0E-08 | 5.2E-07 | 8.7E-09 | 5.9E-07 |
| Benzo(g,h,i)perylene | 2.8E-05 | 0.02 | NA | 1 | NA | NA | 1.6E-09 | 7.9E-08 | 0.04 | 1 | NA | NA | 2.1E-08 | 1.1E-06 | NA | 1.1E-06 |
| Benzo(k)fluoranthene | 1.0E-05 | 0.02 | 0.073 | 1 | 5.7E-10 | 4.2E-11 | 5.7E-10 | 2.9E-08 | 0.02 | 1 | 3.8E-09 | 2.8E-10 | 3.8E-09 | 1.9E-07 | 3.2E-10 | 2.2E-07 |
| Chrysene | 7.8E-05 | 0.02 | 0.0073 | 1 | 4.4E-09 | 3.2E-11 | 4.4E-09 | 2.2E-07 | 0.02 | 1 | 3.0E-08 | 2.2E-10 | 3.0E-08 | 1.5E-06 | 2.5E-10 | 1.7E-06 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 8.6E-10 | 6.3E-09 | 8.6E-10 | 4.3E-08 | 0.02 | 1 | 5.7E-09 | 4.2E-08 | 5.7E-09 | 2.9E-07 | 4.8E-08 | 3.3E-07 |
| Fluoranthene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 5.7E-09 | 1.4E-07 | 0.04 | 1 | NA | NA | 7.6E-08 | 1.9E-06 | NA | 2.1E-06 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 5.7E-09 | 1.4E-07 | 0.04 | 1 | NA | NA | 7.6E-08 | 1.9E-06 | NA | 2.1E-06 |
| Indeno(1,2,3-cd)pyrene | 2.8E-05 | 0.02 | 0.73 | 1 | 1.6E-09 | 1.1E-09 | 1.6E-09 | 7.9E-08 | 0.02 | 1 | 1.1E-08 | 7.7E-09 | 1.1E-08 | 5.3E-07 | 8.8E-09 | 6.0E-07 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 5.7E-08 | 2.9E-06 | 0.04 | 1 | NA | NA | 7.6E-07 | 3.8E-05 | NA | 4.1E-05 |
| Phenanthrene | 2.8E-04 | 0.02 | NA | 1 | NA | NA | 1.6E-08 | 7.9E-07 | 0.04 | 1 | NA | NA | 2.1E-07 | 1.1E-05 | NA | 1.1E-05 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 5.7E-09 | 1.9E-07 | 0.04 | 1 | NA | NA | 7.6E-08 | 2.5E-06 | NA | 2.7E-06 |
| BAP-TEQ | 1.9E-03 | 0.02 | 7.3 | 1 | 1.1E-07 | 8.1E-07 | 1.1E-07 | 5.6E-06 | 0.02 | 1 | 7.4E-07 | 5.4E-06 | 7.4E-07 | 3.7E-05 | 6.3E-06 | 4.3E-05 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 1.4E-08 | 1.7E-09 | 1.4E-08 | 4.8E-07 | 0.65 | 1 | 3.1E-06 | 3.7E-07 | 3.1E-06 | 1.0E-04 | 3.7E-07 | 1.0E-04 |
| Total | | | | | | 1.5E-08 | | 9.0E-06 | | | | 4.6E-07 | | 2.1E-04 | 4.8E-07 | 2.2E-04 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Child Recreational Visitor from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (7-18) as per WDNR comments |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 3 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3133 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 365 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 11 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 4015 | |
| BW: Body Weight | kg | 48 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | Incidental Ingestion RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Dermal Contact Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Total Risk(SW) | HI(SW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 2.1E-07 | 3.5E-06 | 0.04 | 1 | NA | NA | 2.6E-06 | 4.4E-05 | NA | 4.7E-05 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 2.1E-07 | 1.0E-05 | 0.04 | 1 | NA | NA | 2.6E-06 | 1.3E-04 | NA | 1.4E-04 |
| Anthracene | 5.0E-05 | 0.3 | NA | 1 | NA | NA | 1.0E-08 | 3.5E-08 | 0.04 | 1 | NA | NA | 1.3E-07 | 4.4E-07 | NA | 4.7E-07 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 2.1E-09 | 1.5E-09 | 2.1E-09 | 1.0E-07 | 0.02 | 1 | 1.3E-08 | 9.5E-09 | 1.3E-08 | 6.5E-07 | 1.1E-08 | 7.6E-07 |
| Benzo(a)pyrene | 1.0E-05 | 0.02 | 7.3 | 1 | 2.1E-09 | 1.5E-08 | 2.1E-09 | 1.0E-07 | 0.02 | 1 | 1.3E-08 | 9.5E-08 | 1.3E-08 | 6.5E-07 | 1.1E-07 | 7.6E-07 |
| Benzo(b)fluoranthene | 2.7E-05 | 0.02 | 0.73 | 1 | 5.6E-09 | 4.1E-09 | 5.6E-09 | 2.8E-07 | 0.02 | 1 | 3.5E-08 | 2.6E-08 | 3.5E-08 | 1.8E-06 | 3.0E-08 | 2.0E-06 |
| Benzo(g,h,i)perylene | 2.8E-05 | 0.02 | NA | 1 | NA | NA | 5.7E-09 | 2.9E-07 | 0.04 | 1 | NA | NA | 7.2E-08 | 3.6E-06 | NA | 3.9E-06 |
| Benzo(k)fluoranthene | 1.0E-05 | 0.02 | 0.073 | 1 | 2.1E-09 | 1.5E-10 | 2.1E-09 | 1.0E-07 | 0.02 | 1 | 1.3E-08 | 9.5E-10 | 1.3E-08 | 6.5E-07 | 1.1E-09 | 7.6E-07 |
| Chrysene | 7.8E-05 | 0.02 | 0.0073 | 1 | 1.6E-08 | 1.2E-10 | 1.6E-08 | 8.1E-07 | 0.02 | 1 | 1.0E-07 | 7.4E-10 | 1.0E-07 | 5.1E-06 | 8.6E-10 | 5.9E-06 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 3.1E-09 | 2.3E-08 | 3.1E-09 | 1.6E-07 | 0.02 | 1 | 2.0E-08 | 1.4E-07 | 2.0E-08 | 9.8E-07 | 1.7E-07 | 1.1E-06 |
| Fluoranthene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 2.1E-08 | 5.2E-07 | 0.04 | 1 | NA | NA | 2.6E-07 | 6.5E-06 | NA | 7.0E-06 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 2.1E-08 | 5.2E-07 | 0.04 | 1 | NA | NA | 2.6E-07 | 6.5E-06 | NA | 7.0E-06 |
| Indeno(1,2,3-cd)pyrene | 2.8E-05 | 0.02 | 0.73 | 1 | 5.7E-09 | 4.2E-09 | 5.7E-09 | 2.9E-07 | 0.02 | 1 | 3.6E-08 | 2.6E-08 | 3.6E-08 | 1.8E-06 | 3.0E-08 | 2.1E-06 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 2.1E-07 | 1.0E-05 | 0.04 | 1 | NA | NA | 2.6E-06 | 1.3E-04 | NA | 1.4E-04 |
| Phenanthrene | 2.8E-04 | 0.02 | NA | 1 | NA | NA | 5.7E-08 | 2.9E-06 | 0.04 | 1 | NA | NA | 7.2E-07 | 3.6E-05 | NA | 3.9E-05 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 2.1E-08 | 6.9E-07 | 0.04 | 1 | NA | NA | 2.6E-07 | 8.7E-06 | NA | 9.4E-06 |
| BAP-TEQ | 1.9E-03 | 0.02 | 7.3 | 1 | 4.1E-07 | 3.0E-06 | 4.1E-07 | 2.0E-05 | 0.02 | 1 | 2.5E-06 | 1.9E-05 | 2.5E-06 | 1.3E-04 | 2.2E-05 | 1.5E-04 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 5.2E-08 | 6.2E-09 | 5.2E-08 | 1.7E-06 | 0.65 | 1 | 1.1E-05 | 1.3E-06 | 1.1E-05 | 3.5E-04 | 1.3E-06 | 3.6E-04 |
| Total | | | | | | 5.4E-08 | | 3.3E-05 | | | | 1.6E-06 | | 7.3E-04 | 1.6E-06 | 7.6E-04 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Adult Recreational Visitor from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Recreational Visitor (adult) as per WDNR comments |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 3 - Incidental Surface Water Ingestion and Dermal Contact |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 3341 | |
| ET: Surface Water Exposure Time | h/d | 1 | |
| EF: Surface Water Exposure Frequency | d/y | 120 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | Incidental Ingestion RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Dermal Contact Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Total Risk(SW) | HI(SW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 4.6E-08 | 7.6E-07 | 0.04 | 1 | NA | NA | 6.1E-07 | 1.0E-05 | NA | 1.1E-05 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 4.6E-08 | 2.3E-06 | 0.04 | 1 | NA | NA | 6.1E-07 | 3.1E-05 | NA | 3.3E-05 |
| Anthracene | 5.0E-05 | 0.3 | NA | 1 | NA | NA | 2.3E-09 | 7.6E-09 | 0.04 | 1 | NA | NA | 3.1E-08 | 1.0E-07 | NA | 1.1E-07 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 4.6E-10 | 3.3E-10 | 4.6E-10 | 2.3E-08 | 0.02 | 1 | 3.1E-09 | 2.2E-09 | 3.1E-09 | 1.5E-07 | 2.6E-09 | 1.8E-07 |
| Benzo(a)pyrene | 1.0E-05 | 0.02 | 7.3 | 1 | 4.6E-10 | 3.3E-09 | 4.6E-10 | 2.3E-08 | 0.02 | 1 | 3.1E-09 | 2.2E-08 | 3.1E-09 | 1.5E-07 | 2.6E-08 | 1.8E-07 |
| Benzo(b)fluoranthene | 2.7E-05 | 0.02 | 0.73 | 1 | 1.2E-09 | 9.0E-10 | 1.2E-09 | 6.2E-08 | 0.02 | 1 | 8.3E-09 | 6.0E-09 | 8.3E-09 | 4.1E-07 | 6.9E-09 | 4.7E-07 |
| Benzo(g,h,i)perylene | 2.8E-05 | 0.02 | NA | 1 | NA | NA | 1.3E-09 | 6.3E-08 | 0.04 | 1 | NA | NA | 1.7E-08 | 8.4E-07 | NA | 9.0E-07 |
| Benzo(k)fluoranthene | 1.0E-05 | 0.02 | 0.073 | 1 | 4.6E-10 | 3.3E-11 | 4.6E-10 | 2.3E-08 | 0.02 | 1 | 3.1E-09 | 2.2E-10 | 3.1E-09 | 1.5E-07 | 2.6E-10 | 1.8E-07 |
| Chrysene | 7.8E-05 | 0.02 | 0.0073 | 1 | 3.5E-09 | 2.6E-11 | 3.5E-09 | 1.8E-07 | 0.02 | 1 | 2.4E-08 | 1.7E-10 | 2.4E-08 | 1.2E-06 | 2.0E-10 | 1.4E-06 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 6.9E-10 | 5.0E-09 | 6.9E-10 | 3.4E-08 | 0.02 | 1 | 4.6E-09 | 3.4E-08 | 4.6E-09 | 2.3E-07 | 3.9E-08 | 2.6E-07 |
| Fluoranthene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 4.6E-09 | 1.1E-07 | 0.04 | 1 | NA | NA | 6.1E-08 | 1.5E-06 | NA | 1.6E-06 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 4.6E-09 | 1.1E-07 | 0.04 | 1 | NA | NA | 6.1E-08 | 1.5E-06 | NA | 1.6E-06 |
| Indeno(1,2,3-cd)pyrene | 2.8E-05 | 0.02 | 0.73 | 1 | 1.3E-09 | 9.2E-10 | 1.3E-09 | 6.3E-08 | 0.02 | 1 | 8.4E-09 | 6.1E-09 | 8.4E-09 | 4.2E-07 | 7.1E-09 | 4.8E-07 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 4.6E-08 | 2.3E-06 | 0.04 | 1 | NA | NA | 6.1E-07 | 3.1E-05 | NA | 3.3E-05 |
| Phenanthrene | 2.8E-04 | 0.02 | NA | 1 | NA | NA | 1.3E-08 | 6.3E-07 | 0.04 | 1 | NA | NA | 1.7E-07 | 8.4E-06 | NA | 9.0E-06 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 4.6E-09 | 1.5E-07 | 0.04 | 1 | NA | NA | 6.1E-08 | 2.0E-06 | NA | 2.2E-06 |
| BAP-TEQ | 1.9E-03 | 0.02 | 7.3 | 1 | 8.9E-08 | 6.5E-07 | 8.9E-08 | 4.5E-06 | 0.02 | 1 | 6.0E-07 | 4.4E-06 | 6.0E-07 | 3.0E-05 | 5.0E-06 | 3.4E-05 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 1.1E-08 | 1.4E-09 | 1.1E-08 | 3.8E-07 | 0.65 | 1 | 2.5E-06 | 3.0E-07 | 2.5E-06 | 8.3E-05 | 3.0E-07 | 8.3E-05 |
| Total | | | | | | 1.2E-08 | | 7.2E-06 | | | | 3.7E-07 | | 1.7E-04 | 3.8E-07 | 1.8E-04 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Child Hunter from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (7-18) as per WDNR comments |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 3 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 928 | |
| ET: Surface Water Exposure Time | h/d | 0.5 | |
| EF: Surface Water Exposure Frequency | d/y | 16 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 11 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 4015 | |
| BW: Body Weight | kg | 48 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| Compound | EPC Surface Water (mg/L) | RfD (mg/kg-d) | CSF 1/(mg/kg-d) | Incidental Ingestion RAFow | ADDing-c mg/kg-d | Risking | ADDing-nc mg/kg-d | HIing | Dermal Contact Kp (cm/hr) | RAFdw | ADDder-c mg/kg-d | Riskder | ADDder-nc mg/kg-d | HIder | Total Risk(SW) | HI(SW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 9.1E-09 | 1.5E-07 | 0.04 | 1 | NA | NA | 1.7E-08 | 2.8E-07 | NA | 4.3E-07 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 9.1E-09 | 4.6E-07 | 0.04 | 1 | NA | NA | 1.7E-08 | 8.5E-07 | NA | 1.3E-06 |
| Anthracene | 5.0E-05 | 0.3 | NA | 1 | NA | NA | 4.6E-10 | 1.5E-09 | 0.04 | 1 | NA | NA | 8.5E-10 | 2.8E-09 | NA | 4.3E-09 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 9.1E-11 | 6.7E-11 | 9.1E-11 | 4.6E-09 | 0.02 | 1 | 8.5E-11 | 6.2E-11 | 8.5E-11 | 4.2E-09 | 1.3E-10 | 8.8E-09 |
| Benzo(a)pyrene | 1.0E-05 | 0.02 | 7.3 | 1 | 9.1E-11 | 6.7E-10 | 9.1E-11 | 4.6E-09 | 0.02 | 1 | 8.5E-11 | 6.2E-10 | 8.5E-11 | 4.2E-09 | 1.3E-09 | 8.8E-09 |
| Benzo(b)fluoranthene | 2.7E-05 | 0.02 | 0.73 | 1 | 2.5E-10 | 1.8E-10 | 2.5E-10 | 1.2E-08 | 0.02 | 1 | 2.3E-10 | 1.7E-10 | 2.3E-10 | 1.1E-08 | 3.5E-10 | 2.4E-08 |
| Benzo(g,h,i)perylene | 2.8E-05 | 0.02 | NA | 1 | NA | NA | 2.5E-10 | 1.3E-08 | 0.04 | 1 | NA | NA | 4.7E-10 | 2.3E-08 | NA | 3.6E-08 |
| Benzo(k)fluoranthene | 1.0E-05 | 0.02 | 0.073 | 1 | 9.1E-11 | 6.7E-12 | 9.1E-11 | 4.6E-09 | 0.02 | 1 | 8.5E-11 | 6.2E-12 | 8.5E-11 | 4.2E-09 | 1.3E-11 | 8.8E-09 |
| Chrysene | 7.8E-05 | 0.02 | 0.0073 | 1 | 7.1E-10 | 5.2E-12 | 7.1E-10 | 3.5E-08 | 0.02 | 1 | 6.6E-10 | 4.8E-12 | 6.6E-10 | 3.3E-08 | 1.0E-11 | 6.8E-08 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 1.4E-10 | 1.0E-09 | 1.4E-10 | 6.8E-09 | 0.02 | 1 | 1.3E-10 | 9.3E-10 | 1.3E-10 | 6.4E-09 | 1.9E-09 | 1.3E-08 |
| Fluoranthene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 9.1E-10 | 2.3E-08 | 0.04 | 1 | NA | NA | 1.7E-09 | 4.2E-08 | NA | 6.5E-08 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 9.1E-10 | 2.3E-08 | 0.04 | 1 | NA | NA | 1.7E-09 | 4.2E-08 | NA | 6.5E-08 |
| Indeno(1,2,3-cd)pyrene | 2.8E-05 | 0.02 | 0.73 | 1 | 2.5E-10 | 1.8E-10 | 2.5E-10 | 1.3E-08 | 0.02 | 1 | 2.3E-10 | 1.7E-10 | 2.3E-10 | 1.2E-08 | 3.5E-10 | 2.4E-08 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 9.1E-09 | 4.6E-07 | 0.04 | 1 | NA | NA | 1.7E-08 | 8.5E-07 | NA | 1.3E-06 |
| Phenanthrene | 2.8E-04 | 0.02 | NA | 1 | NA | NA | 2.5E-09 | 1.3E-07 | 0.04 | 1 | NA | NA | 4.7E-09 | 2.3E-07 | NA | 3.6E-07 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 9.1E-10 | 3.0E-08 | 0.04 | 1 | NA | NA | 1.7E-09 | 5.6E-08 | NA | 8.7E-08 |
| BAP-TEQ | 1.9E-03 | 0.02 | 7.3 | 1 | 1.8E-08 | 1.3E-07 | 1.8E-08 | 8.9E-07 | 0.02 | 1 | 1.7E-08 | 1.2E-07 | 1.7E-08 | 8.3E-07 | 2.5E-07 | 1.7E-06 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 2.3E-09 | 2.7E-10 | 2.3E-09 | 7.6E-08 | 0.65 | 1 | 6.9E-08 | 8.3E-09 | 6.9E-08 | 2.3E-06 | 8.5E-09 | 2.4E-06 |
| Total | | | | | | 2.4E-09 | | 1.4E-06 | | | | 1.0E-08 | | 4.7E-06 | 1.3E-08 | 6.2E-06 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

**Evaluation of Potential Risk to Adult Hunter from Surface Water using WDNR's Exposure Assumptions**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| **Scenario:** | Current |
| **Receptor:** | Hunter (adult) as per WDNR comments |
| **Medium:** | Surface Water |
| **Exposure Pathway:** | Area 3 - Incidental Surface Water Ingestion and Dermal Contact |

| | Units | Value | Comment |
|---|---|---|---|
| IRsw: Surface Water Incidental Ingestion Rate | L/d | 0.01 | |
| SA: Surface Water Dermal Contact Skin Exposed | cm2 | 904 | |
| ET: Surface Water Exposure Time | h/d | 0.5 | |
| EF: Surface Water Exposure Frequency | d/y | 16 | |
| EP: Surface Water Exposure Period - Cancer | y | 70 | |
| EP: Surface Water Exposure Period - Non-Cancer | y | 24 | |
| ATc: Surface Water Averaging Time - Cancer | d | 25550 | |
| ATn: Surface Water Averaging Time - Non-Cancer | d | 8760 | |
| BW: Body Weight | kg | 71.8 | |
| CF: Conversion Factor | L/cm3 | 1.00E-03 | |

$$ADD_{ing} = \frac{C_{sw} \times IR_{sw} \times RAF_{ow} \times EF \times EP}{AP \times BW}$$

$$ADD_{der} = \frac{C_{sw} \times CF \times SA \times K_p \times ET \times RAF_{dw} \times EF \times EP}{AP \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk = ADD_{ing} \times CSF$$

$$Risk = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

| | EPC | | | Incidental Ingestion | | | | | Dermal Contact | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Water | RfD | CSF | RAFow | ADDing-c | Risking | ADDing-nc | HIing | Kp | RAFdw | ADDder-c | Riskder | ADDder-nc | HIder | Risk(SW) | HI(SW) |
| Compound | (mg/L) | (mg/kg-d) | 1/(mg/kg-d) | | mg/kg-d | | mg/kg-d | | (cm/hr) | | mg/kg-d | | mg/kg-d | | | |
| Acenaphthene | 1.0E-03 | 0.06 | NA | 1 | NA | NA | 6.1E-09 | 1.0E-07 | 0.04 | 1 | NA | NA | 1.1E-08 | 1.8E-07 | NA | 2.9E-07 |
| Acenaphthylene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 6.1E-09 | 3.1E-07 | 0.04 | 1 | NA | NA | 1.1E-08 | 5.5E-07 | NA | 8.6E-07 |
| Anthracene | 5.0E-05 | 0.3 | NA | 1 | NA | NA | 3.1E-10 | 1.0E-09 | 0.04 | 1 | NA | NA | 5.5E-10 | 1.8E-09 | NA | 2.9E-09 |
| Benzo(a)anthracene | 1.0E-05 | 0.02 | 0.73 | 1 | 6.1E-11 | 4.5E-11 | 6.1E-11 | 3.1E-09 | 0.02 | 1 | 5.5E-11 | 4.0E-11 | 5.5E-11 | 2.8E-09 | 8.5E-11 | 5.8E-09 |
| Benzo(a)pyrene | 1.0E-05 | 0.02 | 7.3 | 1 | 6.1E-11 | 4.5E-10 | 6.1E-11 | 3.1E-09 | 0.02 | 1 | 5.5E-11 | 4.0E-10 | 5.5E-11 | 2.8E-09 | 8.5E-10 | 5.8E-09 |
| Benzo(b)fluoranthene | 2.7E-05 | 0.02 | 0.73 | 1 | 1.6E-10 | 1.2E-10 | 1.6E-10 | 8.2E-09 | 0.02 | 1 | 1.5E-10 | 1.1E-10 | 1.5E-10 | 7.5E-09 | 2.3E-10 | 1.6E-08 |
| Benzo(g,h,i)perylene | 2.8E-05 | 0.02 | NA | 1 | NA | NA | 1.7E-10 | 8.4E-09 | 0.04 | 1 | NA | NA | 3.0E-10 | 1.5E-08 | NA | 2.4E-08 |
| Benzo(k)fluoranthene | 1.0E-05 | 0.02 | 0.073 | 1 | 6.1E-11 | 4.5E-12 | 6.1E-11 | 3.1E-09 | 0.02 | 1 | 5.5E-11 | 4.0E-12 | 5.5E-11 | 2.8E-09 | 8.5E-12 | 5.8E-09 |
| Chrysene | 7.8E-05 | 0.02 | 0.0073 | 1 | 4.7E-10 | 3.5E-12 | 4.7E-10 | 2.4E-08 | 0.02 | 1 | 4.3E-10 | 3.1E-12 | 4.3E-10 | 2.1E-08 | 6.6E-12 | 4.5E-08 |
| Dibenz(a,h)anthracene | 1.5E-05 | 0.02 | 7.3 | 1 | 9.2E-11 | 6.7E-10 | 9.2E-11 | 4.6E-09 | 0.02 | 1 | 8.3E-11 | 6.0E-10 | 8.3E-11 | 4.1E-09 | 1.3E-09 | 8.7E-09 |
| Fluoranthene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 6.1E-10 | 1.5E-08 | 0.04 | 1 | NA | NA | 1.1E-09 | 2.8E-08 | NA | 4.3E-08 |
| Fluorene | 1.0E-04 | 0.04 | NA | 1 | NA | NA | 6.1E-10 | 1.5E-08 | 0.04 | 1 | NA | NA | 1.1E-09 | 2.8E-08 | NA | 4.3E-08 |
| Indeno(1,2,3-cd)pyrene | 2.8E-05 | 0.02 | 0.73 | 1 | 1.7E-10 | 1.2E-10 | 1.7E-10 | 8.4E-09 | 0.02 | 1 | 1.5E-10 | 1.1E-10 | 1.5E-10 | 7.6E-09 | 2.3E-10 | 1.6E-08 |
| Naphthalene | 1.0E-03 | 0.02 | NA | 1 | NA | NA | 6.1E-09 | 3.1E-07 | 0.04 | 1 | NA | NA | 1.1E-08 | 5.5E-07 | NA | 8.6E-07 |
| Phenanthrene | 2.8E-04 | 0.02 | NA | 1 | NA | NA | 1.7E-09 | 8.4E-08 | 0.04 | 1 | NA | NA | 3.0E-09 | 1.5E-07 | NA | 2.4E-07 |
| Pyrene | 1.0E-04 | 0.03 | NA | 1 | NA | NA | 6.1E-10 | 2.0E-08 | 0.04 | 1 | NA | NA | 1.1E-09 | 3.7E-08 | NA | 5.7E-08 |
| BAP-TEQ | 1.9E-03 | 0.02 | 7.3 | 1 | 1.2E-08 | 8.7E-08 | 1.2E-08 | 5.9E-07 | 0.02 | 1 | 1.1E-08 | 7.8E-08 | 1.1E-08 | 5.4E-07 | 1.7E-07 | 1.1E-06 |
| Pentachlorophenol | 2.5E-04 | 0.03 | 0.12 | 1 | 1.5E-09 | 1.8E-10 | 1.5E-09 | 5.1E-08 | 0.65 | 1 | 4.5E-08 | 5.4E-09 | 4.5E-08 | 1.5E-06 | 5.6E-09 | 1.5E-06 |
| Total | | | | | | 1.6E-09 | | 9.6E-07 | | | | 6.7E-09 | | 3.1E-06 | 8.2E-09 | 4.1E-06 |

NA - Not available
NC - Not calculated
ND - Not detected
2,3,7,8-TCDD TEQ is not a COPC in this medium

## Appendix G

## Summary of PAH Toxicity Results from Beazer Sites

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# Toxicity of Creosote-Derived PAH in Sediments

P.D. Anderson, A. Nair, J. Patarcity, K. Cerreto

SETAC 2006

Montreal, Canada

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# Goals Today

- Summarize sediment toxicity testing results from four recently investigated wood treating sites
  - Pond in New England
  - Wooded stream in the Southeast
  - Marsh streams in the mid-Atlantic
  - Stream running through disturbed habitat in the Gulf Coast
- Three of four sites have information on full triad
  - Today's focus
    - 10-day *Hyalella* mortality results across all four sites
    - New England pond benthic community results
- Look for PAH-related dose-response
  - Total PAH (mg/kg)
  - Organic carbon normalized PAH (OC-tPAH (mg/kg))
  - Toxic Units (Sum-TU)

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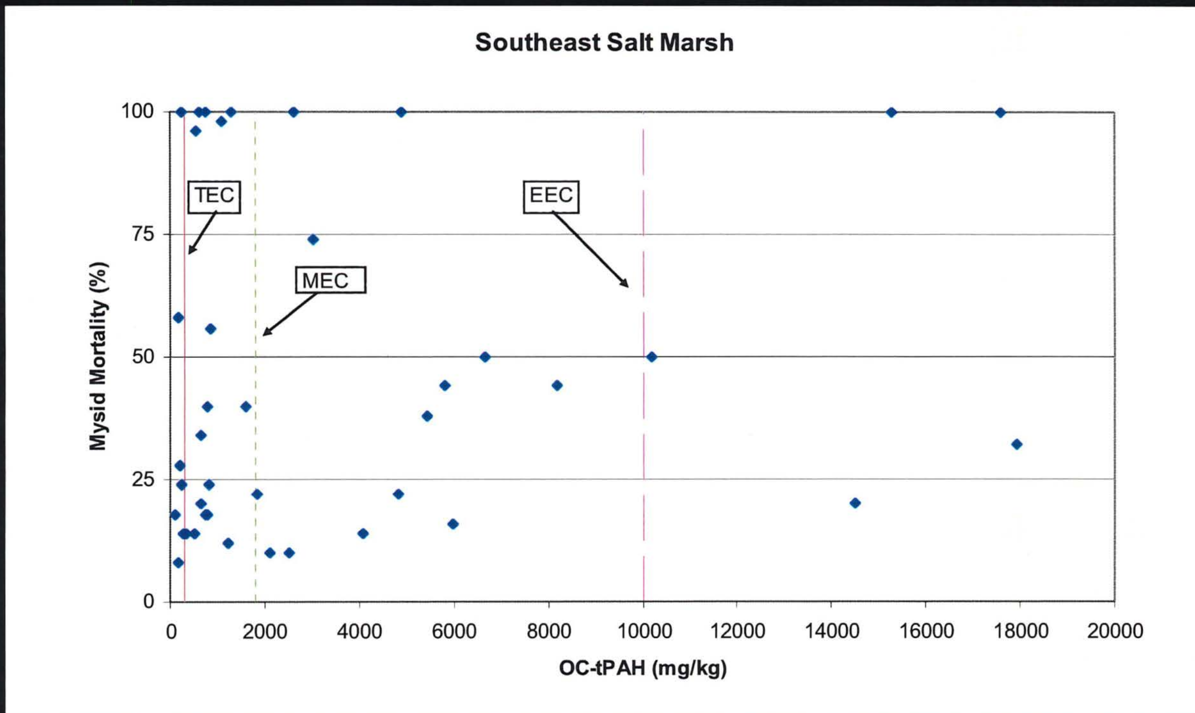
# A Bit of Historical Context




- Toxicity test data from urbanized waterways
- Four areas of focus
  - Low mortality at low PAH
  - High mortality at low PAH – other chemical co-occurrence?
  - High mortality at high PAH – PAH toxicity, but…
  - Low mortality at intermediate and high PAH

- Could it be that intermediate and high concentrations of creosote-derived PAH are much less toxic than expected?
- Results confounded by non wood-treating sources
- Look at sites where creosote-derived PAH are primary constituent of concern

# Summary of Select Key Site Characteristics

| Location | Sample Size | tPAH (mg/kg) | OC-tPAH (mg/kg) | Corrected Sum-TU |
|---|---|---|---|---|
| Mid-Atlantic stream | 13 | 3.2-5,890 | 212-525,857 | 1.2-3,126 |
| Southeast stream | 6 | 0.4-41 | 21-1,913 | 1.0-9.8 |
| New England pond | 5 | 0.2-144 | 17-8,471 | 2.0-65 |
| Gulf Coast stream | 5 | 0.5-25 | 104-3,524 | 0.7-18 |

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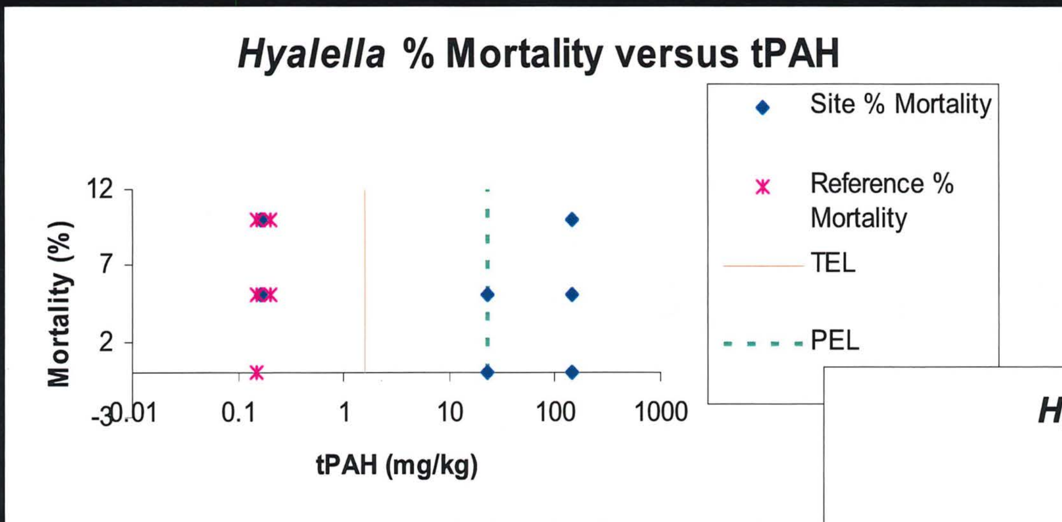
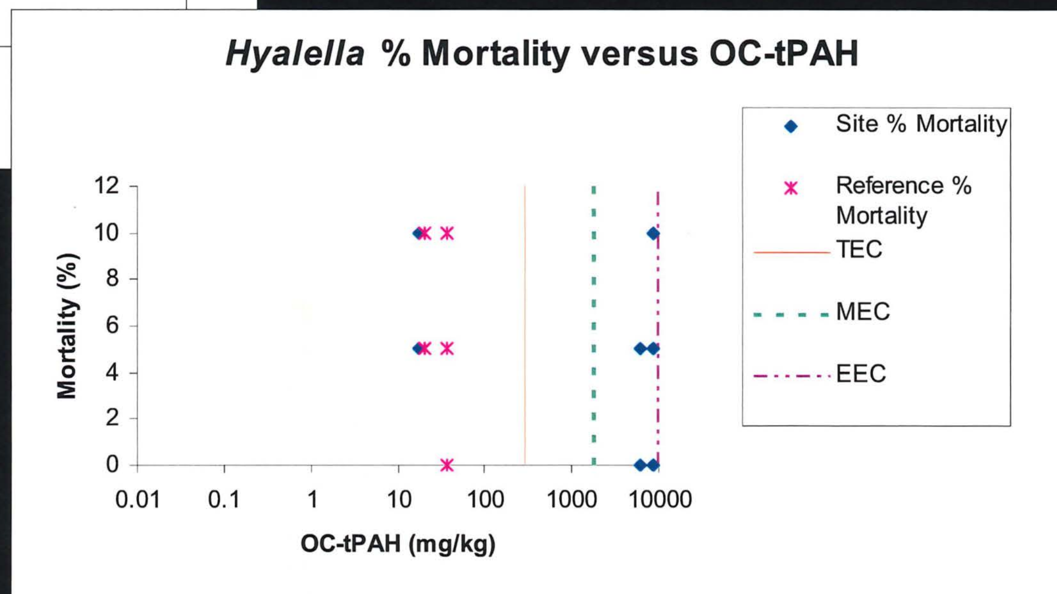
# Bioassay Results at Individual Sites: Example of New England Pond



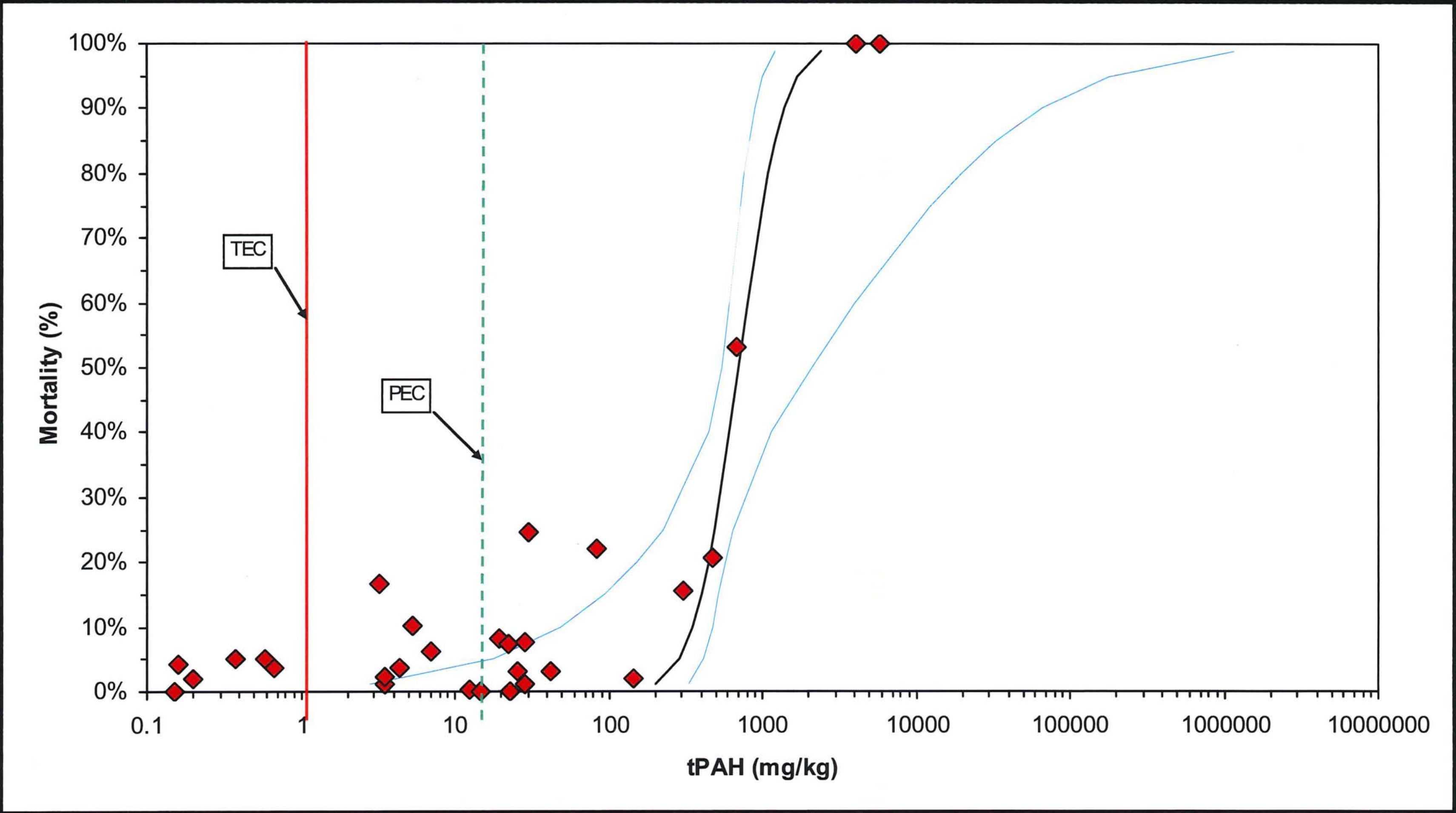




No significant difference in mortality between reference and site
(2 sample t-test, p = 0.8)

# Summary of Bioassay Results at Individual Sites

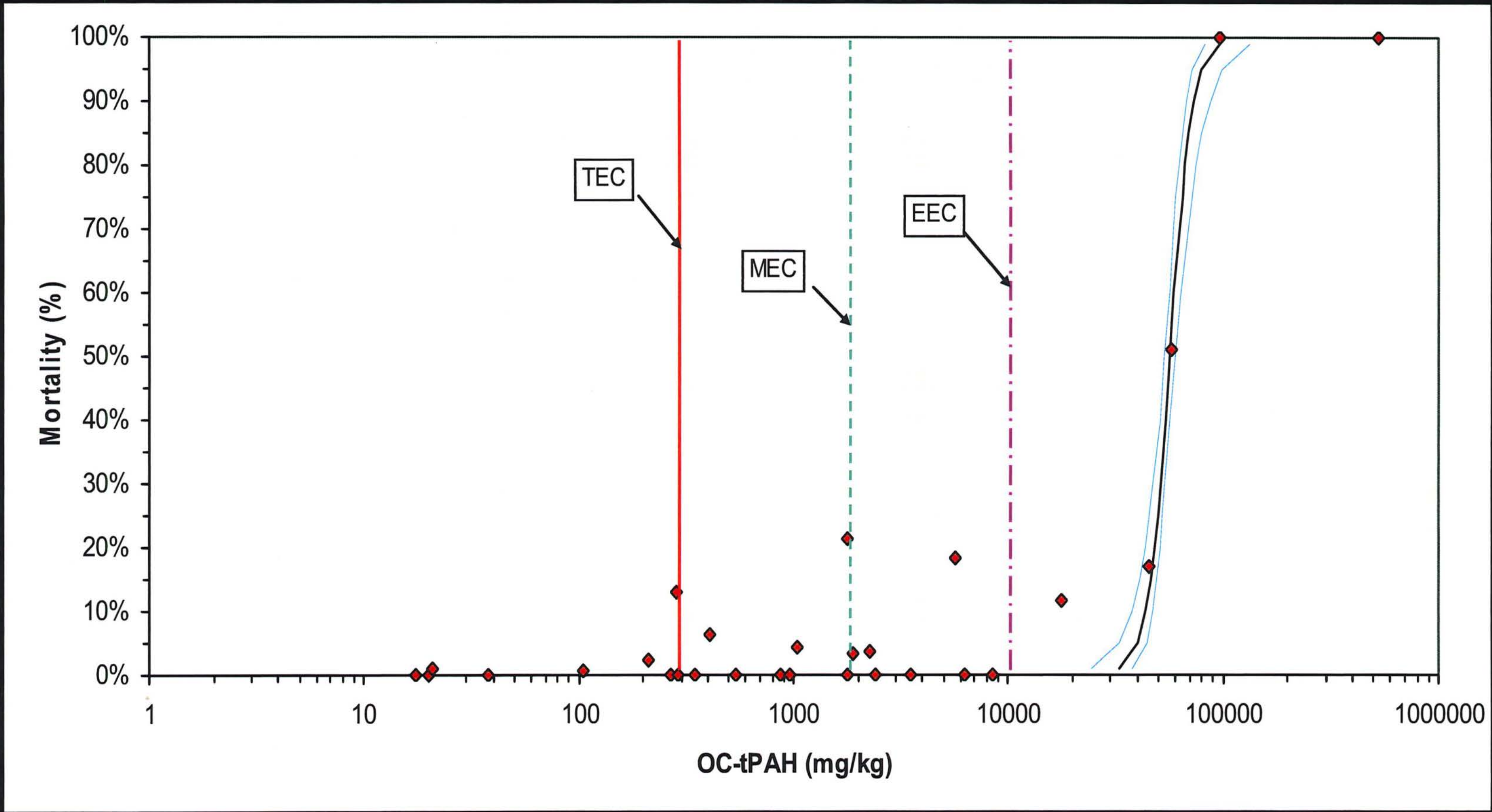
- At all sites, no significant difference in mortality between locations with tPAH<150 mg/kg and reference locations
- No significant relationship between growth and tPAH at 3 of 4 sites
  - Weak relationship at one site
- Relatively few sample locations
  - Five or six sample locations at three of four sites
- Limited statistical power
- Pool results from all four sites to improve statistical power

# *Hyalella* Mortality versus Total PAH (All Sites)



SETAC 2006

# *Hyalella* Mortality versus Organic Carbon Normalized Total PAH (All Sites)



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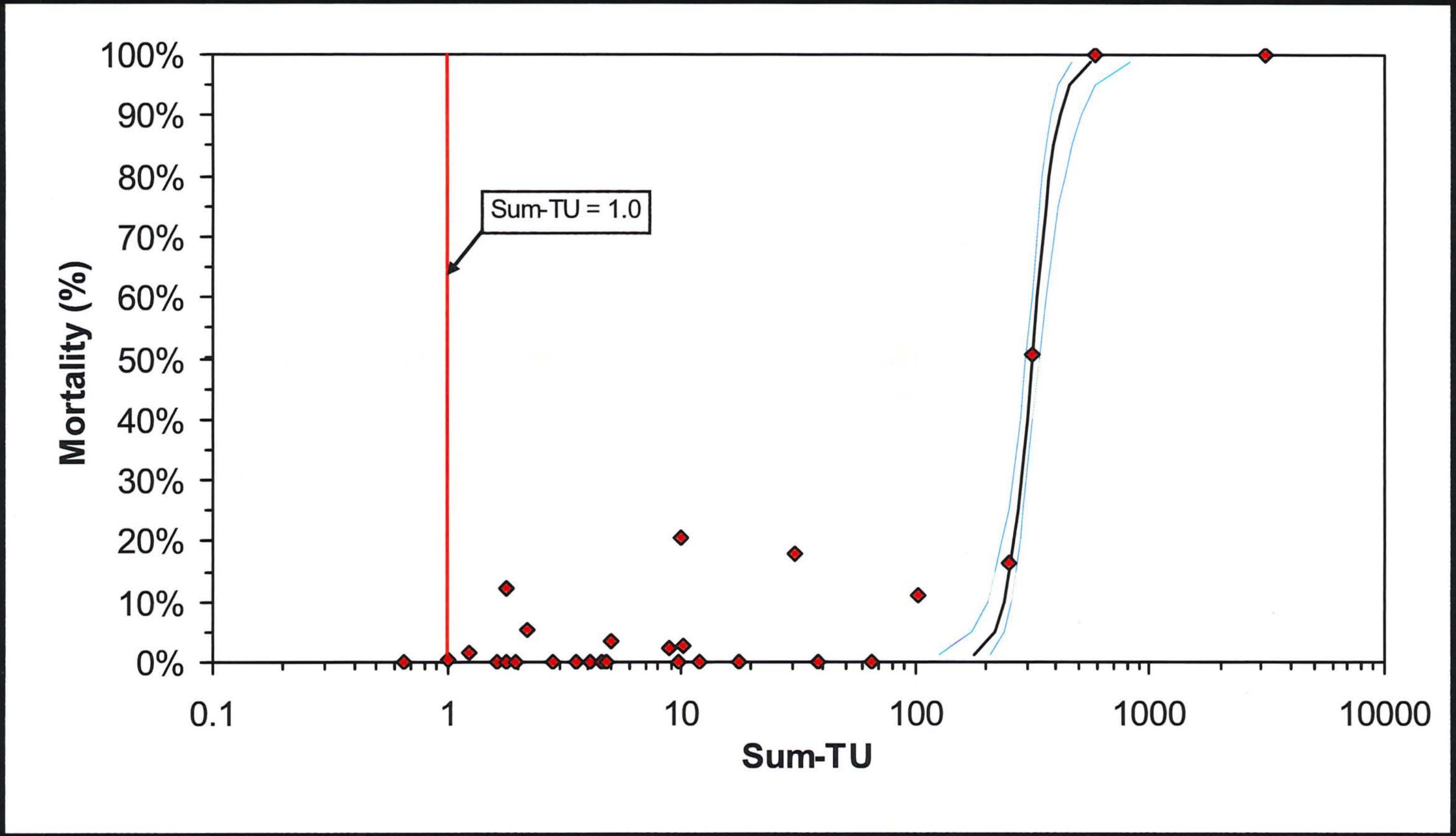
# *Hyalella* Mortality versus Corrected Sum-TU (All Sites)



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# Summary of Pooled *Hyalella* Mortality Findings

- No significant mortality well above typical Sediment Quality Guidelines (SQGs)
- From these studies, lowest potential SQGs for creosote-derived PAH:
  - 100 mg tPAH/kg
  - 10,000 mg OC - tPAH/kg
  - 100 corrected Sum-TU

| | *Hyalella* Mortality | |
|---|---|---|
| **PAH** | **$EC_{20}$ (95% CI)** | **$EC_{50}$ (95% CI)** |
| tPAH (mg/kg) | 447 (152-573) | 699 (546-2092) |
| OC-tPAH (mg/kg) | 47,971 (43,217-50964) | 56,483 (53,525-59,944) |
| Sum TU | 264 (236-281) | 314 (297-335) |
| | ***Chironomus* Mortality** | |
| **PAH** | **$EC_{20}$ (95% CI)** | **$EC_{50}$ (95% CI)** |
| tPAH (mg/kg) | 515 (338-578) | 602 (500-658) |
| OC-tPAH (mg/kg) | 48,927 (36,039-52,381) | 53,538 (46824-56081) |
| Sum TU | 533 (269-597) | 613 (459-662) |

- $EC_{20}$s/$EC_{50}$s from these studies are even higher
  - Based on limited data
  - Consistent with pyrogenic PAH literature
  - More data would increase confidence

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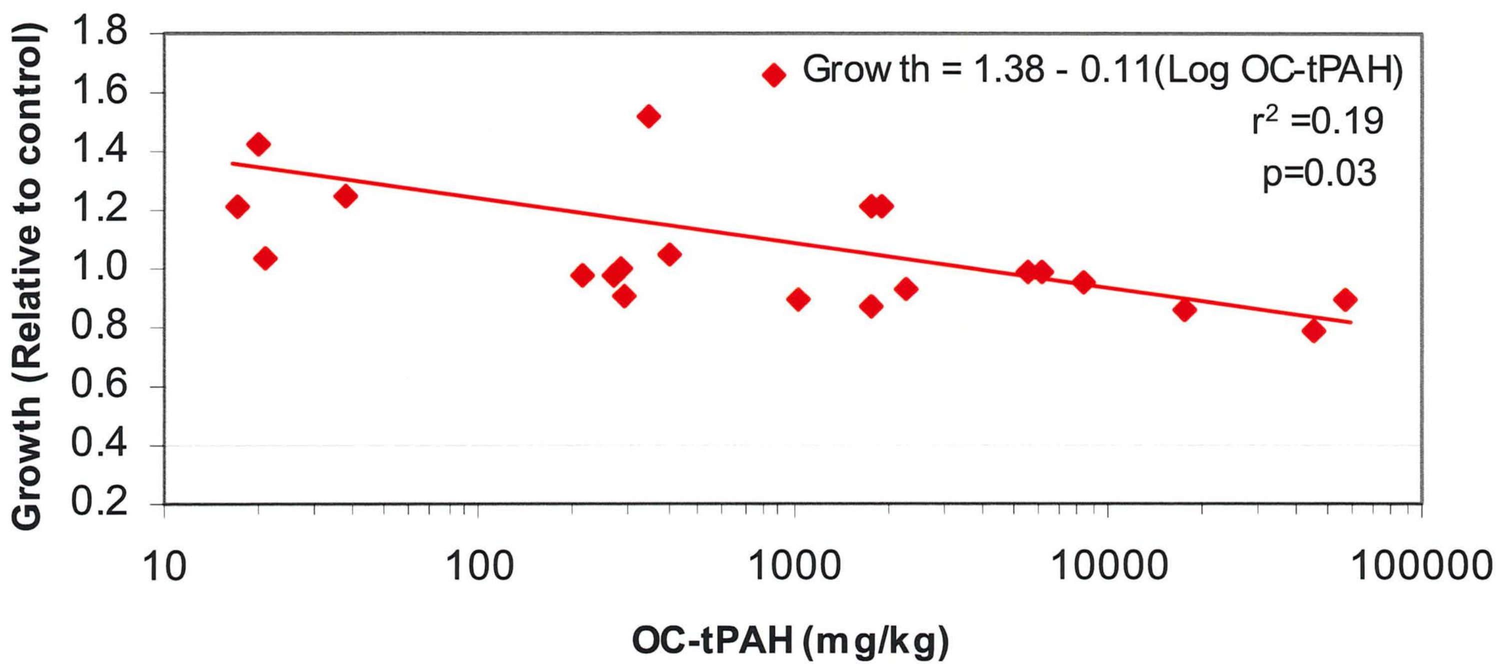
# What About Other Endpoints?

- *Chironomus* mortality findings very similar
  - Lack of significant mortality at similar concentrations to *Hyalella* studies
  - $EC_{20}$s and $EC_{50}$s similar to *Hyalella* studies
- *Hyalella* growth
  - No statistically significant differences between site and reference locations
  - Weak relationship at PAH concentrations that did not cause significant mortality
  - Limited to concentration range at which *Hyalella* survive
  - Requires normalizing for differences in initial weight in different experiments
  - Concentrations far above typical SQGs needed to produce 20% growth reduction

# *Hyalella* Growth versus Organic Carbon Normalized PAH



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# Benthic Macroinvertebrate Community: New England Pond as an Example

- Calculated 10 invertebrate community metrics
- Compared site to reference sample locations
- Examined relationship between PAH and each metric
- Similar approach and findings at other two sites with benthic community data
- In general, *in situ* benthic community appears less sensitive than organisms in bioassays

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# New England Benthic Invertebrate Community Results: Comparison of Site to Reference

| Metric | p value |
|---|---|
| Estimated Abundance | 0.4 |
| Total No. of Taxa | 1.0 |
| No. of ETO Taxa | 0.8 |
| % ETO Taxa | 0.2 |
| % Oligochaetes | 0.4 |
| % Dominant Taxa | 0.8 |
| % Crustaceans & Molluscs | *0.02** |
| HBI | *0.008** |
| % Suspension Feeders | 0.7 |
| % Grazers & Scrapers | 0.06 |
| BMI | 0.4 |

* Indicates significant difference

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# New England Benthic Invertebrate Community Results: Regression of Metrics versus PAH

- 7 of 8 endpoints: no significant relationship
  - Regardless how PAH concentration expressed
- % grazers and scrapers only endpoint with significant relationship
- Other sites have fewer significant effects
- Overall, *in situ* benthic community not affected

| | | p value | |
|---|---|---|---|
| **Metric** | **tPAH** | **log OC-tPAH** | **Corrected Sum-TU** |
| Abundance | 0.8 | 0.4 | 0.4 |
| Total # Taxa | 0.8 | 0.3 | 0.3 |
| % Dominant Taxa | 0.3 | 1 | 0.6 |
| % Oligochaetes | 0.9 | 0.8 | 0.7 |
| HBI | 0.2 | 0.5 | 0.7 |
| % ETO Taxa | 0.6 | 0.9 | 0.7 |
| % Suspension Feeders | 0.2 | 0.3 | 0.5 |
| % Grazers & Scrapers | 0.3 | ***0.02**** | ***0.01**** |

* Indicates significant relationship

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# Why the Absence of Toxicity at Concentrations Well Above Typical Screening Benchmarks?

- Benchmarks not applicable to creosote-derived PAH in sediments
  - Co-occurring chemicals may be driving benchmarks
  - PAH at sites used to derive benchmarks have other (non creosote-derived – e.g., petrogenic) sources
    - Relative contribution of parent PAH
    - Proportion of parent to substituted PAH
- Sum–TU over-predicts toxicity
  - PAH at wood-treating sites have reduced bioavailability
    - Predominated by historical releases – aging reduces bioavailability
  - Sum-TU uses theoretical water-carbon partition coefficients
  - Field-derived partition coefficients at pyrogenic PAH sites may be 1-2 orders of magnitude higher (work of S. Hawthorne)
  - May explain why Sum-TU needs to exceed 100 for response

amec

# Conclusions

- Toxicity data from four sites
- Creosote-derived PAH primary chemical stressor
- Substantial toxicity expected, based upon typical sediment benchmarks and guidelines … *but not observed*
- Site-specific data suggest much higher PAH concentrations could be used as SQGs
  - 100 mg tPAH/kg
  - 10,000 mg tPAH/kg OC
  - 100 corrected Sum-TU
- No significant toxicity observed at these concentrations
- Actual allowable concentrations may be even higher
  - Currently, limited data at concentrations above 150 mg/kg tPAH
- *In situ* invertebrate community less sensitive than laboratory bioassay organisms

# Appendix H

## Ecological Data from Previous Reports

# TABLE 6-5

## Supplemental Surface Water and Streambed Sediment Investigation Report
## Koppers Industries, Inc. Facility
## Superior, Wisconsin

### Macroinvertebrate Survey Results - Dredge Samples

| | Reference Location | | | | | Location 1 | | | | | Location 2 | | | | | Location 3 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAXON | R-A | R-B | R-C | R-D | R-E | 1-A | 1-B | 1-C | 1-D | 1-E | 2-A | 2-B | 2-C | 2-D | 2-E | 3-A | 3-B | 3-C | 3-D | 3-E |
| INSECTA | | | | | | | | | | | | | | | | | | | | |
| DIPTERA | | | | | | | | | | | | | | | | | | | | |
| CHIRONOMIDAE | | | | | | | | | | | | | | | | | | | | |
| Cryptochironomus | | | 2 | | | | | | | | | | | | | | | | | |
| Cryptotendipes | | | | | | | | 1 | | | | | | | | | 1 | | 1 | |
| Dicrotendipes modestus | | 4 | | 1 | | | | | | | | | | 1 | | | | | 1 | 1 |
| Dicrotendipes neomodestus | | | | | | | | | | | | | 2 | 1 | | | | | | |
| Dicrotendipes nervosus | | 2 | | | | | 2 | | | | 1 | 3 | 4 | 3 | 1 | | | | | |
| Einfeldia species group D | | 1 | | | | | | | | | | | | | | | | | | |
| Endochironomus subtendens group | 1 | | | | | | | | | | | | | | | | | | | |
| Glyptotendipes species group A | | 1 | | | | | | | | | | | | | | | | | | |
| Harnischia curtilamellata | | | | | | | | | | | | | | | | | 1 | | | |
| Paratendipes | | | | | | | | | | | | | | | | 1 | 1 | | | |
| Phaenopsectra punctipes group | | 1 | | | | | | | | | | | | | | 1 | | | | |
| Polypedilum halterale group | | 1 | 3 | 1 | | | | | | | | | | | | | | | | 1 |
| Polypedilum tritum group | | | | | | | | | | | | | | 1 | | | | | | |
| Tribelos jucundum | | 1 | 1 | | | | | | | | | | | | | | | | | |
| TOTAL CHIRONOMINI | 1 | 11 | 6 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 3 | 6 | 6 | 1 | 2 | 3 | 0 | 2 | 2 |
| Paratanytarsus | | 1 | | | | | | | | | 1 | | 1 | 1 | | | | | | |
| Tanytarsus | | | | | | | | | 1 | | | | | | | | | | | |
| TOTAL TANYTARSINI | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL CHIRONOMINAE | 1 | 12 | 6 | 2 | 0 | 0 | 2 | 1 | 1 | 0 | 2 | 3 | 7 | 7 | 1 | 2 | 3 | 0 | 2 | 2 |
| Nanocladius balticus group | 1 | | | | | | | | | | | | | | | | | | | |
| TOTAL ORTHOCLADIINAE | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ablabesmyia mallochi | | | | | | | | | | | | | 1 | 1 | | | | | | |
| Ablabesmyia monilis | | 1 | | | | | | | | | | | 1 | 1 | | | | | | |
| Conchapelopia | | | | | | | | | | | | | 1 | | | | | | | |
| Procladius | 2 | 9 | | 1 | 1 | 3 | | | | | | 1 | | | | 1 | | | | 1 |
| TOTAL TANYPODINAE | 2 | 10 | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 1 |
| TOTAL CHIRONOMIDAE | 4 | 22 | 6 | 3 | 1 | 3 | 2 | 1 | 1 | 0 | 2 | 4 | 10 | 9 | 1 | 3 | 3 | 0 | 2 | 3 |
| TRICHOPTERA | | | | | | | | | | | | | | | | | | | | |
| DIPSEUDOPSIDAE | | | | | | | | | | | | | | | | | | | | |
| Phylocentropus sp. | | 2 | 1 | | | | | | | | | | | | | | | | | |
| COLEOPTERA | | | | | | | | | | | | | | | | | | | | |
| ELMIDAE | | | | | | | | | | | | | | | | | | | | |
| Dubiraphia (larva) | | 1 | | | | | | | | | | | | | | | | | | |
| Aquatic mites | | | | | | | | | | | | | | | 3 | | | | | |
| MOLLUSCA | | | | | | | | | | | | | | | | | | | | |
| BIVALVIA | | | | | | | | | | | | | | | | | | | | |
| Musculium/Sphaerium | | | | | | | 1 | | | | | | | | | | | | | |
| Sphaerium simile/striatinum | | | | | | | 1 | | 1 | | | | | | | | | | | |
| Pisidium sp. | | | | | | | 1 | | 1 | | | | | | | | | | | |
| TOTAL BIVALVIA | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GASTROPODA | | | | | | | | | | | | | | | | | | | | |
| Physa/Physella | | | | | | 1 | | | | | 6 | 7 | 7 | 11 | 7 | 3 | | 1 | | |
| TOTAL GASTROPODA | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 6 | 7 | 7 | 11 | 7 | 3 | 0 | 1 | 0 | 0 |
| ANNELIDA | | | | | | | | | | | | | | | | | | | | |
| OLIGOCHAETA | | | | | | | | | | | | | | | | | | | | |
| immature Tubificidae without hairs | 7 | 6 | 8 | 5 | 2 | 2 | 13 | 4 | 3 | 1 | | | | | | | | | | |
| Aulodrilus pigueti | | | 1 | | | | | | | | | | | | | | | | | |
| Limnodrilus hoffmeisteri | | 2 | 2 | 1 | | 13 | 33 | 10 | 4 | 1 | | | | | | 1 | 1 | | | |
| Limnodrilus udekemianus | | | | | | | | | 1 | | | | | | | | | 1 | | |
| Eclipidrilus sp. | | | | | | | | | | | | | 1 | | | | | | | |
| Megadrili | | | | | | | | | | 2 | | | | | | 1 | | | | |
| TOTAL OLIGOCHAETA | 7 | 8 | 11 | 6 | 2 | 15 | 46 | 14 | 8 | 4 | 0 | 0 | 1 | 0 | 0 | 2 | 1 | 1 | 0 | 0 |
| TAXA RICHNESS | 4 | 14 | 7 | 5 | 2 | 4 | 6 | 3 | 6 | 3 | 3 | 3 | 8 | 8 | 3 | 6 | 4 | 2 | 2 | 3 |

Notes:

1) A total of five dredge samples were collected from each location by BBL in July 1999.
2) Taxonomic identification was conducted by the Lake Superior Research Institute.

## TABLE 6-6

### Supplemental Surface Water and Streambed Sediment Investigation Report
### Koppers Industries, Inc. Facility
### Superior, Wisconsin

### Macroinvertebrate Survey Results - Sweepnet Samples

| TAXON | Locations 1 | 2 | 3 | Ref. |
|---|---|---|---|---|
| INSECTA | | | | |
| DIPTERA | | | | |
| CHIRONOMIDAE | | | | |
| Cryptochironomus | | | | 1 |
| Endochironomus subtendens group | | 1 | | |
| Phaenopsectra punctipes group | | 2 | | |
| Polypedilum halterale group | | | | |
| Polypedilum illinoense group | | 10 | | 1 |
| TOTAL CHIRONOMINI | 0 | 13 | 0 | 2 |
| TOTAL CHIRONOMINAE | 0 | 13 | 0 | 2 |
| Procladius | | 2 | | 1 |
| TOTAL TANYPODINAE | 0 | 2 | 0 | 1 |
| TOTAL CHIRONOMIDAE | 0 | 15 | 0 | 3 |
| | | | | |
| COLEOPTERA | | | | |
| ELMIDAE | | | | |
| Dubiraphia (larva) | | | | |
| CURCULIONIDAE (terrestrial ?) | | 2 | | |
| DYTISCIDAE | | | | |
| Coptotomus (larvae) | | | 1 | |
| Hygrotus sayi (adult) | | | 4 | |
| Ilybius pleuriticus (adult) | | | 1 | |
| Laccophilus (larva) | | | 1 | |
| Neoporus undulatus (adult) | | | 2 | |
| HALIPLIDAE | | | | |
| Haliplus immaculicollis | 8 | 1 | 10 | 1 |
| Haliplus longulus | | | 1 | |
| TOTAL COLEOPTERA | 8 | 3 | 20 | 1 |
| | | | | |
| ODONATA | | | | |
| AESHNIDAE | | | | |
| Aeshna (too small) | 4 | 1 | 4 | 1 |
| Aeshna tuberculifera | 1 | | | 2 |
| CORDULIIDAE | | | | |
| Epitheca canis | 1 | | | |
| LIBELLULIDAE | | | | |
| Perithemis tenera | | 4 | 1 | |
| Sympetrum obtrusum | | | 1 | |
| LESTIDAE | | | | |
| Lestes unguiculatus | 1 | | | |
| TOTAL ODONATA | 7 | 5 | 6 | 3 |
| | | | | |
| CRUSTACEA | | | | |
| AMPHIPODA | | | | |
| Hyalella azteca | 14 | 3 | | 10 |
| DECAPODA (too small) | | | | 1 |

| TAXON | Locations 1 | 2 | 3 | Ref. |
|---|---|---|---|---|
| HETEROPTERA | | | | |
| CORIXIDAE | | | | |
| Sigara grossolineata | | | | 1 |
| Sigara knighti | | | | 1 |
| corixid nymphs | | 2 | | 5 |
| GERRIDAE | | | | |
| Gerris insperatus | | | | 1 |
| Limnoporus dissortis | | | 1 | |
| gerrid nymphs | | | | 5 |
| NOTONECTIDAE | | | | |
| Notonecta (nymphs) | 4 | | | |
| PLEIDAE | | | | |
| Neoplea striola | | | 1 | |
| TOTAL HETEROPTERA | 4 | 2 | 2 | 13 |
| | | | | |
| EPHEMEROPTERA | | | | |
| BAETIDAE | | | | |
| Procloeon sp. | 1 | | | 3 |
| CAENIDAE | | | | |
| Caenis latipennis | | | | 1 |
| | | | | |
| Aquatic mites | | | | 1 |
| spiders | | 1 | 1 | 1 |
| | | | | |
| MOLLUSCA | | | | |
| BIVALVIA | | | | |
| Musculium/Sphaerium | 2 | | | |
| Pisidium sp. | 2 | | | 4 |
| TOTAL BIVALVIA | 4 | 0 | 0 | 4 |
| GASTROPODA | | | | |
| Ferrissia sp. | | 1 | | |
| Fossaria sp. | | | 1 | |
| Gyraulus sp. | 2 | 8 | 2 | 8 |
| Helisoma sp. | 1 | 2 | | 1 |
| Physa/Physella | 63 | 75 | 243 | 7 |
| Lymnaeidae (terrestrial ?) | 1 | | | |
| TOTAL GASTROPODA | 67 | 86 | 246 | 16 |
| | | | | |
| ANNELIDA | | | | |
| OLIGOCHAETA | | | | |
| Limnodrilus hoffmeisteri | | 1 | | |
| Megadrili | 1 | | | |
| TOTAL OLIGOCHAETA | 1 | 1 | 0 | 0 |
| HIRUDINOIDEA (leeches) | | | | |
| Glossiphonia complanata | | 1 | | |
| | | | | |
| TAXA RICHNESS | 15 | 17 | 16 | 21 |

Notes:

1) One sweepnet sample was collected from each location by BBL in July 1999.
2) Taxonomic identification was conducted by the Lake Superior Institute.

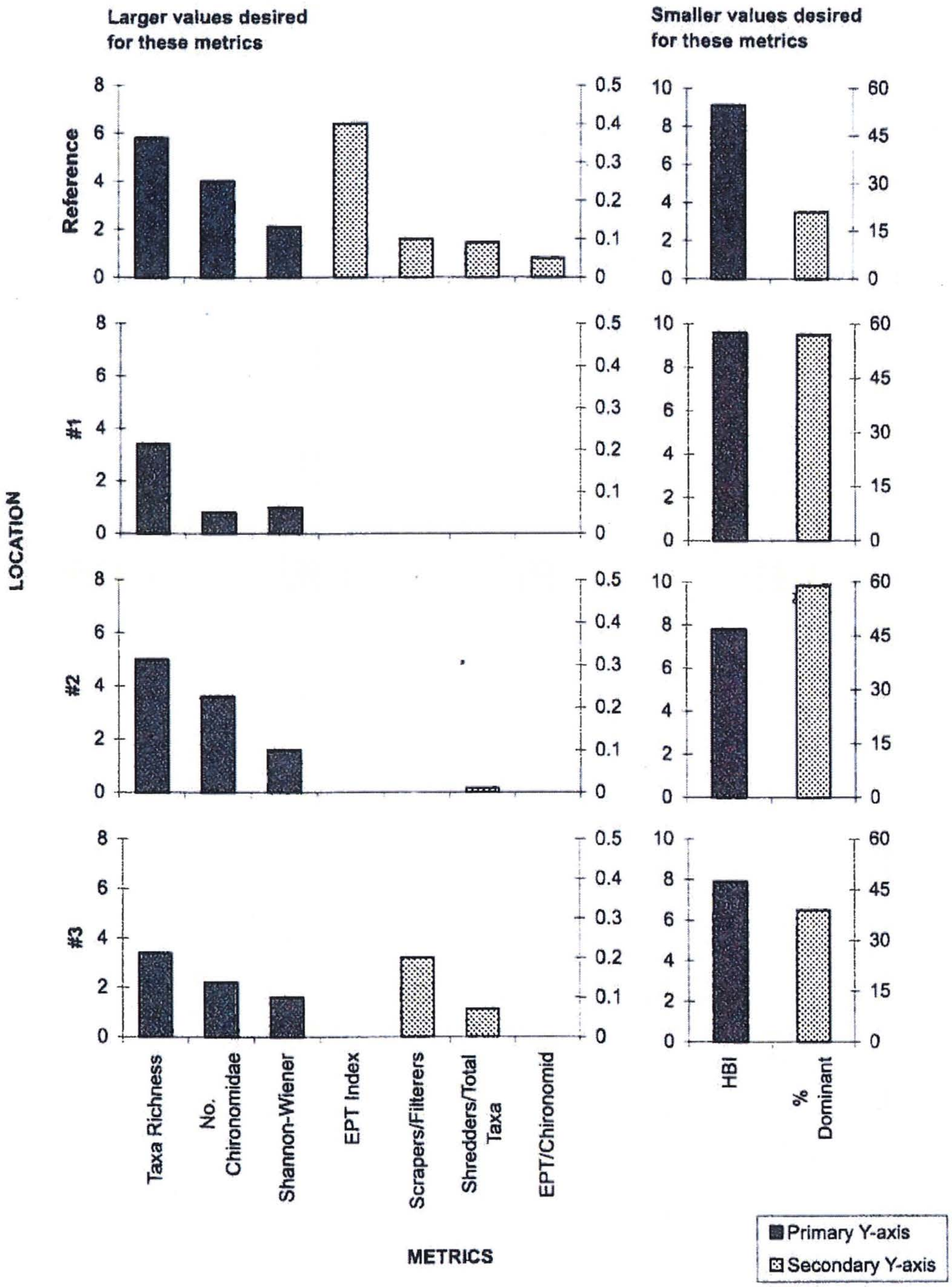
**TABLE 6-7**

**Supplemental Surface Water and Streambed Sediment Investigation Report**
**Koppers Industries, Inc. Facility**
**Superior, Wisconsin**

**Macroinvertebrate Survey Results - Hester-Dendy Samples**

| | Reference Location | | | | | Location 1 | | | | | Location 2 | | | | | Location 3 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAXON | R-A | R-B | R-C | R-D | R-E | 1-A | 1-B | 1-C | 1-D | 1-E | 2-A | 2-B | 2-C | 2-D | 2-E | 3-A | 3-B | 3-C | 3-D | 3-E |
| INSECTA | | | | | | | | | | | | | | | | | | | | |
| DIPTERA | | | | | | | | | | | | | | | | | | | | |
| CHIRONOMIDAE | | | | | | | | | | | | | | | | | | | | |
| Chironomini (too small) | 21 | 13 | 14 | 10 | 17 | 11 | 8 | 10 | 8 | 6 | 3 | 1 | 6 | 3 | 4 | 4 | 2 | 10 | 7 | 14 |
| Chironomus | 3 | 3 | 1 | 2 | | | 2 | 1 | | 1 | | 1 | | 1 | 1 | 2 | | | 2 | |
| Cryptochironomus | | | | | | | | | | | | | | | | | | 1 | | 1 |
| Dicrotendipes modestus | 2 | 4 | 6 | 6 | 3 | 2 | 6 | 7 | | 3 | 2 | 1 | 13 | 3 | 3 | 6 | 6 | 3 | 14 | 10 |
| Dicrotendipes neomodestus | | 2 | 2 | | 1 | 2 | 2 | 1 | 1 | 4 | 1 | | 3 | 2 | 1 | 2 | 1 | 2 | 2 | 6 |
| Dicrotendipes nervosus | 4 | 4 | 5 | 12 | 7 | 3 | 3 | 3 | 1 | 2 | 1 | 5 | 6 | 4 | 10 | 14 | 3 | 15 | 13 | 7 |
| Dicrotendipes simpsoni | | | | | | | | | | | | | 1 | | | | | | | |
| Endochironomus subtendens group | | | 1 | | | | | | | | | | | | | | | | | |
| Glyptotendipes species group A | | | 1 | 1 | | | | | 1 | | | | | | 1 | | | 1 | | |
| Kiefferulus | | | | | 1 | | | | | | | | | | | | | | | |
| Microtendipes pedellus group | 1 | 2 | | 1 | 2 | | | 3 | 2 | 3 | 3 | 7 | 5 | 3 | 3 | | 1 | 1 | 2 | |
| Nilothauma | | | | | | | | 1 | | | | | | | | | | | | |
| Parachironomus arcuatus group | 1 | | 1 | 1 | 1 | 1 | 1 | | | 1 | | | | 1 | | | 2 | | 3 | 3 |
| Paratendipes | 1 | | | | 1 | | | 1 | | | | | | | | 1 | | | 1 | |
| Phaenopsectra obediens group | 2 | 4 | 1 | 1 | 2 | | 2 | | 2 | | | | 1 | | | 1 | 1 | | | |
| Phaenopsectra punctipes group | | 1 | | | | 2 | | | | | 1 | | | | | | 2 | 1 | 3 | |
| Polypedilum fallax group | 1 | | | | | | | | | 1 | 1 | | | | | | | 1 | 1 | 1 |
| Polypedilum halterale group | | | | | | | 1 | | | | | | | | | | | | | |
| Polypedilum illinoense group | 7 | 13 | 8 | 6 | 6 | 17 | 19 | 8 | 10 | 7 | 18 | 21 | 15 | 17 | 13 | 26 | 23 | 20 | 12 | 12 |
| Tribelos jucundum | | | | | | | 1 | | 1 | 1 | | | | | | | | | 2 | |
| TOTAL CHIRONOMINI | 43 | 46 | 40 | 40 | 41 | 38 | 45 | 35 | 26 | 29 | 30 | 36 | 50 | 34 | 36 | 56 | 41 | 55 | 62 | 54 |
| Cladotanytarsus | | | | | | | | | | | | | 1 | | | | | | | |
| Paratanytarsus | 5 | 6 | 7 | 3 | 11 | 8 | 9 | 9 | 7 | 7 | 15 | 11 | 7 | 21 | 19 | 5 | 4 | 6 | 12 | 5 |
| Rheotanytarsus | | | | | | | | | | | | | | | | | 1 | | | |
| Tanytarsus | 2 | 1 | 3 | 4 | 5 | 3 | 5 | 1 | 5 | 1 | 7 | 4 | 1 | 5 | 2 | 3 | 3 | 3 | 3 | 7 |
| TOTAL TANYTARSINI | 7 | 7 | 10 | 7 | 16 | 11 | 14 | 10 | 12 | 8 | 22 | 15 | 9 | 26 | 21 | 8 | 8 | 9 | 15 | 12 |
| TOTAL CHIRONOMINAE | 50 | 53 | 50 | 47 | 57 | 49 | 59 | 45 | 38 | 37 | 52 | 51 | 59 | 60 | 57 | 64 | 49 | 64 | 77 | 66 |
| Orthocladiinae (too small) | 2 | 3 | 3 | 2 | 3 | | | | 2 | | 2 | 1 | 2 | 1 | 1 | | 2 | 1 | 2 | 2 |
| Corynoneua | 6 | 5 | 9 | 12 | 9 | 11 | 6 | 11 | 5 | 14 | 12 | 7 | 6 | 9 | 2 | 5 | 5 | 3 | 5 | 3 |
| Cricotopus/Orthocladius | | 1 | | | 1 | | | | | | 7 | | | 2 | 1 | 1 | 3 | | 1 | 3 |
| Cricotopus bicinctus group | | | | | | | 1 | | | | 5 | 2 | 1 | 1 | 2 | 1 | 3 | 1 | 3 | |
| Diplocladius cultriger | | 1 | | | | | 1 | | | | | | | | | | | | | |
| Limnophyes | | | | | | | | | | | | | 1 | | | | | | | |
| Nanocladius parvulus group | | | | | | 2 | | 1 | 1 | 2 | | | 1 | 6 | 1 | 2 | 1 | | 3 | 3 |
| Parakiefferiella | | | | | | | | | | | | | | | | | | | 1 | |
| Parametriocnemus | | 2 | | 1 | 2 | 1 | 2 | 3 | 2 | | 3 | 1 | 1 | 1 | | | 1 | 2 | 3 | 3 |
| Thienemanniella | | | 1 | | | | | | | | 7 | 2 | 1 | 6 | 3 | | | | | |
| TOTAL ORTHOCLADIINAE | 8 | 12 | 13 | 15 | 15 | 14 | 10 | 15 | 10 | 16 | 36 | 13 | 13 | 26 | 10 | 9 | 15 | 7 | 18 | 14 |
| Tanypodinae (too small, damaged) | 1 | 1 | 4 | 3 | 1 | 4 | 4 | 1 | 7 | 3 | | 1 | 2 | | | 4 | 11 | 3 | 2 | 2 |
| Ablabesmyia mallochi | | 1 | | | | 1 | | | | | | | | | | | | 2 | | |
| Ablabesmyia monilis | 3 | 4 | 1 | 1 | | 1 | 3 | 1 | 4 | 4 | | 1 | | | 2 | 1 | 4 | 3 | | |
| Conchapelopia/Helopelopia | | | | | | | | | | | | | | | | | 1 | | | |
| Labrundinia pilosella | | | 1 | | 1 | 1 | | 1 | 1 | 1 | | | | | | 1 | 2 | | | |
| Meropelopia/Thienemanniymia | | | | | | | | | 1 | | | 1 | 2 | | 2 | | 1 | 1 | | |
| Paramerina | | 1 | | | | 1 | | 1 | | | | | | | | | | 1 | | |
| Procladius | 1 | 1 | | | 3 | 2 | 1 | 3 | 1 | | | | | | | | | | | |
| Zavrelimyia | | | 1 | | | 2 | 1 | | 1 | 2 | | | | | | | | | | |
| TOTAL TANYPODINAE | 5 | 8 | 7 | 4 | 5 | 12 | 9 | 7 | 15 | 10 | 0 | 3 | 4 | 0 | 4 | 6 | 19 | 10 | 2 | 2 |
| TOTAL CHIRONOMIDAE | 63 | 73 | 70 | 66 | 77 | 75 | 78 | 67 | 63 | 63 | 88 | 67 | 76 | 86 | 71 | 79 | 83 | 81 | 97 | 82 |
| OTHER DIPTERA | | | | | | | | | | | | | | | | | | | | |
| CERATOPOGONIDAE | | | | | | | | | | | | | | | | | | | | |
| Culicoides | | 1 | | | | 1 | | | | | | | 1 | | | 1 | | | | |
| EMPIDIDAE | | | | | | | | | | | | | | | | | | | | |
| Hemerodromia | | | | | | | | | | | | | | | | | 1 | | | |
| SIMULIIDAE | | | | | | | | | | | | | | | | | | | | |
| Simulium | | | | | | | | | | | | 1 | | 2 | 2 | | | | | |

See notes on page 2.



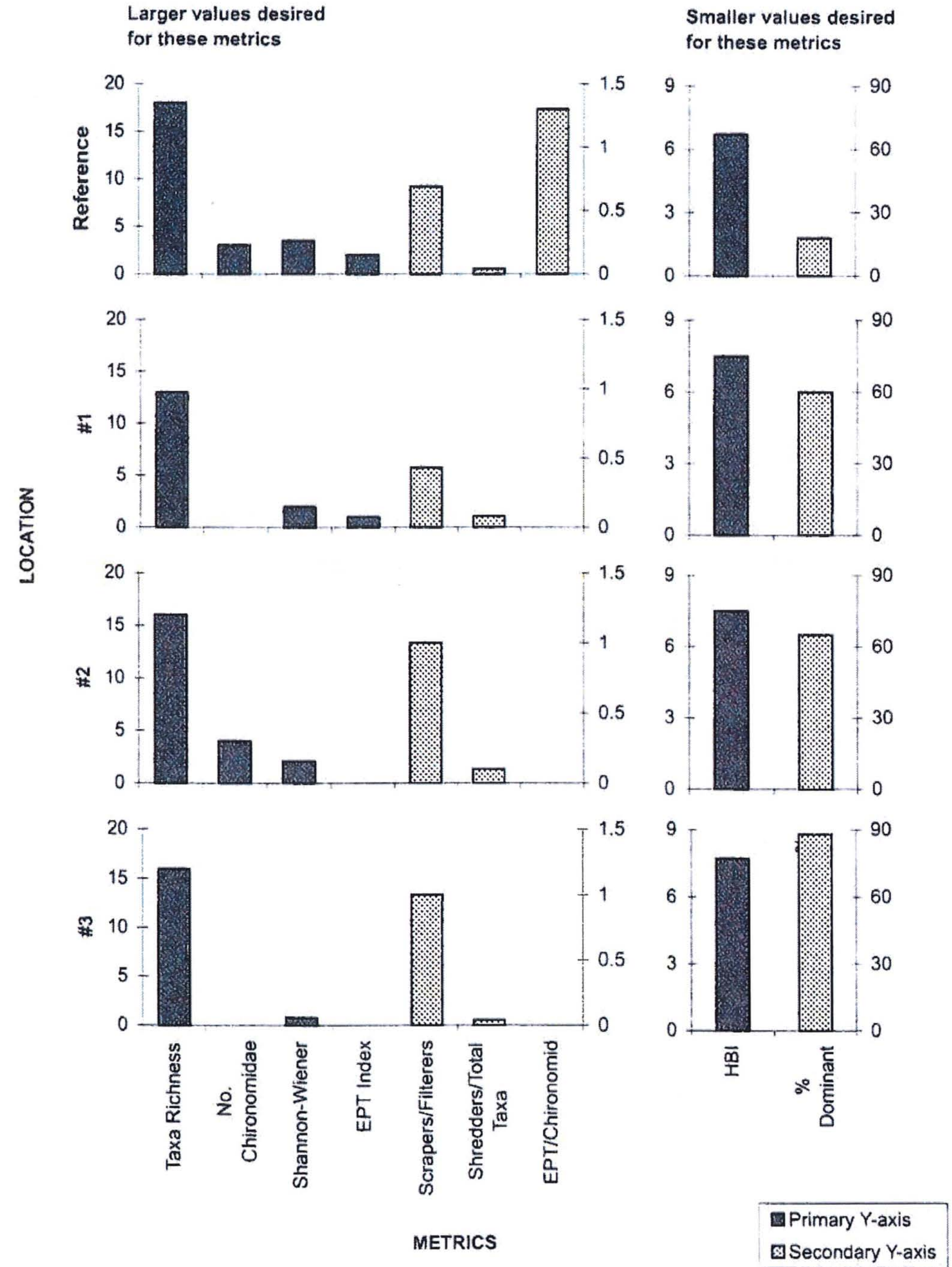

KOPPERS INDUSTRIES, INC. FACILITY
SUPERIOR, WISCONSIN
**SUPPLEMENTAL SURFACE WATER AND STREAMBED SEDIMENT INVESTIGATION REPORT**

## MACROINVERTEBRATE SURVEY RESULTS - DREDGE SAMPLES

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 6-2

08/00 SYR-D54-DJH LBR
38737002/38737g12.CDR



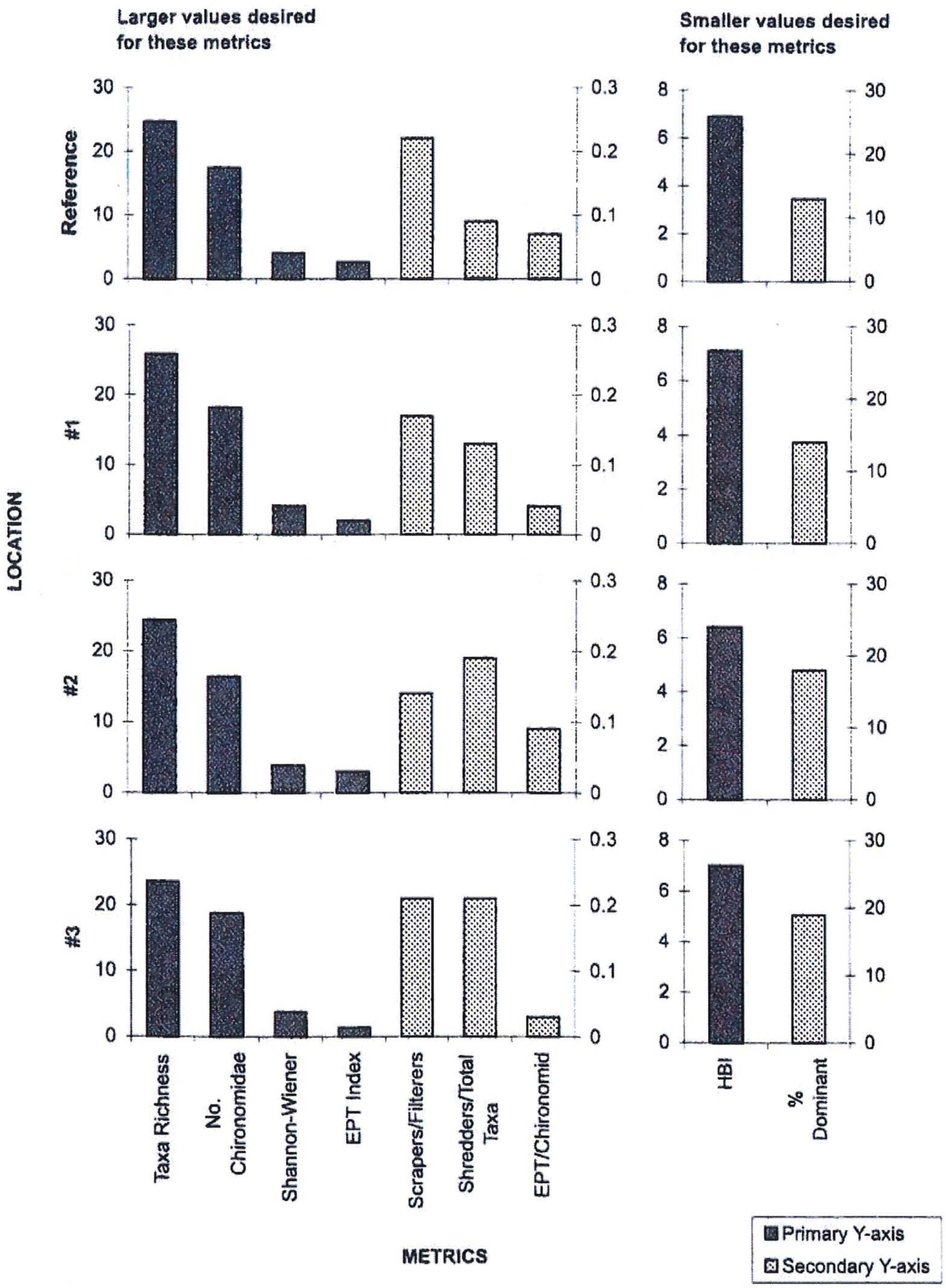

KOPPERS INDUSTRIES, INC. FACILITY
SUPERIOR, WISCONSIN
**SUPPLEMENTAL SURFACE WATER AND STREAMBED SEDIMENT INVESTIGATION REPORT**

## MACROINVERTEBRATE SURVEY RESULTS - SWEEPNET SAMPLES

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

**FIGURE 6-3**

06/00 SYR-D54-DJH LBR
38737002/38737g14.CDR




KOPPERS INDUSTRIES, INC. FACILITY
SUPERIOR, WISCONSIN
SUPPLEMENTAL SURFACE WATER AND STREAMBED SEDIMENT INVESTIGATION REPORT

## MACROINVERTEBRATE SURVEY RESULTS - HESTER-DENDY SAMPLES

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 6-4

08/00 SYR-D54-DJH LBR
38737002/38737g13.CDR

# Appendix I

## Ecological Risk Calculations

**Area 1**
**Ecological Risk Calculations**
**Using TRVs Based on NOAELs**

**Evaluation of Potential Risk to Little Brown Bat**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

Site: Superior, WI

Area: Off- Property Area

Receptor: Little Brown Bat

Pathway: Consumption of Invertebrates
Consumption of Surface Water

| Parameter | Value |
|---|---|
| Invert Ingestion Rate (kg/d): | 5.11E-03 |
| Total Dietary Intake (kg/d) | 5.11E-03 |
| Body Weight (kg) | 9.00E-03 |
| Invert Dry wt./wet wt. CF | 1.00E+00 |
| Water Ingestion Rate (L/d) | 1.43E-03 |
| Home range (ha) | 1.00E+01 |
| SUF | 5.00E-01 |
| AUF | 1.00E+00 |

| Constituent | TRV (mg/kg-d) | Mean Conc. In US SW (mg/L) | Mean Conc. in inverts (mg/kg) | Intake from water (mg/kg-d) | Intake from inverts (mg/kg-d) | TQ-water | TQ-inverts | TQ-Total |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 2.52E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 1.4E-03 | 1.4E-03 |
| Acenaphthylene | 2.52E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 1.4E-03 | 1.4E-03 |
| Anthracene | 1.44E+02 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-04 | 2.4E-04 |
| Benzo(a)anthracene | 1.44E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-02 | 2.4E-02 |
| Benzo(a)pyrene | 1.44E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-02 | 2.4E-02 |
| Benzo(b)fluoranthene | 1.44E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-02 | 2.4E-02 |
| Benzo(g,h,i)perylene | 1.44E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-02 | 2.4E-02 |
| Benzo(k)fluoranthene | 1.44E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-02 | 2.4E-02 |
| Chrysene | 1.44E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-02 | 2.4E-02 |
| Dibenzo(a,h)anthracene | 1.44E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-02 | 2.4E-02 |
| Fluoranthene | 1.80E+01 | 0.00E+00 | 2.30E-01 | 0.00E+00 | 6.53E-02 | 0.0E+00 | 3.6E-03 | 3.6E-03 |
| Fluorene | 1.80E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 1.9E-03 | 1.9E-03 |
| Indeno(1,2,3-cd)pyrene | 1.44E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-02 | 2.4E-02 |
| Naphthalene | 1.33E+02 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.6E-04 | 2.6E-04 |
| Phenanthrene | 1.08E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 3.2E-03 | 3.2E-03 |
| Pyrene | 1.08E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 3.2E-03 | 3.2E-03 |
| Pentachlorophenol | 7.98E+00 | 4.10E-04 | 0.00E+00 | 3.25E-05 | 0.00E+00 | 4.1E-06 | 0.0E+00 | 4.1E-06 |
| 2,3,7,8-TCDD TEQ (Mamm | 2.66E-06 | NA | 1.25E-06 | NA | 3.54E-07 | NA | 1.3E-01 | 1.3E-01 |
| | | | | | PAHs | 0.0E+00 | 2.0E-01 | 2.0E-01 |
| | | | | | Pentachlorphenol | 4.1E-06 | 0.0E+00 | 4.1E-06 |
| | | | | | TCDD TEQ | NA | 1.3E-01 | 1.3E-01 |

Notes:
See Table 3-10 for TRV sources
NA: compound was not analyzed for in this sample
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Belted Kingfisher**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Belted Kingfisher |
| Pathway: | Consumption of Invertebrates<br>Consumption of Fish<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Invert Ingestion Rate (kg/d): | 3.68E-02 |
| Fish Ingestion Rate (kg/d) | 3.68E-02 |
| Total Dietary Intake (kg/d) | 7.37E-02 |
| Water ingestion rate (L/day) | 1.10E-01 |
| Body Weight (kg) | 1.47E-01 |
| Fish Dry wt./wet wt. CF | 1.00E+00 |
| Sediment Dry wt./wet wt. CF | 6.50E-01 |
| Ins Dry wt./wet wt. CF | 1.00E+00 |
| Home range (km shoreline) | 1.16E+00 |
| AUF | 1.00E+00 |
| SUF | 5.00E-01 |

| Constituent | TRV (mg/kg-d) | Conc. in water (mg/L) | Conc. in benthic inverts (mg/kg) | Conc. in fish (mg/kg) | from water (mg/kg-d) | from benthic inverts (mg/kg-d) | Intake from fish (mg/kg-d) | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+00 | 0.00E+00 | 5.8E+00 | 2.9E+00 | 0.0E+00 | 7.3E-01 | 3.62E-01 | 0.0E+00 | 7.2E-01 | 3.6E-01 | **1.1E+00** |
| Acenaphthylene | 1.01E+00 | 0.00E+00 | 8.5E-02 | 7.8E-02 | 0.0E+00 | 1.1E-02 | 9.79E-03 | 0.0E+00 | 1.1E-02 | 9.7E-03 | 2.0E-02 |
| Anthracene | 1.11E+00 | 0.00E+00 | 1.0E+00 | 4.7E-01 | 0.0E+00 | 1.3E-01 | 5.83E-02 | 0.0E+00 | 1.1E-01 | 5.3E-02 | 1.7E-01 |
| Benzo(a)anthracene | 1.01E+00 | 0.00E+00 | 2.0E-01 | 1.1E-01 | 0.0E+00 | 2.5E-02 | 1.40E-02 | 0.0E+00 | 2.5E-02 | 1.4E-02 | 3.9E-02 |
| Benzo(a)pyrene | 1.01E+00 | 0.00E+00 | 1.1E-01 | 8.7E-02 | 0.0E+00 | 1.4E-02 | 1.08E-02 | 0.0E+00 | 1.4E-02 | 1.1E-02 | 2.4E-02 |
| Benzo(b)fluoranthene | 1.01E+00 | 0.00E+00 | 2.1E-01 | 1.2E-01 | 0.0E+00 | 2.6E-02 | 1.50E-02 | 0.0E+00 | 2.6E-02 | 1.5E-02 | 4.1E-02 |
| Benzo(g,h,i)perylene | 1.01E+00 | 0.00E+00 | 8.0E-02 | 7.7E-02 | 0.0E+00 | 1.0E-02 | 9.58E-03 | 0.0E+00 | 9.9E-03 | 9.5E-03 | 1.9E-02 |
| Benzo(k)fluoranthene | 1.01E+00 | 0.00E+00 | 6.4E-02 | 7.1E-02 | 0.0E+00 | 8.0E-03 | 8.92E-03 | 0.0E+00 | 7.9E-03 | 8.8E-03 | 1.7E-02 |
| Chrysene | 1.01E+00 | 0.00E+00 | 2.1E-01 | 1.2E-01 | 0.0E+00 | 2.6E-02 | 1.52E-02 | 0.0E+00 | 2.6E-02 | 1.5E-02 | 4.1E-02 |
| Dibenzo(a,h)anthracene | 1.01E+00 | 0.00E+00 | 9.5E-02 | 8.2E-02 | 0.0E+00 | 1.2E-02 | 1.02E-02 | 0.0E+00 | 1.2E-02 | 1.0E-02 | 2.2E-02 |
| Fluoranthene | 1.01E+00 | 0.00E+00 | 3.4E+00 | 1.6E+00 | 0.0E+00 | 4.3E-01 | 2.04E-01 | 0.0E+00 | 4.2E-01 | 2.0E-01 | 6.2E-01 |
| Fluorene | 1.01E+00 | 0.00E+00 | 3.7E+00 | 1.8E+00 | 0.0E+00 | 4.6E-01 | 2.25E-01 | 0.0E+00 | 4.6E-01 | 2.2E-01 | 6.8E-01 |
| Indeno(1,2,3-cd)pyrene | 1.01E+00 | 0.00E+00 | 9.5E-02 | 8.2E-02 | 0.0E+00 | 1.2E-02 | 1.02E-02 | 0.0E+00 | 1.2E-02 | 1.0E-02 | 2.2E-02 |
| Naphthalene | 1.11E+00 | 0.00E+00 | 2.3E+00 | 1.3E+00 | 0.0E+00 | 2.9E-01 | 1.61E-01 | 0.0E+00 | 2.6E-01 | 1.5E-01 | 4.0E-01 |
| Phenanthrene | 1.13E+00 | 0.00E+00 | 6.8E+00 | 3.1E+00 | 0.0E+00 | 8.5E-01 | 3.90E-01 | 0.0E+00 | 7.5E-01 | 3.4E-01 | **1.1E+00** |
| Pyrene | 1.11E+00 | 0.00E+00 | 1.6E+00 | 9.1E-01 | 0.0E+00 | 2.0E-01 | 1.14E-01 | 0.0E+00 | 1.8E-01 | 1.0E-01 | 2.8E-01 |
| Pentachlorophenol | 8.71E+01 | 4.10E-04 | 0.0E+00 | 0.0E+00 | 1.5E-04 | 0.0E+00 | 0.00E+00 | 1.8E-06 | 0.0E+00 | 0.0E+00 | 1.8E-06 |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-05 | NA | 2.0E-06 | 1.6E-06 | NA | 2.5E-07 | 2.02E-07 | NA | 1.8E-02 | 1.4E-02 | 3.2E-02 |
| | | | | | | | PAHs | 0.0E+00 | 3.0E+00 | 1.5E+00 | 4.6E+00 |
| | | | | | | | Pentachlorphenol | 1.8E-06 | 0.0E+00 | 0.0E+00 | 1.8E-06 |
| | | | | | | | TCDD TEQ | NA | 1.8E-02 | 1.4E-02 | 3.2E-02 |

Notes:
See Table 3-8 for TRV sources
NA: compound was not analyzed for in this sample
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Mink**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

Site: Superior, WI

Area: Off- Property Area

Receptor: Mink

Pathway: Consumption of Invertebrates
Consumption of Fish
Consumption of Surface Water

| Parameter | Value |
|---|---|
| Body Weight (kg) | 1.02E+00 |
| Invert Ingestion Rate (kg/d): | 5.61E-02 |
| Fish Ingestion Rate (kg/d) | 1.68E-01 |
| Total Dietary Intake (kg/d) | 2.24E-01 |
| Water ingestion rate (L/day) | 7.90E-02 |
| Fish Dry wt./wet wt. CF | 1.00E+00 |
| Sediment Dry wt./wet wt. CF | 6.50E-01 |
| Home range (ha) | 2.66E+02 |
| AUF | 1.00E+00 |
| Invert Dry wt./wet wt. CF | 1.00E+00 |
| SUF | 1.00E+00 |

| Constituent | TRV (mg/kg-d) | Conc. in water (mg/L) | Conc. in benthic inverts (mg/kg) | Avg. Conc. in fish (mg/kg) | Intake from water (mg/kg-d) | Intake from benthic inverts (mg/kg-d) | Intake from fish (mg/kg-d) | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 7.25E+00 | 0.00E+00 | 5.80E+00 | 2.9E+00 | 0.00E+00 | 3.19E-01 | 4.8E-01 | 0.0E+00 | 4.4E-02 | 6.6E-02 | 1.1E-01 |
| Acenaphthylene | 7.25E+00 | 0.00E+00 | 8.50E-02 | 7.8E-02 | 0.00E+00 | 4.68E-03 | 1.3E-02 | 0.0E+00 | 6.5E-04 | 1.8E-03 | 2.4E-03 |
| Anthracene | 4.14E+01 | 0.00E+00 | 1.00E+00 | 4.7E-01 | 0.00E+00 | 5.50E-02 | 7.7E-02 | 0.0E+00 | 1.3E-03 | 1.9E-03 | 3.2E-03 |
| Benzo(a)anthracene | 4.14E-01 | 0.00E+00 | 2.00E-01 | 1.1E-01 | 0.00E+00 | 1.10E-02 | 1.8E-02 | 0.0E+00 | 2.7E-02 | 4.4E-02 | 7.1E-02 |
| Benzo(a)pyrene | 4.14E-01 | 0.00E+00 | 1.10E-01 | 8.7E-02 | 0.00E+00 | 6.05E-03 | 1.4E-02 | 0.0E+00 | 1.5E-02 | 3.5E-02 | 4.9E-02 |
| Benzo(b)fluoranthene | 4.14E-01 | 0.00E+00 | 2.10E-01 | 1.2E-01 | 0.00E+00 | 1.16E-02 | 2.0E-02 | 0.0E+00 | 2.8E-02 | 4.8E-02 | 7.6E-02 |
| Benzo(g,h,i)perylene | 4.14E-01 | 0.00E+00 | 8.00E-02 | 7.7E-02 | 0.00E+00 | 4.40E-03 | 1.3E-02 | 0.0E+00 | 1.1E-02 | 3.1E-02 | 4.1E-02 |
| Benzo(k)fluoranthene | 4.14E-01 | 0.00E+00 | 6.40E-02 | 7.1E-02 | 0.00E+00 | 3.52E-03 | 1.2E-02 | 0.0E+00 | 8.5E-03 | 2.8E-02 | 3.7E-02 |
| Chrysene | 4.14E-01 | 0.00E+00 | 2.10E-01 | 1.2E-01 | 0.00E+00 | 1.16E-02 | 2.0E-02 | 0.0E+00 | 2.8E-02 | 4.8E-02 | 7.6E-02 |
| Dibenzo(a,h)anthracene | 4.14E-01 | 0.00E+00 | 9.50E-02 | 8.2E-02 | 0.00E+00 | 5.23E-03 | 1.3E-02 | 0.0E+00 | 1.3E-02 | 3.3E-02 | 4.5E-02 |
| Fluoranthene | 5.18E+00 | 0.00E+00 | 3.40E+00 | 1.6E+00 | 0.00E+00 | 1.87E-01 | 2.7E-01 | 0.0E+00 | 3.6E-02 | 5.2E-02 | 8.8E-02 |
| Fluorene | 5.18E+00 | 0.00E+00 | 3.70E+00 | 1.8E+00 | 0.00E+00 | 2.04E-01 | 3.0E-01 | 0.0E+00 | 3.9E-02 | 5.7E-02 | 9.7E-02 |
| Indeno(1,2,3-cd)pyrene | 4.14E-01 | 0.00E+00 | 9.50E-02 | 8.2E-02 | 0.00E+00 | 5.23E-03 | 1.3E-02 | 0.0E+00 | 1.3E-02 | 3.3E-02 | 4.5E-02 |
| Naphthalene | 3.83E+01 | 0.00E+00 | 2.30E+00 | 1.3E+00 | 0.00E+00 | 1.27E-01 | 2.1E-01 | 0.0E+00 | 3.3E-03 | 5.6E-03 | 8.9E-03 |
| Phenanthrene | 3.11E+00 | 0.00E+00 | 6.80E+00 | 3.1E+00 | 0.00E+00 | 3.74E-01 | 5.1E-01 | 0.0E+00 | 1.2E-01 | 1.7E-01 | 2.9E-01 |
| Pyrene | 3.11E+00 | 0.00E+00 | 1.60E+00 | 9.1E-01 | 0.00E+00 | 8.80E-02 | 1.5E-01 | 0.0E+00 | 2.8E-02 | 4.8E-02 | 7.7E-02 |
| Pentachlorophenol | 2.30E+00 | 4.10E-04 | 0.00E+00 | 0.0E+00 | 3.18E-05 | 0.00E+00 | 0.0E+00 | 1.4E-05 | 0.0E+00 | 0.0E+00 | 1.4E-05 |
| 2,3,7,8-TCDD TEQ (mamm) | 7.65E-07 | NA | 1.83E-06 | 1.4E-06 | NA | 1.00E-07 | 2.4E-07 | NA | 1.3E-01 | 3.1E-01 | 4.4E-01 |
| | | | | | | | PAHs | 0.0E+00 | 4.1E-01 | 7.0E-01 | 1.1E+00 |
| | | | | | | | Pentachlorphenol | 1.4E-05 | 0.0E+00 | 0.0E+00 | 1.4E-05 |
| | | | | | | | TCDD TEQ | NA | 1.3E-01 | 3.1E-01 | 4.4E-01 |

Notes:
See Table 3-10 for TRV sources
NA: compound was not analyzed for in this sample
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to American Robin**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | American Robin |
| Pathway: | Consumption of Earthworms<br>Soil Ingestion<br>Consumption of Surface Water<br>Consumption of Vegetation |

| Parameter | Value |
|---|---|
| Body Weight (kg): | 7.90E-02 |
| Total dietary intake (kg/d): | 9.52E-02 |
| Soil Ingestion Rate (kg/d): | 1.13E-03 |
| Veg IR | 4.71E-02 |
| earthworm ir | 4.81E-02 |
| soil dw/ww CF | 6.00E-01 |
| veg dw/ww CF | 2.00E-01 |
| Water ingestion rate (L/d) | 1.11E-02 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 5.00E-01 |
| Home Range | 2.50E-01 |

| Constituent | TRV (mg/kg-d) | Mean Conc. in soil (mg/kg) | Avg Conc. in US Water (mg/L) | earthworms BTF [(mg/kg)/(mg/kg)] | Conc. in earthworms (mg/kg) | Veg BTF [(mg/kg)/(mg/kg)] | Conc. in veg (mg/kg) | Intake from Soil (mg/kg-d) | Intake from water (mg/kg-d) | Intake from earth (mg/kg-d) | Intake from veg (mg/kg-d) | HQ Soil | HQ Water | HQ veg | HQ-earth | Total HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+00 | 6.45E-02 | 0.0E+00 | 8.0E-02 | 5.16E-03 | 4.50E-02 | 2.90E-03 | 4.61E-04 | 0.00E+00 | 1.57E-03 | 1.73E-04 | 4.6E-04 | 0.00E+00 | 1.7E-04 | 1.6E-03 | 2.2E-03 |
| Acenaphthylene | 1.01E+00 | 9.10E-01 | 0.0E+00 | 8.0E-02 | 7.28E-02 | 4.50E-02 | 4.10E-02 | 6.51E-03 | 0.00E+00 | 2.22E-02 | 2.44E-03 | 6.4E-03 | 0.00E+00 | 2.4E-03 | 2.2E-02 | 3.1E-02 |
| Anthracene | 1.11E+00 | 1.78E+00 | 0.0E+00 | 8.0E-02 | 1.42E-01 | 4.50E-02 | 7.99E-02 | 1.27E-02 | 0.00E+00 | 4.32E-02 | 4.76E-03 | 1.1E-02 | 0.00E+00 | 4.3E-03 | 3.9E-02 | 5.5E-02 |
| Benzo(a)anthracene | 1.01E+00 | 6.50E-01 | 0.0E+00 | 3.0E-02 | 1.95E-02 | 2.02E-02 | 1.31E-02 | 4.65E-03 | 0.00E+00 | 5.93E-03 | 7.83E-04 | 4.6E-03 | 0.00E+00 | 7.8E-04 | 5.9E-03 | 1.1E-02 |
| Benzo(a)pyrene | 1.01E+00 | 1.65E+00 | 0.0E+00 | 7.0E-02 | 1.16E-01 | 1.11E-02 | 1.83E-02 | 1.18E-02 | 0.00E+00 | 3.51E-02 | 1.09E-03 | 1.2E-02 | 0.00E+00 | 1.1E-03 | 3.5E-02 | 4.8E-02 |
| Benzo(b)fluoranthene | 1.01E+00 | 1.80E+00 | 0.0E+00 | 7.0E-02 | 1.26E-01 | 1.01E-02 | 1.82E-02 | 1.29E-02 | 0.00E+00 | 3.83E-02 | 1.08E-03 | 1.3E-02 | 0.00E+00 | 1.1E-03 | 3.8E-02 | 5.2E-02 |
| Benzo(g,h,i)perylene | 1.01E+00 | 2.80E+00 | 0.0E+00 | 8.0E-02 | 2.24E-01 | 4.50E-02 | 1.26E-01 | 2.00E-02 | 0.00E+00 | 6.82E-02 | 7.52E-03 | 2.0E-02 | 0.00E+00 | 7.4E-03 | 6.7E-02 | 9.5E-02 |
| Benzo(k)fluoranthene | 1.01E+00 | 6.63E-01 | 0.0E+00 | 8.0E-02 | 5.30E-02 | 1.01E-02 | 6.69E-03 | 4.74E-03 | 0.00E+00 | 1.61E-02 | 3.99E-04 | 4.7E-03 | 0.00E+00 | 4.0E-04 | 1.6E-02 | 2.1E-02 |
| Chrysene | 1.01E+00 | 3.40E+00 | 0.0E+00 | 4.0E-02 | 1.36E-01 | 1.87E-02 | 6.36E-02 | 2.43E-02 | 0.00E+00 | 4.14E-02 | 3.79E-03 | 2.4E-02 | 0.00E+00 | 3.8E-03 | 4.1E-02 | 6.9E-02 |
| Dibenzo(a,h)anthracene | 1.01E+00 | 4.65E-01 | 0.0E+00 | 7.0E-02 | 3.26E-02 | 6.40E-03 | 2.98E-03 | 3.32E-03 | 0.00E+00 | 9.90E-03 | 1.78E-04 | 3.3E-03 | 0.00E+00 | 1.8E-04 | 9.8E-03 | 1.3E-02 |
| Fluoranthene | 1.01E+00 | 5.20E-01 | 0.0E+00 | 8.0E-02 | 4.16E-02 | 4.50E-02 | 2.34E-02 | 3.72E-03 | 0.00E+00 | 1.27E-02 | 1.40E-03 | 3.7E-03 | 0.00E+00 | 1.4E-03 | 1.3E-02 | 1.8E-02 |
| Fluorene | 1.01E+00 | 1.63E-01 | 0.0E+00 | 8.0E-02 | 1.30E-02 | 4.50E-02 | 7.31E-03 | 1.16E-03 | 0.00E+00 | 3.96E-03 | 4.36E-04 | 1.2E-03 | 0.00E+00 | 4.3E-04 | 3.9E-03 | 5.5E-03 |
| Indeno(1,2,3-cd)pyrene | 1.01E+00 | 2.35E+00 | 0.0E+00 | 8.0E-02 | 1.88E-01 | 3.90E-03 | 9.17E-03 | 1.68E-02 | 0.00E+00 | 5.72E-02 | 5.47E-04 | 1.7E-02 | 0.00E+00 | 5.4E-04 | 5.7E-02 | 7.4E-02 |
| Naphthalene | 1.11E+00 | 9.55E-02 | 0.0E+00 | 8.0E-02 | 7.64E-03 | 4.50E-02 | 4.30E-03 | 6.83E-04 | 0.00E+00 | 2.32E-03 | 2.56E-04 | 6.2E-04 | 0.00E+00 | 2.3E-04 | 2.1E-03 | 2.9E-03 |
| Phenanthrene | 1.13E+00 | 2.45E-01 | 0.0E+00 | 8.0E-02 | 1.96E-02 | 4.50E-02 | 1.10E-02 | 1.75E-03 | 0.00E+00 | 5.96E-03 | 6.58E-04 | 1.6E-03 | 0.00E+00 | 5.8E-04 | 5.3E-03 | 7.4E-03 |
| Pyrene | 1.11E+00 | 4.93E-01 | 0.0E+00 | 8.0E-02 | 3.94E-02 | 4.50E-02 | 2.22E-02 | 3.52E-03 | 0.00E+00 | 1.20E-02 | 1.32E-03 | 3.2E-03 | 0.00E+00 | 1.2E-03 | 1.1E-02 | 1.5E-02 |
| Pentachlorophenol | 8.71E+01 | 2.08E+00 | 4.1E-04 | 1.0E+00 | 2.08E+00 | 4.49E-02 | 9.32E-02 | 1.48E-02 | 2.87E-05 | 6.31E-01 | 5.56E-03 | 1.7E-04 | 3.30E-07 | 6.4E-05 | 7.2E-03 | 7.5E-03 |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-05 | 1.53E-04 | NA | 4.4E-01 | 6.73E-05 | 5.60E-03 | 8.56E-07 | 1.09E-06 | NA | 2.05E-05 | 5.11E-08 | 7.8E-02 | NA | 3.6E-03 | 1.5E+00 | **1.5E+0** |
| | | | | | | | | | | | PAHs | 1.3E-01 | 0.0E+00 | 2.6E-02 | 3.7E-01 | 5.2E |
| | | | | | | | | | | | Pentachlorphenol | 1.7E-04 | 3.3E-07 | 6.4E-05 | 7.2E-03 | 7.5E |
| | | | | | | | | | | | TCDD TEQ | 7.8E-02 | NA | 3.6E-03 | 1.5E+00 | 1.5E+ |

Notes:
See Table 3-8 for TRV sources
NA: compound was not analyzed for in this sample
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Swallow**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Swallow |
| Pathway: | Consumption of Insects<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Body Weight (kg): | 2.00E-02 |
| Total Dietary Intake (kg/d): | 3.52E-02 |
| Insect Ingestion Rate (kg/d): | 3.52E-02 |
| Water Ingestion Rate (L/d): | 4.40E-03 |
| Home Range (ha) | 7.80E+00 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 5.00E-01 |

| Constituent | TRV (mg/kg-d) | Avg Conc. in US Water (mg/L) | Avg. Conc. In US Insects (mg/kg) | Intake from Water (mg/kg-d) | Intake from Insects (mg/kg-d) | TQ-Water | TQ-Insects | Total TQ |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-01 | 1.0E-01 |
| Acenaphthylene | 1.01E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-01 | 1.0E-01 |
| Anthracene | 1.11E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 9.5E-02 | 9.5E-02 |
| Benzo(a)anthracene | 1.01E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-01 | 1.0E-01 |
| Benzo(a)pyrene | 1.01E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-01 | 1.0E-01 |
| Benzo(b)fluoranthene | 1.01E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-01 | 1.0E-01 |
| Benzo(g,h,i)perylene | 1.01E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-01 | 1.0E-01 |
| Benzo(k)fluoranthene | 1.01E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-01 | 1.0E-01 |
| Chrysene | 1.01E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-01 | 1.0E-01 |
| Dibenzo(a,h)anthracene | 1.01E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-01 | 1.0E-01 |
| Fluoranthene | 1.01E+00 | 0.00E+00 | 2.30E-01 | 0.00E+00 | 2.02E-01 | 0.0E+00 | 2.0E-01 | 2.0E-01 |
| Fluorene | 1.01E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-01 | 1.0E-01 |
| Indeno(1,2,3-cd)pyrene | 1.01E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-01 | 1.0E-01 |
| Naphthalene | 1.11E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 9.5E-02 | 9.5E-02 |
| Phenanthrene | 1.13E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 9.3E-02 | 9.3E-02 |
| Pyrene | 1.11E+00 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 9.5E-02 | 9.5E-02 |
| Pentachlorophenol | 8.71E+01 | 4.10E-04 | 0.00E+00 | 4.51E-05 | 0.00E+00 | 5.2E-07 | 0.0E+00 | 5.2E-07 |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-05 | NA | 1.30E-06 | NA | 1.15E-06 | NA | 8.2E-02 | 8.2E-02 |
| | | | | | PAHs | 0.0E+00 | 1.7E+00 | 1.7E+00 |
| | | | | | Pentachlorphenol | 5.2E-07 | 0.0E+00 | 5.2E-07 |
| | | | | | TCDD TEQ | NA | 8.2E-02 | 8.2E-02 |

Notes:
See Table 3-8 for TRV sources
NA: compound was not analyzed for in this sample
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Meadow Vole**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Meadow Vole |
| Pathway: | Soil Ingestion<br>Consumption of Vegetation<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Vegetation Ingestion Rate (kg/d) | 1.15E-02 |
| Body Weight (kg) | 2.24E-02 |
| Total Dietary Intake (kg/d) | 1.15E-02 |
| soil dw/ww CF | 6.00E-01 |
| veg dw/ww CF | 2.00E-01 |
| Soil Ingestion Rate (kg/day) | 2.76E-04 |
| Water Ingestion Rate (L/d) | 4.71E-03 |
| Home Range (ha) | 2.00E-02 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 1.00E+00 |

| Constituent | NOAEL TRV (mg/kg-d) | Mean Conc. in soil (mg/kg) | Veg. BTF [(mg/kg)/(mg/kg)] | Conc. in Veg. (mg/kg) | Mean Conc. In US SW (mg/L) | Intake from Soil (mg/kg-d) | Intake from Veg. (mg/kg-d) | Intake from Water (mg/kg-d) | TQ-Soil | TQ-Veg. | TQ-Water | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.71E+01 | 6.45E-02 | 4.5E-02 | 2.9E-03 | 0.0E+00 | 7.9E-04 | 3.0E-04 | 0.00E+00 | 4.6E-05 | 1.7E-05 | 0.0E+00 | 0.0001 |
| Acenaphthylene | 1.71E+01 | 9.10E-01 | 4.5E-02 | 4.1E-02 | 0.0E+00 | 1.1E-02 | 4.2E-03 | 0.00E+00 | 6.5E-04 | 2.5E-04 | 0.0E+00 | 0.0009 |
| Anthracene | 9.78E+01 | 1.78E+00 | 4.5E-02 | 8.0E-02 | 0.0E+00 | 2.2E-02 | 8.2E-03 | 0.00E+00 | 2.2E-04 | 8.4E-05 | 0.0E+00 | 0.0003 |
| Benzo(a)anthracene | 9.78E-01 | 6.50E-01 | 2.0E-02 | 1.3E-02 | 0.0E+00 | 8.0E-03 | 1.3E-03 | 0.00E+00 | 8.2E-03 | 1.4E-03 | 0.0E+00 | 0.010 |
| Benzo(a)pyrene | 9.78E-01 | 1.65E+00 | 1.1E-02 | 1.8E-02 | 0.0E+00 | 2.0E-02 | 1.9E-03 | 0.00E+00 | 2.1E-02 | 1.9E-03 | 0.0E+00 | 0.023 |
| Benzo(b)fluoranthene | 9.78E-01 | 1.80E+00 | 1.0E-02 | 1.8E-02 | 0.0E+00 | 2.2E-02 | 1.9E-03 | 0.00E+00 | 2.3E-02 | 1.9E-03 | 0.0E+00 | 0.025 |
| Benzo(g,h,i)perylene | 9.78E-01 | 2.80E+00 | 4.5E-02 | 1.3E-01 | 0.0E+00 | 3.4E-02 | 1.3E-02 | 0.00E+00 | 3.5E-02 | 1.3E-02 | 0.0E+00 | 0.05 |
| Benzo(k)fluoranthene | 9.78E-01 | 6.63E-01 | 1.0E-02 | 6.7E-03 | 0.0E+00 | 8.2E-03 | 6.9E-04 | 0.00E+00 | 8.3E-03 | 7.0E-04 | 0.0E+00 | 0.009 |
| Chrysene | 9.78E-01 | 3.40E+00 | 1.9E-02 | 6.4E-02 | 0.0E+00 | 4.2E-02 | 6.5E-03 | 0.00E+00 | 4.3E-02 | 6.7E-03 | 0.0E+00 | 0.05 |
| Dibenzo(a,h)anthracene | 9.78E-01 | 4.65E-01 | 6.4E-03 | 3.0E-03 | 0.0E+00 | 5.7E-03 | 3.1E-04 | 0.00E+00 | 5.9E-03 | 3.1E-04 | 0.0E+00 | 0.006 |
| Fluoranthene | 1.22E+01 | 5.20E-01 | 4.5E-02 | 2.3E-02 | 0.0E+00 | 6.4E-03 | 2.4E-03 | 0.00E+00 | 5.2E-04 | 2.0E-04 | 0.0E+00 | 0.0007 |
| Fluorene | 1.22E+01 | 1.63E-01 | 4.5E-02 | 7.3E-03 | 0.0E+00 | 2.0E-03 | 7.5E-04 | 0.00E+00 | 1.6E-04 | 6.1E-05 | 0.0E+00 | 0.0002 |
| Indeno(1,2,3-cd)pyrene | 9.78E-01 | 2.35E+00 | 3.9E-03 | 9.2E-03 | 0.0E+00 | 2.9E-02 | 9.4E-04 | 0.00E+00 | 3.0E-02 | 9.6E-04 | 0.0E+00 | 0.031 |
| Naphthalene | 9.04E+01 | 9.55E-02 | 4.5E-02 | 4.3E-03 | 0.0E+00 | 1.2E-03 | 4.4E-04 | 0.00E+00 | 1.3E-05 | 4.9E-06 | 0.0E+00 | 0.00002 |
| Phenanthrene | 7.33E+00 | 2.45E-01 | 4.5E-02 | 1.1E-02 | 0.0E+00 | 3.0E-03 | 1.1E-03 | 0.00E+00 | 4.1E-04 | 1.5E-04 | 0.0E+00 | 0.0006 |
| Pyrene | 7.33E+00 | 4.93E-01 | 4.5E-02 | 2.2E-02 | 0.0E+00 | 6.1E-03 | 2.3E-03 | 0.00E+00 | 8.3E-04 | 3.1E-04 | 0.0E+00 | 0.0011 |
| Pentachlorophenol | 5.42E+00 | 2.08E+00 | 4.5E-02 | 9.3E-02 | 4.1E-04 | 2.6E-02 | 9.6E-03 | 8.61E-05 | 4.7E-03 | 1.8E-03 | 1.6E-05 | 0.006 |
| 2,3,7,8-TCDD TEQ (mamm) | 1.81E-06 | 1.62E-04 | 5.6E-03 | 9.1E-07 | NA | 2.0E-06 | 9.3E-08 | NA | 1.1E+00 | 5.1E-02 | NA | 1.2 |
| | | | | | | | | PAHs | 1.8E-01 | 2.8E-02 | 0.0E+00 | 2.0E-01 |
| | | | | | | | | Pentachlorphenol | 4.7E-03 | 1.8E-03 | 1.6E-05 | 6.5E-03 |
| | | | | | | | | TCDD TEQ | 1.1E+00 | 5.1E-02 | NA | 1.2E+00 |

Notes:
See Table 3-10 for TRV sources
NA: compound was not analyzed for in this sample
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Area 2**
**Ecological Risk Calculations**
**Using TRVs Based on NOAELs**

**Evaluation of Potential Risk to Little Brown Bat**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Little Brown Bat |
| Pathway: | Consumption of invertebrates<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Invert Ingestion Rate (kg/d): | 5.11E-03 |
| Total Dietary Intake (kg/d) | 5.11E-03 |
| Body Weight (kg) | 9.00E-03 |
| Invert Dry wt./wet wt. CF | 1.00E+00 |
| Water Ingestion Rate (L/d) | 1.43E-03 |
| Home range (ha) | 1.00E+01 |
| SUF | 5.00E-01 |
| AUF | 1.00E+00 |

| Constituent | TRV (mg/kg-d) | Mean Conc. In US SW (mg/L) | Mean Conc. in inverts (mg/kg) | Intake from water (mg/kg-d) | Intake from inverts (mg/kg-d) | TQ-water | TQ-inverts | TQ-Total |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 2.52E+01 | 1.00E-03 | 4.33E-02 | 7.93E-05 | 1.23E-02 | 3.1E-06 | 4.9E-04 | 4.9E-04 |
| Acenaphthylene | 2.52E+01 | 1.00E-03 | 2.13E-01 | 7.93E-05 | 6.05E-02 | 3.1E-06 | 2.4E-03 | 2.4E-03 |
| Anthracene | 1.44E+02 | 7.75E-05 | 5.33E-02 | 6.14E-06 | 1.51E-02 | 4.3E-08 | 1.1E-04 | 1.1E-04 |
| Benzo(a)anthracene | 1.44E+00 | 1.00E-05 | 5.33E-02 | 7.93E-07 | 1.51E-02 | 5.5E-07 | 1.1E-02 | 1.1E-02 |
| Benzo(a)pyrene | 1.44E+00 | 4.00E-05 | 5.33E-02 | 3.17E-06 | 1.51E-02 | 2.2E-06 | 1.1E-02 | 1.1E-02 |
| Benzo(b)fluoranthene | 1.44E+00 | 1.27E-04 | 5.10E-02 | 1.01E-05 | 1.45E-02 | 7.0E-06 | 1.0E-02 | 1.0E-02 |
| Benzo(g,h,i)perylene | 1.44E+00 | 3.00E-05 | 5.83E-02 | 2.38E-06 | 1.66E-02 | 1.7E-06 | 1.2E-02 | 1.2E-02 |
| Benzo(k)fluoranthene | 1.44E+00 | 3.20E-05 | 5.33E-02 | 2.54E-06 | 1.51E-02 | 1.8E-06 | 1.1E-02 | 1.1E-02 |
| Chrysene | 1.44E+00 | 7.75E-05 | 5.33E-02 | 6.14E-06 | 1.51E-02 | 4.3E-06 | 1.1E-02 | 1.1E-02 |
| Dibenzo(a,h)anthracene | 1.44E+00 | 1.50E-05 | 5.33E-02 | 1.19E-06 | 1.51E-02 | 8.3E-07 | 1.1E-02 | 1.1E-02 |
| Fluoranthene | 1.80E+01 | 1.33E-04 | 2.23E-01 | 1.05E-05 | 6.34E-02 | 5.8E-07 | 3.5E-03 | 3.5E-03 |
| Fluorene | 1.80E+01 | 1.00E-04 | 4.20E-02 | 7.93E-06 | 1.19E-02 | 4.4E-07 | 6.6E-04 | 6.6E-04 |
| Indeno(1,2,3-cd)pyrene | 1.44E+00 | 3.90E-05 | 5.33E-02 | 3.09E-06 | 1.51E-02 | 2.1E-06 | 1.1E-02 | 1.1E-02 |
| Naphthalene | 1.33E+02 | 1.00E-03 | 7.10E-02 | 7.93E-05 | 2.01E-02 | 6.0E-07 | 1.5E-04 | 1.5E-04 |
| Phenanthrene | 1.08E+01 | 3.00E-04 | 6.27E-02 | 2.38E-05 | 1.78E-02 | 2.2E-06 | 1.6E-03 | 1.6E-03 |
| Pyrene | 1.08E+01 | 1.00E-04 | 5.33E-02 | 7.93E-06 | 1.51E-02 | 7.3E-07 | 1.4E-03 | 1.4E-03 |
| pentachlorophenol | 7.98E+00 | 2.15E-04 | 0.00E+00 | 1.70E-05 | 0.00E+00 | 2.1E-06 | 0.0E+00 | 2.1E-06 |
| 2,3,7,8-TCDD TEQ (Mamm | 2.66E-06 | NA | 1.90E-06 | NA | 5.40E-07 | NA | 2.0E-01 | 2.0E-01 |
| | | | | | PAHs | 3.1E-05 | 9.5E-02 | 9.5E-02 |
| | | | | | Pentachlorophenol | 2.1E-06 | 0.0E+00 | 2.1E-06 |
| | | | | | TCDD TEQ | NA | 2.0E-01 | 2.0E-01 |

Notes:
See Table 3-10 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit

**Evaluation of Potential Risk to Belted Kingfisher**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

Site: Superior, WI

Area: Off- Property Area

Receptor: Belted Kingfisher

Pathway: Consumption of Invertebrates
Consumption of Fish
Consumption of Surface Water

| Parameter | Value |
|---|---|
| Invert Ingestion Rate (kg/d): | 3.68E-02 |
| Fish Ingestion Rate (kg/d) | 3.68E-02 |
| Total Dietary Intake (kg/d) | 7.37E-02 |
| Water ingestion rate (L/day) | 1.10E-01 |
| Body Weight (kg) | 1.47E-01 |
| Fish Dry wt./wet wt. CF | 1.00E+00 |
| Sediment Dry wt./wet wt. CF | 6.50E-01 |
| Ins Dry wt./wet wt. CF | 1.00E+00 |
| Home range (km shoreline) | 1.16E+00 |
| AUF | 1.00E+00 |
| SUF | 5.00E-01 |

| Constituent | TRV (mg/kg-d) | Conc. in water (mg/L) | Conc. in benthic inverts (mg/kg) | Conc. in fish (mg/kg) | Intake from water (mg/kg-d) | Intake from benthic inverts (mg/kg-d) | Intake from fish (mg/kg-d) | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+00 | 1.00E-03 | 5.80E+00 | 2.90E+00 | 3.73E-04 | 7.25E-01 | 3.62E-01 | 3.7E-04 | 7.2E-01 | 3.6E-01 | **1.1E+00** |
| Acenaphthylene | 1.01E+00 | 1.00E-03 | 8.50E-02 | 7.83E-02 | 3.73E-04 | 1.06E-02 | 9.79E-03 | 3.7E-04 | 1.1E-02 | 9.7E-03 | 2.1E-02 |
| Anthracene | 1.11E+00 | 7.75E-05 | 1.00E+00 | 4.67E-01 | 2.89E-05 | 1.25E-01 | 5.83E-02 | 2.6E-05 | 1.1E-01 | 5.3E-02 | 1.7E-01 |
| Benzo(a)anthracene | 1.01E+00 | 1.00E-05 | 2.00E-01 | 1.12E-01 | 3.73E-06 | 2.50E-02 | 1.40E-02 | 3.7E-06 | 2.5E-02 | 1.4E-02 | 3.9E-02 |
| Benzo(a)pyrene | 1.01E+00 | 4.00E-05 | 1.10E-01 | 8.67E-02 | 1.49E-05 | 1.38E-02 | 1.08E-02 | 1.5E-05 | 1.4E-02 | 1.1E-02 | 2.4E-02 |
| Benzo(b)fluoranthene | 1.01E+00 | 1.27E-04 | 2.10E-01 | 1.20E-01 | 4.73E-05 | 2.63E-02 | 1.50E-02 | 4.7E-05 | 2.6E-02 | 1.5E-02 | 4.1E-02 |
| Benzo(g,h,i)perylene | 1.01E+00 | 3.00E-05 | 8.00E-02 | 7.67E-02 | 1.12E-05 | 1.00E-02 | 9.58E-03 | 1.1E-05 | 9.9E-03 | 9.5E-03 | 1.9E-02 |
| Benzo(k)fluoranthene | 1.01E+00 | 3.20E-05 | 6.40E-02 | 7.13E-02 | 1.19E-05 | 8.00E-03 | 8.92E-03 | 1.2E-05 | 7.9E-03 | 8.8E-03 | 1.7E-02 |
| Chrysene | 1.01E+00 | 7.75E-05 | 2.10E-01 | 1.21E-01 | 2.89E-05 | 2.63E-02 | 1.52E-02 | 2.9E-05 | 2.6E-02 | 1.5E-02 | 4.1E-02 |
| Dibenzo(a,h)anthracene | 1.01E+00 | 1.50E-05 | 9.50E-02 | 8.17E-02 | 5.60E-06 | 1.19E-02 | 1.02E-02 | 5.5E-06 | 1.2E-02 | 1.0E-02 | 2.2E-02 |
| Fluoranthene | 1.01E+00 | 1.33E-04 | 3.40E+00 | 1.63E+00 | 4.95E-05 | 4.25E-01 | 2.04E-01 | 4.9E-05 | 4.2E-01 | 2.0E-01 | 6.2E-01 |
| Fluorene | 1.01E+00 | 1.00E-04 | 3.70E+00 | 1.80E+00 | 3.73E-05 | 4.63E-01 | 2.25E-01 | 3.7E-05 | 4.6E-01 | 2.2E-01 | 6.8E-01 |
| Indeno(1,2,3-cd)pyrene | 1.01E+00 | 3.90E-05 | 9.50E-02 | 8.17E-02 | 1.46E-05 | 1.19E-02 | 1.02E-02 | 1.4E-05 | 1.2E-02 | 1.0E-02 | 2.2E-02 |
| Naphthalene | 1.11E+00 | 1.00E-03 | 2.30E+00 | 1.29E+00 | 3.73E-04 | 2.88E-01 | 1.61E-01 | 3.4E-04 | 2.6E-01 | 1.5E-01 | 4.0E-01 |
| Phenanthrene | 1.13E+00 | 3.00E-04 | 6.80E+00 | 3.12E+00 | 1.12E-04 | 8.50E-01 | 3.90E-01 | 9.9E-05 | 7.5E-01 | 3.4E-01 | **1.1E+00** |
| Pyrene | 1.11E+00 | 1.00E-04 | 1.60E+00 | 9.10E-01 | 3.73E-05 | 2.00E-01 | 1.14E-01 | 3.4E-05 | 1.8E-01 | 1.0E-01 | 2.8E-01 |
| Pentachlorophenol | 8.71E+01 | 2.15E-04 | 0.00E+00 | 0.00E+00 | 8.03E-05 | 0.00E+00 | 0.00E+00 | 9.2E-07 | 0.0E+00 | 0.0E+00 | 9.2E-07 |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-05 | NA | 2.02E-06 | 1.62E-06 | NA | 2.52E-07 | 2.02E-07 | NA | 1.8E-02 | 1.4E-02 | 3.2E-02 |
| | | | | | | | PAHs | 1.5E-03 | 3.0E+00 | 1.5E+00 | 4.6E+00 |
| | | | | | | | Pentachlorophenol | 9.2E-07 | 0.0E+00 | 0.0E+00 | 9.2E-07 |
| | | | | | | | TCDD TEQ | NA | 1.8E-02 | 1.4E-02 | 3.2E-02 |

Notes:
See Table 3-8 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit

**Evaluation of Potential Risk to Mink**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Mink |
| Pathway: | Consumption of Invertebrates<br>Consumption of Fish<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Body Weight (kg) | 1.02E+00 |
| Invert Ingestion Rate (kg/d): | 5.61E-02 |
| Fish Ingestion Rate (kg/d) | 1.68E-01 |
| Total Dietary Intake (kg/d) | 2.24E-01 |
| Water ingestion rate (L/day) | 7.90E-02 |
| Fish Dry wt./wet wt. CF | 1.00E+00 |
| Sediment Dry wt./wet wt. CF | 6.50E-01 |
| Home range (ha) | 2.66E+02 |
| AUF | 1.00E+00 |
| Invert Dry wt./wet wt. CF | 1.00E+00 |
| SUF | 1.00E+00 |

| Constituent | TRV (mg/kg-d) | Conc. in water (mg/L) | Conc. in benthic inverts (mg/kg) | Avg. Conc. in fish (mg/kg) | Intake from water (mg/kg-d) | Intake from benthic inverts (mg/kg-d) | Intake from fish (mg/kg-d) | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 7.25E+00 | 1.00E-03 | 5.80E+00 | 2.90E+00 | 7.75E-05 | 3.19E-01 | 4.78E-01 | 1.1E-05 | 4.4E-02 | 6.6E-02 | 1.1E-01 |
| Acenaphthylene | 7.25E+00 | 1.00E-03 | 8.50E-02 | 7.83E-02 | 7.75E-05 | 4.68E-03 | 1.29E-02 | 1.1E-05 | 6.5E-04 | 1.8E-03 | 2.4E-03 |
| Anthracene | 4.14E+01 | 7.75E-05 | 1.00E+00 | 4.67E-01 | 6.01E-06 | 5.50E-02 | 7.70E-02 | 1.4E-07 | 1.3E-03 | 1.9E-03 | 3.2E-03 |
| Benzo(a)anthracene | 4.14E-01 | 1.00E-05 | 2.00E-01 | 1.12E-01 | 7.75E-07 | 1.10E-02 | 1.84E-02 | 1.9E-06 | 2.7E-02 | 4.4E-02 | 7.1E-02 |
| Benzo(a)pyrene | 4.14E-01 | 4.00E-05 | 1.10E-01 | 8.67E-02 | 3.10E-06 | 6.05E-03 | 1.43E-02 | 7.5E-06 | 1.5E-02 | 3.5E-02 | 4.9E-02 |
| Benzo(b)fluoranthene | 4.14E-01 | 1.27E-04 | 2.10E-01 | 1.20E-01 | 9.83E-06 | 1.16E-02 | 1.98E-02 | 2.4E-05 | 2.8E-02 | 4.8E-02 | 7.6E-02 |
| Benzo(g,h,i)perylene | 4.14E-01 | 3.00E-05 | 8.00E-02 | 7.67E-02 | 2.32E-06 | 4.40E-03 | 1.27E-02 | 5.6E-06 | 1.1E-02 | 3.1E-02 | 4.1E-02 |
| Benzo(k)fluoranthene | 4.14E-01 | 3.20E-05 | 6.40E-02 | 7.13E-02 | 2.48E-06 | 3.52E-03 | 1.18E-02 | 6.0E-06 | 8.5E-03 | 2.8E-02 | 3.7E-02 |
| Chrysene | 4.14E-01 | 7.75E-05 | 2.10E-01 | 1.21E-01 | 6.01E-06 | 1.16E-02 | 2.00E-02 | 1.4E-05 | 2.8E-02 | 4.8E-02 | 7.6E-02 |
| Dibenzo(a,h)anthracene | 4.14E-01 | 1.50E-05 | 9.50E-02 | 8.17E-02 | 1.16E-06 | 5.23E-03 | 1.35E-02 | 2.8E-06 | 1.3E-02 | 3.3E-02 | 4.5E-02 |
| Fluoranthene | 5.18E+00 | 1.33E-04 | 3.40E+00 | 1.63E+00 | 1.03E-05 | 1.87E-01 | 2.69E-01 | 2.0E-06 | 3.6E-02 | 5.2E-02 | 8.8E-02 |
| Fluorene | 5.18E+00 | 1.00E-04 | 3.70E+00 | 1.80E+00 | 7.75E-06 | 2.04E-01 | 2.96E-01 | 1.5E-06 | 3.9E-02 | 5.7E-02 | 9.7E-02 |
| Indeno(1,2,3-cd)pyrene | 4.14E-01 | 3.90E-05 | 9.50E-02 | 8.17E-02 | 3.02E-06 | 5.23E-03 | 1.35E-02 | 7.3E-06 | 1.3E-02 | 3.3E-02 | 4.5E-02 |
| Naphthalene | 3.83E+01 | 1.00E-03 | 2.30E+00 | 1.29E+00 | 7.75E-05 | 1.27E-01 | 2.13E-01 | 2.0E-06 | 3.3E-03 | 5.6E-03 | 8.9E-03 |
| Phenanthrene | 3.11E+00 | 3.00E-04 | 6.80E+00 | 3.12E+00 | 2.32E-05 | 3.74E-01 | 5.14E-01 | 7.5E-06 | 1.2E-01 | 1.7E-01 | 2.9E-01 |
| Pyrene | 3.11E+00 | 1.00E-04 | 1.60E+00 | 9.10E-01 | 7.75E-06 | 8.80E-02 | 1.50E-01 | 2.5E-06 | 2.8E-02 | 4.8E-02 | 7.7E-02 |
| Pentachlorophenol | 2.30E+00 | 2.15E-04 | 0.00E+00 | 0.00E+00 | 1.67E-05 | 0.00E+00 | 0.00E+00 | 7.3E-06 | 0.0E+00 | 0.0E+00 | 7.3E-06 |
| 2,3,7,8-TCDD TEQ (mamm) | 7.65E-07 | NA | 1.83E-06 | 1.45E-06 | NA | 1.00E-07 | 2.39E-07 | NA | 1.3E-01 | 3.1E-01 | 4.4E-01 |
| | | | | | | | PAHs | 1.1E-04 | 4.1E-01 | 7.0E-01 | 1.1E+00 |
| | | | | | | | Pentachlorophenol | 7.3E-06 | 0.0E+00 | 0.0E+00 | 7.3E-06 |
| | | | | | | | TCDD TEQ | NA | 1.3E-01 | 3.1E-01 | 4.4E-01 |

Notes:
See Table 3-10 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit

**Evaluation of Potential Risk to American Robin**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

Site: Superior, WI

Area: Off- Property Area

Receptor: American Robin

Pathway:
Consumption of Earthworms
Soil Ingestion
Consumption of Surface Water
Consumption of Vegetation

| Parameter | Value |
|---|---|
| Body Weight (kg): | 7.90E-02 |
| Total dietary intake (kg/d): | 9.52E-02 |
| Soil Ingestion Rate (kg/d): | 1.13E-03 |
| Veg IR | 4.71E-02 |
| earthworm ir | 4.81E-02 |
| soil dw/ww CF | 6.00E-01 |
| veg dw/ww CF | 2.00E-01 |
| Water ingestion rate (L/d) | 1.11E-02 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 5.00E-01 |
| Home Range | 2.50E-01 |

| Constituent | TRV (mg/kg-d) | Mean Conc. in soil (mg/kg) | Avg Conc. in US Water (mg/L) | earthworms BTF [(mg/kg)/(mg/kg)] | Conc. in earthworms (mg/kg) | Veg BTF [(mg/kg)/(mg/kg)] | Conc. in veg (mg/kg) | Intake from Soil (mg/kg-d) | Intake from water (mg/kg-d) | Intake from earth (mg/kg-d) | Intake from veg (mg/kg-d) | HQ Soil | HQ Water | HQ veg | HQ-earth | Total HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+00 | 1.55E-01 | 1.00E-03 | 8.00E-02 | 1.24E-02 | 4.50E-02 | 6.97E-03 | 1.11E-03 | 7.00E-05 | 3.77E-03 | 4.16E-04 | 1.1E-03 | 6.93E-05 | 4.1E-04 | 3.7E-03 | 5.3E-03 |
| Acenaphthylene | 1.01E+00 | 1.70E-01 | 1.00E-03 | 8.00E-02 | 1.36E-02 | 4.50E-02 | 7.65E-03 | 1.22E-03 | 7.00E-05 | 4.14E-03 | 4.56E-04 | 1.2E-03 | 6.93E-05 | 4.5E-04 | 4.1E-03 | 5.8E-03 |
| Anthracene | 1.11E+00 | 2.47E-01 | 7.75E-05 | 8.00E-02 | 1.98E-02 | 4.50E-02 | 1.11E-02 | 1.77E-03 | 5.43E-06 | 6.01E-03 | 6.63E-04 | 1.6E-03 | 4.89E-06 | 6.0E-04 | 5.4E-03 | 7.6E-03 |
| Benzo(a)anthracene | 1.01E+00 | 1.12E-01 | 1.00E-05 | 3.00E-02 | 3.37E-03 | 2.02E-02 | 2.27E-03 | 8.03E-04 | 7.00E-07 | 1.03E-03 | 1.35E-04 | 8.0E-04 | 6.93E-07 | 1.3E-04 | 1.0E-03 | 1.9E-03 |
| Benzo(a)pyrene | 1.01E+00 | 2.09E-01 | 4.00E-05 | 7.00E-02 | 1.46E-02 | 1.11E-02 | 2.32E-03 | 1.49E-03 | 2.80E-06 | 4.44E-03 | 1.38E-04 | 1.5E-03 | 2.77E-06 | 1.4E-04 | 4.4E-03 | 6.0E-03 |
| Benzo(b)fluoranthene | 1.01E+00 | 2.70E-01 | 1.27E-04 | 7.00E-02 | 1.89E-02 | 1.01E-02 | 2.73E-03 | 1.93E-03 | 8.88E-06 | 5.75E-03 | 1.63E-04 | 1.9E-03 | 8.79E-06 | 1.6E-04 | 5.7E-03 | 7.8E-03 |
| Benzo(g,h,i)perylene | 1.01E+00 | 4.37E-01 | 3.00E-05 | 8.00E-02 | 3.50E-02 | 4.50E-02 | 1.97E-02 | 3.13E-03 | 2.10E-06 | 1.06E-02 | 1.17E-03 | 3.1E-03 | 2.08E-06 | 1.2E-03 | 1.1E-02 | 1.5E-02 |
| Benzo(k)fluoranthene | 1.01E+00 | 1.10E-01 | 3.20E-05 | 8.00E-02 | 8.82E-03 | 1.01E-02 | 1.11E-03 | 7.88E-04 | 2.24E-06 | 2.68E-03 | 6.64E-05 | 7.8E-04 | 2.22E-06 | 6.6E-05 | 2.7E-03 | 3.5E-03 |
| Chrysene | 1.01E+00 | 2.24E-01 | 7.75E-05 | 4.00E-02 | 8.96E-03 | 1.87E-02 | 4.19E-03 | 1.60E-03 | 5.43E-06 | 2.73E-03 | 2.50E-04 | 1.6E-03 | 5.37E-06 | 2.5E-04 | 2.7E-03 | 4.5E-03 |
| Dibenzo(a,h)anthracene | 1.01E+00 | 1.46E-01 | 1.50E-05 | 7.00E-02 | 1.02E-02 | 6.40E-03 | 9.32E-04 | 1.04E-03 | 1.05E-06 | 3.10E-03 | 5.56E-05 | 1.0E-03 | 1.04E-06 | 5.5E-05 | 3.1E-03 | 4.2E-03 |
| Fluoranthene | 1.01E+00 | 1.22E-01 | 1.33E-04 | 8.00E-02 | 9.73E-03 | 4.50E-02 | 5.47E-03 | 8.69E-04 | 9.28E-06 | 2.96E-03 | 3.26E-04 | 8.6E-04 | 9.18E-06 | 3.2E-04 | 2.9E-03 | 4.1E-03 |
| Fluorene | 1.01E+00 | 1.29E-01 | 1.00E-04 | 8.00E-02 | 1.03E-02 | 4.50E-02 | 5.81E-03 | 9.23E-04 | 7.00E-06 | 3.14E-03 | 3.47E-04 | 9.1E-04 | 6.93E-06 | 3.4E-04 | 3.1E-03 | 4.4E-03 |
| Indeno(1,2,3-cd)pyrene | 1.01E+00 | 3.82E-01 | 3.90E-05 | 8.00E-02 | 3.06E-02 | 3.90E-03 | 1.49E-03 | 2.73E-03 | 2.73E-06 | 9.30E-03 | 8.89E-05 | 2.7E-03 | 2.70E-06 | 8.8E-05 | 9.2E-03 | 1.2E-02 |
| Naphthalene | 1.11E+00 | 1.33E-01 | 1.00E-03 | 8.00E-02 | 1.06E-02 | 4.50E-02 | 5.99E-03 | 9.52E-04 | 7.00E-05 | 3.24E-03 | 3.57E-04 | 8.6E-04 | 6.31E-05 | 3.2E-04 | 2.9E-03 | 4.2E-03 |
| Phenanthrene | 1.13E+00 | 9.61E-02 | 3.00E-04 | 8.00E-02 | 7.69E-03 | 4.50E-02 | 4.32E-03 | 6.87E-04 | 2.10E-05 | 2.34E-03 | 2.58E-04 | 6.1E-04 | 1.86E-05 | 2.3E-04 | 2.1E-03 | 2.9E-03 |
| Pyrene | 1.11E+00 | 1.20E-01 | 1.00E-04 | 8.00E-02 | 9.59E-03 | 4.50E-02 | 5.40E-03 | 8.57E-04 | 7.00E-06 | 2.92E-03 | 3.22E-04 | 7.7E-04 | 6.31E-06 | 2.9E-04 | 2.6E-03 | 3.7E-03 |
| Pentachlorophenol | 8.71E+01 | 1.38E+00 | 2.15E-04 | 1.00E+00 | 1.38E+00 | 4.49E-02 | 6.18E-02 | 9.85E-03 | 1.51E-05 | 4.19E-01 | 3.69E-03 | 1.1E-04 | 1.73E-07 | 4.2E-05 | 4.8E-03 | 5.0E-03 |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-05 | 2.81E-05 | NA | 4.40E-01 | 1.24E-05 | 5.60E-03 | 1.57E-07 | 2.01E-07 | NA | 3.76E-06 | 9.39E-09 | 1.4E-02 | NA | 6.7E-04 | 2.7E-01 | 2.8E-01 |

| | HQ Soil | HQ Water | HQ veg | HQ-earth | Total HQ |
|---|---|---|---|---|---|
| PAHs | 2.1E-02 | 2.7E-04 | 5.0E-03 | 6.6E-02 | 9.3E-02 |
| Pentachlorophenol | 1.1E-04 | 1.7E-07 | 4.2E-05 | 4.8E-03 | 5.0E-03 |
| TCDD TEQ | 1.4E-02 | NA | 6.7E-04 | 2.7E-01 | 2.8E-01 |

Notes:
See Table 3-8 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit

**Evaluation of Potential Risk to Swallow**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Swallow |
| Pathway: | Consumption of Insects<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Body Weight (kg): | 2.00E-02 |
| Total Dietary Intake (kg/d): | 3.52E-02 |
| Insect Ingestion Rate (kg/d): | 3.52E-02 |
| Water Ingestion Rate (L/d): | 4.40E-03 |
| Home Range (ha) | 7.80E+00 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 5.00E-01 |

| Constituent | TRV (mg/kg-d) | Avg Conc. in US Water (mg/L) | Avg. Conc. In US Insects (mg/kg) | Intake from Water (mg/kg-d) | Intake from Insects (mg/kg-d) | TQ-Water | TQ-Insects | Total TQ |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+00 | 1.00E-03 | 4.33E-02 | 1.10E-04 | 3.81E-02 | 1.1E-04 | 3.8E-02 | 3.8E-02 |
| Acenaphthylene | 1.01E+00 | 1.00E-03 | 2.13E-01 | 1.10E-04 | 1.88E-01 | 1.1E-04 | 1.9E-01 | 1.9E-01 |
| Anthracene | 1.11E+00 | 7.75E-05 | 5.33E-02 | 8.53E-06 | 4.69E-02 | 7.7E-06 | 4.2E-02 | 4.2E-02 |
| Benzo(a)anthracene | 1.01E+00 | 1.00E-05 | 5.33E-02 | 1.10E-06 | 4.69E-02 | 1.1E-06 | 4.6E-02 | 4.6E-02 |
| Benzo(a)pyrene | 1.01E+00 | 4.00E-05 | 5.33E-02 | 4.40E-06 | 4.69E-02 | 4.4E-06 | 4.6E-02 | 4.6E-02 |
| Benzo(b)fluoranthene | 1.01E+00 | 1.27E-04 | 5.10E-02 | 1.39E-05 | 4.49E-02 | 1.4E-05 | 4.4E-02 | 4.4E-02 |
| Benzo(g,h,i)perylene | 1.01E+00 | 3.00E-05 | 5.83E-02 | 3.30E-06 | 5.13E-02 | 3.3E-06 | 5.1E-02 | 5.1E-02 |
| Benzo(k)fluoranthene | 1.01E+00 | 3.20E-05 | 5.33E-02 | 3.52E-06 | 4.69E-02 | 3.5E-06 | 4.6E-02 | 4.6E-02 |
| Chrysene | 1.01E+00 | 7.75E-05 | 5.33E-02 | 8.53E-06 | 4.69E-02 | 8.4E-06 | 4.6E-02 | 4.6E-02 |
| Dibenzo(a,h)anthracene | 1.01E+00 | 1.50E-05 | 5.33E-02 | 1.65E-06 | 4.69E-02 | 1.6E-06 | 4.6E-02 | 4.6E-02 |
| Fluoranthene | 1.01E+00 | 1.33E-04 | 2.23E-01 | 1.46E-05 | 1.97E-01 | 1.4E-05 | 1.9E-01 | 1.9E-01 |
| Fluorene | 1.01E+00 | 1.00E-04 | 4.20E-02 | 1.10E-05 | 3.70E-02 | 1.1E-05 | 3.7E-02 | 3.7E-02 |
| Indeno(1,2,3-cd)pyrene | 1.01E+00 | 3.90E-05 | 5.33E-02 | 4.29E-06 | 4.69E-02 | 4.2E-06 | 4.6E-02 | 4.6E-02 |
| Naphthalene | 1.11E+00 | 1.00E-03 | 7.10E-02 | 1.10E-04 | 6.25E-02 | 9.9E-05 | 5.6E-02 | 5.6E-02 |
| Phenanthrene | 1.13E+00 | 3.00E-04 | 6.27E-02 | 3.30E-05 | 5.51E-02 | 2.9E-05 | 4.9E-02 | 4.9E-02 |
| Pyrene | 1.11E+00 | 1.00E-04 | 5.33E-02 | 1.10E-05 | 4.69E-02 | 9.9E-06 | 4.2E-02 | 4.2E-02 |
| Pentachlorophenol | 8.71E+01 | 2.15E-04 | 0.00E+00 | 2.37E-05 | 0.00E+00 | 2.7E-07 | 0.0E+00 | 2.7E-07 |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-05 | NA | 1.93E-06 | NA | 1.70E-06 | NA | 1.2E-01 | 1.2E-01 |
| | | | | | PAHs | 4.3E-04 | 1.0E+00 | 1.0E+00 |
| | | | | | Pentachlorophenol | 2.7E-07 | 0.0E+00 | 2.7E-07 |
| | | | | | TCDD TEQ | NA | 1.2E-01 | 1.2E-01 |

Notes:
See Table 3-8 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit

**Evaluation of Potential Risk to Meadow Vole**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Meadow Vole |
| Pathway: | Soil Ingestion<br>Consumption of Surface Water<br>Consumption of Vegetation |

| Parameter | Value |
|---|---|
| Vegetation Ingestion Rate (kg/d) | 1.15E-02 |
| Body Weight (kg) | 2.24E-02 |
| Total Dietary Intake (kg/d) | 1.15E-02 |
| soil dw/ww CF | 6.00E-01 |
| veg dw/ww CF | 2.00E-01 |
| Soil Ingestion Rate (kg/day) | 2.76E-04 |
| Water Ingestion Rate (L/d) | 4.71E-03 |
| Home Range (ha) | 2.00E-02 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 1.00E+00 |

| Constituent | NOAEL TRV (mg/kg-d) | Mean Conc. in soil (mg/kg) | Veg. BTF [(mg/kg)/(mg/kg)] | Conc. in Veg. (mg/kg) | Mean Conc. In US SW (mg/L) | Intake from Soil (mg/kg-d) | Intake from Veg. (mg/kg-d) | Intake from Water (mg/kg-d) | TQ-Soil | TQ-Veg. | TQ-Water | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.71E+01 | 1.55E-01 | 4.50E-02 | 6.97E-03 | 1.00E-03 | 1.90E-03 | 7.14E-04 | 2.10E-04 | 1.1E-04 | 4.2E-05 | 1.2E-05 | 1.7E-04 |
| Acenaphthylene | 1.71E+01 | 1.70E-01 | 4.50E-02 | 7.65E-03 | 1.00E-03 | 2.09E-03 | 7.84E-04 | 2.10E-04 | 1.2E-04 | 4.6E-05 | 1.2E-05 | 1.8E-04 |
| Anthracene | 9.78E+01 | 2.47E-01 | 4.50E-02 | 1.11E-02 | 7.75E-05 | 3.04E-03 | 1.14E-03 | 1.63E-05 | 3.1E-05 | 1.2E-05 | 1.7E-07 | 4.3E-05 |
| Benzo(a)anthracene | 9.78E-01 | 1.12E-01 | 2.02E-02 | 2.27E-03 | 1.00E-05 | 1.38E-03 | 2.33E-04 | 2.10E-06 | 1.4E-03 | 2.4E-04 | 2.1E-06 | 1.7E-03 |
| Benzo(a)pyrene | 9.78E-01 | 2.09E-01 | 1.11E-02 | 2.32E-03 | 4.00E-05 | 2.57E-03 | 2.37E-04 | 8.40E-06 | 2.6E-03 | 2.4E-04 | 8.6E-06 | 2.9E-03 |
| Benzo(b)fluoranthene | 9.78E-01 | 2.70E-01 | 1.01E-02 | 2.73E-03 | 1.27E-04 | 3.32E-03 | 2.79E-04 | 2.66E-05 | 3.4E-03 | 2.9E-04 | 2.7E-05 | 3.7E-03 |
| Benzo(g,h,i)perylene | 9.78E-01 | 4.37E-01 | 4.50E-02 | 1.97E-02 | 3.00E-05 | 5.38E-03 | 2.02E-03 | 6.30E-06 | 5.5E-03 | 2.1E-03 | 6.4E-06 | 7.6E-03 |
| Benzo(k)fluoranthene | 9.78E-01 | 1.10E-01 | 1.01E-02 | 1.11E-03 | 3.20E-05 | 1.36E-03 | 1.14E-04 | 6.72E-06 | 1.4E-03 | 1.2E-04 | 6.9E-06 | 1.5E-03 |
| Chrysene | 9.78E-01 | 2.24E-01 | 1.87E-02 | 4.19E-03 | 7.75E-05 | 2.76E-03 | 4.30E-04 | 1.63E-05 | 2.8E-03 | 4.4E-04 | 1.7E-05 | 3.3E-03 |
| Dibenzo(a,h)anthracene | 9.78E-01 | 1.46E-01 | 6.40E-03 | 9.32E-04 | 1.50E-05 | 1.79E-03 | 9.56E-05 | 3.15E-06 | 1.8E-03 | 9.8E-05 | 3.2E-06 | 1.9E-03 |
| Fluoranthene | 1.22E+01 | 1.22E-01 | 4.50E-02 | 5.47E-03 | 1.33E-04 | 1.50E-03 | 5.61E-04 | 2.78E-05 | 1.2E-04 | 4.6E-05 | 2.3E-06 | 1.7E-04 |
| Fluorene | 1.22E+01 | 1.29E-01 | 4.50E-02 | 5.81E-03 | 1.00E-04 | 1.59E-03 | 5.96E-04 | 2.10E-05 | 1.3E-04 | 4.9E-05 | 1.7E-06 | 1.8E-04 |
| Indeno(1,2,3-cd)pyrene | 9.78E-01 | 3.82E-01 | 3.90E-03 | 1.49E-03 | 3.90E-05 | 4.70E-03 | 1.53E-04 | 8.19E-06 | 4.8E-03 | 1.6E-04 | 8.4E-06 | 5.0E-03 |
| Naphthalene | 9.04E+01 | 1.33E-01 | 4.50E-02 | 5.99E-03 | 1.00E-03 | 1.64E-03 | 6.14E-04 | 2.10E-04 | 1.8E-05 | 6.8E-06 | 2.3E-06 | 2.7E-05 |
| Phenanthrene | 7.33E+00 | 9.61E-02 | 4.50E-02 | 4.32E-03 | 3.00E-04 | 1.18E-03 | 4.43E-04 | 6.30E-05 | 1.6E-04 | 6.0E-05 | 8.6E-06 | 2.3E-04 |
| Pyrene | 7.33E+00 | 1.20E-01 | 4.50E-02 | 5.40E-03 | 1.00E-04 | 1.48E-03 | 5.53E-04 | 2.10E-05 | 2.0E-04 | 7.5E-05 | 2.9E-06 | 2.8E-04 |
| Pentachlorophenol | 5.42E+00 | 1.38E+00 | 4.49E-02 | 6.18E-02 | 2.15E-04 | 1.69E-02 | 6.34E-03 | 4.52E-05 | 3.1E-03 | 1.2E-03 | 8.3E-06 | 4.3E-03 |
| 2,3,7,8-TCDD TEQ (mamm) | 1.81E-06 | 2.95E-05 | 5.60E-03 | 1.65E-07 | NA | 3.62E-07 | 1.69E-08 | NA | 2.0E-01 | 9.4E-03 | NA | 2.1E-01 |
| | | | | | | | | PAHs | 2.5E-02 | 4.0E-03 | 1.2E-04 | 2.9E-02 |
| | | | | | | | | Pentachlorophenol | 3.1E-03 | 1.2E-03 | 8.3E-06 | 4.3E-03 |
| | | | | | | | | TCDD TEQ | 2.0E-01 | 9.4E-03 | NA | 2.1E-01 |

Notes:
See Table 3-10 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit

**Area 3**
**Ecological Risk Calculations**
**Using TRVs Based on NOAELs**

**Evaluation of Potential Risk to Little Brown Bat**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

Site: Superior, WI

Area: Off- Property Area

Receptor: Little Brown Bat

Pathway: Consumption of Invertebrates
Consumption of Surface Water

| Parameter | Value |
|---|---|
| Invert Ingestion Rate (kg/d): | 5.11E-03 |
| Total Dietary Intake (kg/d) | 5.11E-03 |
| Body Weight (kg) | 9.00E-03 |
| Invert Dry wt./wet wt. CF | 1.00E+00 |
| Water Ingestion Rate (L/d) | 1.43E-03 |
| Home range (ha) | 1.00E+01 |
| SUF | 5.00E-01 |
| AUF | 1.00E+00 |

| Constituent | TRV (mg/kg-d) | Mean Conc. In DS SW (mg/L) | Mean Conc. in inverts (mg/kg) | Intake from water (mg/kg-d) | Intake from inverts (mg/kg-d) | TQ-water | TQ-inverts | TQ-inverts |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 2.52E+01 | 1.00E-03 | 4.33E-02 | 2.84E-04 | 1.23E-02 | 1.1E-05 | 4.9E-04 | 5.0E-04 |
| Acenaphthylene | 2.52E+01 | 1.00E-03 | 2.13E-01 | 2.84E-04 | 6.05E-02 | 1.1E-05 | 2.4E-03 | 2.4E-03 |
| Anthracene | 1.44E+02 | 5.00E-05 | 5.33E-02 | 1.42E-05 | 1.51E-02 | 9.9E-08 | 1.1E-04 | 1.1E-04 |
| Benzo(a)anthracene | 1.44E+00 | 1.00E-05 | 5.33E-02 | 2.84E-06 | 1.51E-02 | 2.0E-06 | 1.1E-02 | 1.1E-02 |
| Benzo(a)pyrene | 1.44E+00 | 1.00E-05 | 5.33E-02 | 2.84E-06 | 1.51E-02 | 2.0E-06 | 1.1E-02 | 1.1E-02 |
| Benzo(b)fluoranthene | 1.44E+00 | 2.70E-05 | 5.10E-02 | 7.66E-06 | 1.45E-02 | 5.3E-06 | 1.0E-02 | 1.0E-02 |
| Benzo(g,h,i)perylene | 1.44E+00 | 2.75E-05 | 5.83E-02 | 7.80E-06 | 1.66E-02 | 5.4E-06 | 1.2E-02 | 1.2E-02 |
| Benzo(k)fluoranthene | 1.44E+00 | 1.00E-05 | 5.33E-02 | 2.84E-06 | 1.51E-02 | 2.0E-06 | 1.1E-02 | 1.1E-02 |
| Chrysene | 1.44E+00 | 7.75E-05 | 5.33E-02 | 2.20E-05 | 1.51E-02 | 1.5E-05 | 1.1E-02 | 1.1E-02 |
| Dibenzo(a,h)anthracene | 1.44E+00 | 1.50E-05 | 5.33E-02 | 4.26E-06 | 1.51E-02 | 3.0E-06 | 1.1E-02 | 1.1E-02 |
| Fluoranthene | 1.80E+01 | 1.00E-04 | 2.23E-01 | 2.84E-05 | 6.34E-02 | 1.6E-06 | 3.5E-03 | 3.5E-03 |
| Fluorene | 1.80E+01 | 1.00E-04 | 4.20E-02 | 2.84E-05 | 1.19E-02 | 1.6E-06 | 6.6E-04 | 6.6E-04 |
| Indeno(1,2,3-cd)pyrene | 1.44E+00 | 2.75E-05 | 5.33E-02 | 7.80E-06 | 1.51E-02 | 5.4E-06 | 1.1E-02 | 1.1E-02 |
| Naphthalene | 1.33E+02 | 1.00E-03 | 7.10E-02 | 2.84E-04 | 2.01E-02 | 2.1E-06 | 1.5E-04 | 1.5E-04 |
| Phenanthrene | 1.08E+01 | 2.75E-04 | 6.27E-02 | 7.80E-05 | 1.78E-02 | 7.2E-06 | 1.6E-03 | 1.7E-03 |
| Pyrene | 1.08E+01 | 1.00E-04 | 5.33E-02 | 2.84E-05 | 1.51E-02 | 2.6E-06 | 1.4E-03 | 1.4E-03 |
| pentachlorophenol | 7.98E+00 | 2.50E-04 | 0.00E+00 | 7.09E-05 | 0.00E+00 | 8.9E-06 | 0.0E+00 | 8.9E-06 |
| 2,3,7,8-TCDD TEQ (Mamm | 2.66E-06 | NA | 1.90E-06 | NA | 5.40E-07 | NA | 2.0E-01 | 2.0E-01 |
| | | | | | PAHs | 7.8E-05 | 9.5E-02 | 9.5E-02 |
| | | | | | Pentachlorphenol | 8.9E-06 | 0.0E+00 | 8.9E-06 |
| | | | | | TCDD TEQ | NA | 2.0E-01 | 2.0E-01 |

Notes:
See Table 3-10 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Belted Kingfisher**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Belted Kingfisher |
| Pathway: | Consumption of Invertebrates<br>Consumption of Fish<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Invert Ingestion Rate (kg/d): | 3.68E-02 |
| Fish Ingestion Rate (kg/d) | 3.68E-02 |
| Total Dietary Intake (kg/d) | 7.37E-02 |
| Water ingestion rate (L/day) | 1.10E-01 |
| Body Weight (kg) | 1.47E-01 |
| Fish Dry wt./wet wt. CF | 1.00E+00 |
| Sediment Dry wt./wet wt. CF | 6.50E-01 |
| Ins Dry wt./wet wt. CF | 1.00E+00 |
| Home range (km shoreline) | 1.16E+00 |
| AUF | 1.00E+00 |
| SUF | 5.00E-01 |

| Constituent | TRV (mg/kg-d) | Conc. in water (mg/kg-d) | Conc. in benthic inverts (mg/kg) | Conc. in fish (mg/kg) | Intake from water (mg/kg-d) | from benthic inverts (mg/kg-d) | Intake from fish (mg/kg-d) | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+00 | 1.00E-03 | 4.60E-01 | 2.13E-01 | 3.73E-04 | 5.75E-02 | 2.67E-02 | 3.7E-04 | 5.7E-02 | 2.6E-02 | 8.4E-02 |
| Acenaphthylene | 1.01E+00 | 1.00E-03 | 1.60E-02 | 2.67E-02 | 3.73E-04 | 2.00E-03 | 3.33E-03 | 3.7E-04 | 2.0E-03 | 3.3E-03 | 5.7E-03 |
| Anthracene | 1.11E+00 | 5.00E-05 | 1.30E-01 | 7.30E-02 | 1.87E-05 | 1.63E-02 | 9.13E-03 | 1.7E-05 | 1.5E-02 | 8.2E-03 | 2.3E-02 |
| Benzo(a)anthracene | 1.01E+00 | 1.00E-05 | 1.70E-01 | 7.17E-02 | 3.73E-06 | 2.13E-02 | 8.96E-03 | 3.7E-06 | 2.1E-02 | 8.9E-03 | 3.0E-02 |
| Benzo(a)pyrene | 1.01E+00 | 1.00E-05 | 8.10E-02 | 4.83E-02 | 3.73E-06 | 1.01E-02 | 6.04E-03 | 3.7E-06 | 1.0E-02 | 6.0E-03 | 1.6E-02 |
| Benzo(b)fluoranthene | 1.01E+00 | 2.70E-05 | 1.90E-01 | 8.27E-02 | 1.01E-05 | 2.38E-02 | 1.03E-02 | 1.0E-05 | 2.4E-02 | 1.0E-02 | 3.4E-02 |
| Benzo(g,h,i)perylene | 1.01E+00 | 2.75E-05 | 3.30E-02 | 3.23E-02 | 1.03E-05 | 4.13E-03 | 4.04E-03 | 1.0E-05 | 4.1E-03 | 4.0E-03 | 8.1E-03 |
| Benzo(k)fluoranthene | 1.01E+00 | 1.00E-05 | 4.40E-02 | 3.38E-02 | 3.73E-06 | 5.50E-03 | 4.23E-03 | 3.7E-06 | 5.4E-03 | 4.2E-03 | 9.6E-03 |
| Chrysene | 1.01E+00 | 7.75E-05 | 8.20E-02 | 4.03E-02 | 2.89E-05 | 1.03E-02 | 5.04E-03 | 2.9E-05 | 1.0E-02 | 5.0E-03 | 1.5E-02 |
| Dibenzo(a,h)anthracene | 1.01E+00 | 1.50E-05 | 4.40E-02 | 3.38E-02 | 5.60E-06 | 5.50E-03 | 4.23E-03 | 5.5E-06 | 5.4E-03 | 4.2E-03 | 9.6E-03 |
| Fluoranthene | 1.01E+00 | 1.00E-04 | 1.10E+00 | 4.53E-01 | 3.73E-05 | 1.38E-01 | 5.66E-02 | 3.7E-05 | 1.4E-01 | 5.6E-02 | 1.9E-01 |
| Fluorene | 1.01E+00 | 1.00E-04 | 2.80E-01 | 1.31E-01 | 3.73E-05 | 3.50E-02 | 1.63E-02 | 3.7E-05 | 3.5E-02 | 1.6E-02 | 5.1E-02 |
| Indeno(1,2,3-cd)pyrene | 1.01E+00 | 2.75E-05 | 4.40E-02 | 3.38E-02 | 1.03E-05 | 5.50E-03 | 4.23E-03 | 1.0E-05 | 5.4E-03 | 4.2E-03 | 9.6E-03 |
| Naphthalene | 1.11E+00 | 1.00E-03 | 4.60E-01 | 1.75E-01 | 3.73E-04 | 5.75E-02 | 2.19E-02 | 3.4E-04 | 5.2E-02 | 2.0E-02 | 7.2E-02 |
| Phenanthrene | 1.13E+00 | 2.75E-04 | 7.40E-01 | 3.59E-01 | 1.03E-04 | 9.25E-02 | 4.48E-02 | 9.1E-05 | 8.2E-02 | 4.0E-02 | 1.2E-01 |
| Pyrene | 1.11E+00 | 1.00E-04 | 3.60E-01 | 1.96E-01 | 3.73E-05 | 4.50E-02 | 2.45E-02 | 3.4E-05 | 4.1E-02 | 2.2E-02 | 6.3E-02 |
| Pentachlorophenol | 8.71E+01 | 2.50E-04 | 0.00E+00 | 0.00E+00 | 9.33E-05 | 0.00E+00 | 0.00E+00 | 1.1E-06 | 0.0E+00 | 0.0E+00 | 1.1E-06 |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-05 | NA | 8.95E-07 | 6.47E-07 | NA | 1.12E-07 | 8.09E-08 | NA | 8.0E-03 | 5.8E-03 | 1.4E-02 |
| | | | | | | | PAHs | 1.4E-03 | 5.0E-01 | 2.4E-01 | 7.4E-01 |
| | | | | | | | Pentachlorphenol | 1.1E-06 | 0.0E+00 | 0.0E+00 | 1.1E-06 |
| | | | | | | | TCDD TEQ | NA | 8.0E-03 | 5.8E-03 | 1.4E-02 |

Notes:
See Table 3-8 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Mink**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Mink |
| Pathway: | Consumption of Invertebrates<br>Consumption of Fish<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Body Weight (kg) | 1.02E+00 |
| Invert Ingestion Rate (kg/d): | 5.61E-02 |
| Fish Ingestion Rate (kg/d) | 1.68E-01 |
| Total Dietary Intake (kg/d) | 2.24E-01 |
| Water ingestion rate (L/day) | 7.90E-02 |
| Fish Dry wt./wet wt. CF | 1.00E+00 |
| Sediment Dry wt./wet wt. CF | 6.50E-01 |
| Home range (ha) | 2.66E+02 |
| AUF | 1.00E+00 |
| Invert Dry wt./wet wt. CF | 1.00E+00 |
| SUF | 1.00E+00 |

| Constituent | TRV (mg/kg-d) | Conc. in water (mg/L) | Conc. in benthic inverts (mg/kg) | Avg. Conc. in fish (mg/kg) | Intake from water (mg/kg-d) | Intake from benthic inverts (mg/kg-d) | Intake from fish (mg/kg-d) | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 7.25E+00 | 1.00E-03 | 4.60E-01 | 2.13E-01 | 7.75E-05 | 2.53E-02 | 3.52E-02 | 1.1E-05 | 3.5E-03 | 4.9E-03 | 8.4E-03 |
| Acenaphthylene | 7.25E+00 | 1.00E-03 | 1.60E-02 | 2.67E-02 | 7.75E-05 | 8.80E-04 | 4.40E-03 | 1.1E-05 | 1.2E-04 | 6.1E-04 | 7.4E-04 |
| Anthracene | 4.14E+01 | 5.00E-05 | 1.30E-01 | 7.30E-02 | 3.87E-06 | 7.15E-03 | 1.20E-02 | 9.4E-08 | 1.7E-04 | 2.9E-04 | 4.6E-04 |
| Benzo(a)anthracene | 4.14E-01 | 1.00E-05 | 1.70E-01 | 7.17E-02 | 7.75E-07 | 9.35E-03 | 1.18E-02 | 1.9E-06 | 2.3E-02 | 2.9E-02 | 5.1E-02 |
| Benzo(a)pyrene | 4.14E-01 | 1.00E-05 | 8.10E-02 | 4.83E-02 | 7.75E-07 | 4.46E-03 | 7.98E-03 | 1.9E-06 | 1.1E-02 | 1.9E-02 | 3.0E-02 |
| Benzo(b)fluoranthene | 4.14E-01 | 2.70E-05 | 1.90E-01 | 8.27E-02 | 2.09E-06 | 1.05E-02 | 1.36E-02 | 5.1E-06 | 2.5E-02 | 3.3E-02 | 5.8E-02 |
| Benzo(g,h,i)perylene | 4.14E-01 | 2.75E-05 | 3.30E-02 | 3.23E-02 | 2.13E-06 | 1.82E-03 | 5.34E-03 | 5.1E-06 | 4.4E-03 | 1.3E-02 | 1.7E-02 |
| Benzo(k)fluoranthene | 4.14E-01 | 1.00E-05 | 4.40E-02 | 3.38E-02 | 7.75E-07 | 2.42E-03 | 5.58E-03 | 1.9E-06 | 5.8E-03 | 1.3E-02 | 1.9E-02 |
| Chrysene | 4.14E-01 | 7.75E-05 | 8.20E-02 | 4.03E-02 | 6.01E-06 | 4.51E-03 | 6.66E-03 | 1.4E-05 | 1.1E-02 | 1.6E-02 | 2.7E-02 |
| Dibenzo(a,h)anthracene | 4.14E-01 | 1.50E-05 | 4.40E-02 | 3.38E-02 | 1.16E-06 | 2.42E-03 | 5.58E-03 | 2.8E-06 | 5.8E-03 | 1.3E-02 | 1.9E-02 |
| Fluoranthene | 5.18E+00 | 1.00E-04 | 1.10E+00 | 4.53E-01 | 7.75E-06 | 6.05E-02 | 7.47E-02 | 1.5E-06 | 1.2E-02 | 1.4E-02 | 2.6E-02 |
| Fluorene | 5.18E+00 | 1.00E-04 | 2.80E-01 | 1.31E-01 | 7.75E-06 | 1.54E-02 | 2.16E-02 | 1.5E-06 | 3.0E-03 | 4.2E-03 | 7.1E-03 |
| Indeno(1,2,3-cd)pyrene | 4.14E-01 | 2.75E-05 | 4.40E-02 | 3.38E-02 | 2.13E-06 | 2.42E-03 | 5.58E-03 | 5.1E-06 | 5.8E-03 | 1.3E-02 | 1.9E-02 |
| Naphthalene | 3.83E+01 | 1.00E-03 | 4.60E-01 | 1.75E-01 | 7.75E-05 | 2.53E-02 | 2.89E-02 | 2.0E-06 | 6.6E-04 | 7.5E-04 | 1.4E-03 |
| Phenanthrene | 3.11E+00 | 2.75E-04 | 7.40E-01 | 3.59E-01 | 2.13E-05 | 4.07E-02 | 5.92E-02 | 6.9E-06 | 1.3E-02 | 1.9E-02 | 3.2E-02 |
| Pyrene | 3.11E+00 | 1.00E-04 | 3.60E-01 | 1.96E-01 | 7.75E-06 | 1.98E-02 | 3.23E-02 | 2.5E-06 | 6.4E-03 | 1.0E-02 | 1.7E-02 |
| Pentachlorophenol | 2.30E+00 | 2.50E-04 | 0.00E+00 | 0.00E+00 | 1.94E-05 | 0.00E+00 | 0.00E+00 | 8.4E-06 | 0.0E+00 | 0.0E+00 | 8.4E-06 |
| 2,3,7,8-TCDD TEQ (mamm) | 7.65E-07 | NA | 8.00E-07 | 5.92E-07 | NA | 4.40E-08 | 9.77E-08 | NA | 5.7E-02 | 1.3E-01 | 1.9E-01 |
| | | | | | | | PAHs | 7.4E-05 | 1.3E-01 | 2.0E-01 | 3.3E-01 |
| | | | | | | | Pentachlorphenol | 8.4E-06 | 0.0E+00 | 0.0E+00 | 8.4E-06 |
| | | | | | | | TCDD TEQ | NA | 5.7E-02 | 1.3E-01 | 1.9E-01 |

Notes:
See Table 3-10 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to American Robin**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | American Robin |
| Pathway: | Consumption of Earthworms<br>Soil Ingestion<br>Comsumption of Surface Water<br>Consumption of Vegetation |

| Parameter | Value |
|---|---|
| Body Weight (kg): | 7.90E-02 |
| Total dietary intake (kg/d): | 9.52E-02 |
| Soil Ingestion Rate (kg/d): | 1.13E-03 |
| Veg IR | 4.71E-02 |
| earthworm ir | 4.81E-02 |
| soil dw/ww CF | 6.00E-01 |
| veg dw/ww CF | 2.00E-01 |
| Water ingestion rate (L/d) | 1.11E-02 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 5.00E-01 |
| Home Range | 2.50E-01 |

| Constituent | TRV (mg/kg-d) | Mean Conc. in soil (mg/kg) | Avg Conc. in US Water (mg/L) | earthworms BTF [(mg/kg)/ (mg/kg)] | Conc. in earthworms (mg/kg) | Veg BTF [(mg/kg)/ (mg/kg)] | Conc. in veg (mg/kg) | Intake from Soil (mg/kg-d) | Intake from water (mg/kg-d) | Intake from earth (mg/kg-d) | Intake from veg (mg/kg-d) | HQ Soil | HQ Water | HQ veg | HQ-earth | Total HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+00 | 1.55E-01 | 1.00E-03 | 8.00E-02 | 1.24E-02 | 4.50E-02 | 6.97E-03 | 1.11E-03 | 7.00E-05 | 3.77E-03 | 4.16E-04 | 1.1E-03 | 6.93E-05 | 4.1E-04 | 3.7E-03 | 5.3E-03 |
| Acenaphthylene | 1.01E+00 | 1.70E-01 | 1.00E-03 | 8.00E-02 | 1.36E-02 | 4.50E-02 | 7.65E-03 | 1.22E-03 | 7.00E-05 | 4.14E-03 | 4.56E-04 | 1.2E-03 | 6.93E-05 | 4.5E-04 | 4.1E-03 | 5.8E-03 |
| Anthracene | 1.11E+00 | 2.47E-01 | 5.00E-05 | 8.00E-02 | 1.98E-02 | 4.50E-02 | 1.11E-02 | 1.77E-03 | 3.50E-06 | 6.01E-03 | 6.63E-04 | 1.6E-03 | 3.15E-06 | 6.0E-04 | 5.4E-03 | 7.6E-03 |
| Benzo(a)anthracene | 1.01E+00 | 1.12E-01 | 1.00E-05 | 3.00E-02 | 3.37E-03 | 2.02E-02 | 2.27E-03 | 8.03E-04 | 7.00E-07 | 1.03E-03 | 1.35E-04 | 8.0E-04 | 6.93E-07 | 1.3E-04 | 1.0E-03 | 1.9E-03 |
| Benzo(a)pyrene | 1.01E+00 | 2.09E-01 | 1.00E-05 | 7.00E-02 | 1.46E-02 | 1.11E-02 | 2.32E-03 | 1.49E-03 | 7.00E-07 | 4.44E-03 | 1.38E-04 | 1.5E-03 | 6.93E-07 | 1.4E-04 | 4.4E-03 | 6.0E-03 |
| Benzo(b)fluoranthene | 1.01E+00 | 2.70E-01 | 2.70E-05 | 7.00E-02 | 1.89E-02 | 1.01E-02 | 2.73E-03 | 1.93E-03 | 1.89E-06 | 5.75E-03 | 1.63E-04 | 1.9E-03 | 1.87E-06 | 1.6E-04 | 5.7E-03 | 7.8E-03 |
| Benzo(g,h,i)perylene | 1.01E+00 | 4.37E-01 | 2.75E-05 | 8.00E-02 | 3.50E-02 | 4.50E-02 | 1.97E-02 | 3.13E-03 | 1.93E-06 | 1.06E-02 | 1.17E-03 | 3.1E-03 | 1.91E-06 | 1.2E-03 | 1.1E-02 | 1.5E-02 |
| Benzo(k)fluoranthene | 1.01E+00 | 1.10E-01 | 1.00E-05 | 8.00E-02 | 8.82E-03 | 1.01E-02 | 1.11E-03 | 7.88E-04 | 7.00E-07 | 2.68E-03 | 6.64E-05 | 7.8E-04 | 6.93E-07 | 6.6E-05 | 2.7E-03 | 3.5E-03 |
| Chrysene | 1.01E+00 | 2.24E-01 | 7.75E-05 | 4.00E-02 | 8.96E-03 | 1.87E-02 | 4.19E-03 | 1.60E-03 | 5.43E-06 | 2.73E-03 | 2.50E-04 | 1.6E-03 | 5.37E-06 | 2.5E-04 | 2.7E-03 | 4.5E-03 |
| Dibenzo(a,h)anthracene | 1.01E+00 | 1.46E-01 | 1.50E-05 | 7.00E-02 | 1.02E-02 | 6.40E-03 | 9.32E-04 | 1.04E-03 | 1.05E-06 | 3.10E-03 | 5.56E-05 | 1.0E-03 | 1.04E-06 | 5.5E-05 | 3.1E-03 | 4.2E-03 |
| Fluoranthene | 1.01E+00 | 1.22E-01 | 1.00E-04 | 8.00E-02 | 9.73E-03 | 4.50E-02 | 5.47E-03 | 8.69E-04 | 7.00E-06 | 2.96E-03 | 3.26E-04 | 8.6E-04 | 6.93E-06 | 3.2E-04 | 2.9E-03 | 4.1E-03 |
| Fluorene | 1.01E+00 | 1.29E-01 | 1.00E-04 | 8.00E-02 | 1.03E-02 | 4.50E-02 | 5.81E-03 | 9.23E-04 | 7.00E-06 | 3.14E-03 | 3.47E-04 | 9.1E-04 | 6.93E-06 | 3.4E-04 | 3.1E-03 | 4.4E-03 |
| Indeno(1,2,3-cd)pyrene | 1.01E+00 | 3.82E-01 | 2.75E-05 | 8.00E-02 | 3.06E-02 | 3.90E-03 | 1.49E-03 | 2.73E-03 | 1.93E-06 | 9.30E-03 | 8.89E-05 | 2.7E-03 | 1.91E-06 | 8.8E-05 | 9.2E-03 | 1.2E-02 |
| Naphthalene | 1.11E+00 | 1.33E-01 | 1.00E-03 | 8.00E-02 | 1.06E-02 | 4.50E-02 | 5.99E-03 | 9.52E-04 | 7.00E-05 | 3.24E-03 | 3.57E-04 | 8.6E-04 | 6.31E-05 | 3.2E-04 | 2.9E-03 | 4.2E-03 |
| Phenanthrene | 1.13E+00 | 9.61E-02 | 2.75E-04 | 8.00E-02 | 7.69E-03 | 4.50E-02 | 4.32E-03 | 6.87E-04 | 1.93E-05 | 2.34E-03 | 2.58E-04 | 6.1E-04 | 1.70E-05 | 2.3E-04 | 2.1E-03 | 2.9E-03 |
| Pyrene | 1.11E+00 | 1.20E-01 | 1.00E-04 | 8.00E-02 | 9.59E-03 | 4.50E-02 | 5.40E-03 | 8.57E-04 | 7.00E-06 | 2.92E-03 | 3.22E-04 | 7.7E-04 | 6.31E-06 | 2.9E-04 | 2.6E-03 | 3.7E-03 |
| Pentachlorophenol | 8.71E+01 | 1.38E+00 | 2.50E-04 | 1.00E+00 | 1.38E+00 | 4.49E-02 | 6.18E-02 | 9.85E-03 | 1.75E-05 | 4.19E-01 | 3.69E-03 | 1.1E-04 | 2.01E-07 | 4.2E-05 | 4.8E-03 | 5.0E-03 |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-05 | 2.81E-05 | NA | 4.40E-01 | 1.24E-05 | 5.60E-03 | 1.57E-07 | 2.01E-07 | NA | 3.76E-06 | 9.39E-09 | 1.4E-02 | NA | 6.7E-04 | 2.7E-01 | 2.8E-01 |
| | | | | | | | | | | | PAHs | 2.1E-02 | 2.6E-04 | 5.0E-03 | 6.6E-02 | 9.3E-02 |
| | | | | | | | | | | | Pentachlorphenol | 1.1E-04 | 2.0E-07 | 4.2E-05 | 4.8E-03 | 5.0E-03 |
| | | | | | | | | | | | TCDD TEQ | 1.4E-02 | NA | 6.7E-04 | 2.7E-01 | 2.8E-01 |

Notes:
See Table 3-8 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Swallow**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

Site: Superior, WI

Area: Off- Property Area

Receptor: Swallow

Pathway: Consumption of Insects
Consumption of Surface Water

| Parameter | Value |
|---|---|
| Body Weight (kg): | 2.00E-02 |
| Total Dietary Intake (kg/d): | 3.52E-02 |
| Insect Ingestion Rate (kg/d): | 3.52E-02 |
| Water Ingestion Rate (L/d): | 4.40E-03 |
| Home Range (ha) | 7.80E+00 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 5.00E-01 |

| Constituent | TRV (mg/kg-d) | Avg Conc. in DS Water (mg/L) | Avg. Conc. In US Insects (mg/kg) | Intake from Water (mg/kg-d) | Intake from Insects (mg/kg-d) | TQ-Water | TQ-Insects | Total TQ |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+00 | 1.00E-03 | 4.33E-02 | 1.10E-04 | 3.81E-02 | 1.1E-04 | 3.8E-02 | 3.8E-02 |
| Acenaphthylene | 1.01E+00 | 1.00E-03 | 2.13E-01 | 1.10E-04 | 1.88E-01 | 1.1E-04 | 1.9E-01 | 1.9E-01 |
| Anthracene | 1.11E+00 | 5.00E-05 | 5.33E-02 | 5.50E-06 | 4.69E-02 | 5.0E-06 | 4.2E-02 | 4.2E-02 |
| Benzo(a)anthracene | 1.01E+00 | 1.00E-05 | 5.33E-02 | 1.10E-06 | 4.69E-02 | 1.1E-06 | 4.6E-02 | 4.6E-02 |
| Benzo(a)pyrene | 1.01E+00 | 1.00E-05 | 5.33E-02 | 1.10E-06 | 4.69E-02 | 1.1E-06 | 4.6E-02 | 4.6E-02 |
| Benzo(b)fluoranthene | 1.01E+00 | 2.70E-05 | 5.10E-02 | 2.97E-06 | 4.49E-02 | 2.9E-06 | 4.4E-02 | 4.4E-02 |
| Benzo(g,h,i)perylene | 1.01E+00 | 2.75E-05 | 5.83E-02 | 3.03E-06 | 5.13E-02 | 3.0E-06 | 5.1E-02 | 5.1E-02 |
| Benzo(k)fluoranthene | 1.01E+00 | 1.00E-05 | 5.33E-02 | 1.10E-06 | 4.69E-02 | 1.1E-06 | 4.6E-02 | 4.6E-02 |
| Chrysene | 1.01E+00 | 7.75E-05 | 5.33E-02 | 8.53E-06 | 4.69E-02 | 8.4E-06 | 4.6E-02 | 4.6E-02 |
| Dibenzo(a,h)anthracene | 1.01E+00 | 1.50E-05 | 5.33E-02 | 1.65E-06 | 4.69E-02 | 1.6E-06 | 4.6E-02 | 4.6E-02 |
| Fluoranthene | 1.01E+00 | 1.00E-04 | 2.23E-01 | 1.10E-05 | 1.97E-01 | 1.1E-05 | 1.9E-01 | 1.9E-01 |
| Fluorene | 1.01E+00 | 1.00E-04 | 4.20E-02 | 1.10E-05 | 3.70E-02 | 1.1E-05 | 3.7E-02 | 3.7E-02 |
| Indeno(1,2,3-cd)pyrene | 1.01E+00 | 2.75E-05 | 5.33E-02 | 3.03E-06 | 4.69E-02 | 3.0E-06 | 4.6E-02 | 4.6E-02 |
| Naphthalene | 1.11E+00 | 1.00E-03 | 7.10E-02 | 1.10E-04 | 6.25E-02 | 9.9E-05 | 5.6E-02 | 5.6E-02 |
| Phenanthrene | 1.13E+00 | 2.75E-04 | 6.27E-02 | 3.03E-05 | 5.51E-02 | 2.7E-05 | 4.9E-02 | 4.9E-02 |
| Pyrene | 1.11E+00 | 1.00E-04 | 5.33E-02 | 1.10E-05 | 4.69E-02 | 9.9E-06 | 4.2E-02 | 4.2E-02 |
| Pentachlorophenol | 8.71E+01 | 2.50E-04 | 0.00E+00 | 2.75E-05 | 0.00E+00 | 3.2E-07 | 0.0E+00 | 3.2E-07 |
| 2,3,7,8-TCDD TEQ (avian | 1.40E-05 | NA | 1.93E-06 | NA | 1.70E-06 | NA | 1.2E-01 | 1.2E-01 |
| | | | | | PAHs | 4.0E-04 | 1.0E+00 | 1.0E+00 |
| | | | | | Pentachlorphenol | 3.2E-07 | 0.0E+00 | 3.2E-07 |
| | | | | | TCDD TEQ | NA | 1.2E-01 | 1.2E-01 |

Notes:
See Table 3-8 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Meadow Vole**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Meadow Vole |
| Pathway: | Soil Ingestion<br>Consumption of Surface Water<br>Consumption of Vegetation |

| Parameter | Value |
|---|---|
| Vegetation Ingestion Rate (kg/d) | 1.15E-02 |
| Body Weight (kg) | 2.24E-02 |
| Total Dietary Intake (kg/d) | 1.15E-02 |
| soil dw/ww CF | 6.00E-01 |
| veg dw/ww CF | 2.00E-01 |
| Soil Ingestion Rate (kg/day) | 2.76E-04 |
| Water Ingestion Rate (L/d) | 4.71E-03 |
| Home Range (ha) | 2.00E-02 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 1.00E+00 |

| Constituent | NOAEL TRV (mg/kg-d) | Mean Conc. in soil* (mg/kg) | Veg. BTF [(mg/kg)/(mg/kg)] | Conc. in Veg. (mg/kg) | Mean Conc. In DS SW (mg/L) | Intake from Soil (mg/kg-d) | Intake from Veg. (mg/kg-d) | Intake from Water (mg/kg-d) | TQ-Soil | TQ-Veg. | TQ-Water | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.71E+01 | 1.55E-01 | 4.50E-02 | 6.97E-03 | 1.00E-03 | 1.90E-03 | 7.14E-04 | 2.10E-04 | 1.1E-04 | 4.2E-05 | 1.2E-05 | 1.7E-04 |
| Acenaphthylene | 1.71E+01 | 1.70E-01 | 4.50E-02 | 7.65E-03 | 1.00E-03 | 2.09E-03 | 7.84E-04 | 2.10E-04 | 1.2E-04 | 4.6E-05 | 1.2E-05 | 1.8E-04 |
| Anthracene | 9.78E+01 | 2.47E-01 | 4.50E-02 | 1.11E-02 | 5.00E-05 | 3.04E-03 | 1.14E-03 | 1.05E-05 | 3.1E-05 | 1.2E-05 | 1.1E-07 | 4.3E-05 |
| Benzo(a)anthracene | 9.78E-01 | 1.12E-01 | 2.02E-02 | 2.27E-03 | 1.00E-05 | 1.38E-03 | 2.33E-04 | 2.10E-06 | 1.4E-03 | 2.4E-04 | 2.1E-06 | 1.7E-03 |
| Benzo(a)pyrene | 9.78E-01 | 2.09E-01 | 1.11E-02 | 2.32E-03 | 1.00E-05 | 2.57E-03 | 2.37E-04 | 2.10E-06 | 2.6E-03 | 2.4E-04 | 2.1E-06 | 2.9E-03 |
| Benzo(b)fluoranthene | 9.78E-01 | 2.70E-01 | 1.01E-02 | 2.73E-03 | 2.70E-05 | 3.32E-03 | 2.79E-04 | 5.67E-06 | 3.4E-03 | 2.9E-04 | 5.8E-06 | 3.7E-03 |
| Benzo(g,h,i)perylene | 9.78E-01 | 4.37E-01 | 4.50E-02 | 1.97E-02 | 2.75E-05 | 5.38E-03 | 2.02E-03 | 5.78E-06 | 5.5E-03 | 2.1E-03 | 5.9E-06 | 7.6E-03 |
| Benzo(k)fluoranthene | 9.78E-01 | 1.10E-01 | 1.01E-02 | 1.11E-03 | 1.00E-05 | 1.36E-03 | 1.14E-04 | 2.10E-06 | 1.4E-03 | 1.2E-04 | 2.1E-06 | 1.5E-03 |
| Chrysene | 9.78E-01 | 2.24E-01 | 1.87E-02 | 4.19E-03 | 7.75E-05 | 2.76E-03 | 4.30E-04 | 1.63E-05 | 2.8E-03 | 4.4E-04 | 1.7E-05 | 3.3E-03 |
| Dibenzo(a,h)anthracene | 9.78E-01 | 1.46E-01 | 6.40E-03 | 9.32E-04 | 1.50E-05 | 1.79E-03 | 9.56E-05 | 3.15E-06 | 1.8E-03 | 9.8E-05 | 3.2E-06 | 1.9E-03 |
| Fluoranthene | 1.22E+01 | 1.22E-01 | 4.50E-02 | 5.47E-03 | 1.00E-04 | 1.50E-03 | 5.61E-04 | 2.10E-05 | 1.2E-04 | 4.6E-05 | 1.7E-06 | 1.7E-04 |
| Fluorene | 1.22E+01 | 1.29E-01 | 4.50E-02 | 5.81E-03 | 1.00E-04 | 1.59E-03 | 5.96E-04 | 2.10E-05 | 1.3E-04 | 4.9E-05 | 1.7E-06 | 1.8E-04 |
| Indeno(1,2,3-cd)pyrene | 9.78E-01 | 3.82E-01 | 3.90E-03 | 1.49E-03 | 2.75E-05 | 4.70E-03 | 1.53E-04 | 5.78E-06 | 4.8E-03 | 1.6E-04 | 5.9E-06 | 5.0E-03 |
| Naphthalene | 9.04E+01 | 1.33E-01 | 4.50E-02 | 5.99E-03 | 1.00E-03 | 1.64E-03 | 6.14E-04 | 2.10E-04 | 1.8E-05 | 6.8E-06 | 2.3E-06 | 2.7E-05 |
| Phenanthrene | 7.33E+00 | 9.61E-02 | 4.50E-02 | 4.32E-03 | 2.75E-04 | 1.18E-03 | 4.43E-04 | 5.78E-05 | 1.6E-04 | 6.0E-05 | 7.9E-06 | 2.3E-04 |
| Pyrene | 7.33E+00 | 1.20E-01 | 4.50E-02 | 5.40E-03 | 1.00E-04 | 1.48E-03 | 5.53E-04 | 2.10E-05 | 2.0E-04 | 7.5E-05 | 2.9E-06 | 2.8E-04 |
| Pentachlorophenol | 5.42E+00 | 1.38E+00 | 4.50E-02 | 6.20E-02 | 2.50E-04 | 1.69E-02 | 6.36E-03 | 5.25E-05 | 3.1E-03 | 1.2E-03 | 9.7E-06 | 4.3E-03 |
| 2,3,7,8-TCDD TEQ (mamm) | 1.81E-06 | 2.95E-05 | 5.60E-03 | 1.65E-07 | NA | 3.62E-07 | 1.69E-08 | NA | 2.0E-01 | 9.4E-03 | NA | 2.1E-01 |
| | | | | | | | | PAHs | 2.5E-02 | 4.0E-03 | 8.5E-05 | 2.9E-02 |
| | | | | | | | | Pentachlorphenol | 3.1E-03 | 1.2E-03 | 9.7E-06 | 4.3E-03 |
| | | | | | | | | TCDD TEQ | 2.0E-01 | 9.4E-03 | NA | 2.1E-01 |

Notes:
See Table 3-10 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Area 1**
**Ecological Risk Calculations**
**Using TRVs Based on LOAELs**

**Evaluation of Potential Risk to Little Brown Bat**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

Site: Superior, WI

Area: Off- Property Area

Receptor: Little Brown Bat

Pathway: Consumption of Invertebrates
Consumption of Surface Water

| Parameter | Value |
|---|---|
| Invert Ingestion Rate (kg/d): | 5.11E-03 |
| Total Dietary Intake (kg/d) | 5.11E-03 |
| Body Weight (kg) | 9.00E-03 |
| Invert Dry wt./wet wt. CF | 1.00E+00 |
| Water Ingestion Rate (L/d) | 1.43E-03 |
| Home range (ha) | 1.00E+01 |
| SUF | 5.00E-01 |
| AUF | 1.00E+00 |

| Constituent | TRV (mg/kg-d) | Mean Conc. In US SW (mg/L) | Mean Conc. in inverts (mg/kg) | Intake from water (mg/kg-d) | Intake from inverts (mg/kg-d) | TQ-water | TQ-inverts | TQ-Total |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 5.04E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 6.8E-04 | 6.8E-04 |
| Acenaphthylene | 5.04E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 6.8E-04 | 6.8E-04 |
| Anthracene | NA | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | NA | NA | 0.0E+00 |
| Benzo(a)anthracene | 1.44E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-03 | 2.4E-03 |
| Benzo(a)pyrene | 1.44E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-03 | 2.4E-03 |
| Benzo(b)fluoranthene | 1.44E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-03 | 2.4E-03 |
| Benzo(g,h,i)perylene | 1.44E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-03 | 2.4E-03 |
| Benzo(k)fluoranthene | 1.44E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-03 | 2.4E-03 |
| Chrysene | 1.44E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-03 | 2.4E-03 |
| Dibenzo(a,h)anthracene | 1.44E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-03 | 2.4E-03 |
| Fluoranthene | 3.60E+01 | 0.00E+00 | 2.30E-01 | 0.00E+00 | 6.53E-02 | 0.0E+00 | 1.8E-03 | 1.8E-03 |
| Fluorene | 3.60E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 9.5E-04 | 9.5E-04 |
| Indeno(1,2,3-cd)pyrene | 1.44E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 2.4E-03 | 2.4E-03 |
| Naphthalene | 2.66E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 1.3E-03 | 1.3E-03 |
| Phenanthrene | 1.80E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 1.9E-03 | 1.9E-03 |
| Pyrene | 1.80E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 3.40E-02 | 0.0E+00 | 1.9E-03 | 1.9E-03 |
| pentachlorophenol | 2.66E+01 | 4.10E-04 | 0.00E+00 | 3.25E-05 | 0.00E+00 | 1.2E-06 | 0.0E+00 | 1.2E-06 |
| 2,3,7,8-TCDD TEQ (Mamm) | 2.66E-05 | NA | 1.25E-06 | NA | 3.54E-07 | NA | 1.3E-02 | 1.3E-02 |
| | | | | | PAHs | 0.0E+00 | 2.8E-02 | 2.8E-02 |
| | | | | | Pentachlorphenol | 1.2E-06 | 0.0E+00 | 1.2E-06 |
| | | | | | TCDD TEQ | NA | 1.3E-02 | 1.3E-02 |

Notes:
See Table 3-11 for TRV sources
NA: not available
All non detect values were taken at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Belted Kingfisher**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

Site: Superior, WI

Area: Off- Property Area

Receptor: Belted Kingfisher

Pathway: Consumption of Invertebrates
Consumption of Fish
Consumption of Surface Water

| Parameter | Value |
|---|---|
| Invert Ingestion Rate (kg/d): | 3.68E-02 |
| Fish Ingestion Rate (kg/d) | 3.68E-02 |
| Total Dietary Intake (kg/d) | 7.37E-02 |
| Water ingestion rate (L/day) | 1.10E-01 |
| Body Weight (kg) | 1.47E-01 |
| Fish Dry wt./wet wt. CF | 1.00E+00 |
| Sediment Dry wt./wet wt. CF | 6.50E-01 |
| Ins Dry wt./wet wt. CF | 1.00E+00 |
| Home range (km shoreline) | 1.16E+00 |
| AUF | 1.00E+00 |
| SUF | 5.00E-01 |

| Constituent | TRV (mg/kg-d) | Conc. in water (mg/L) | Conc. in benthic inverts (mg/kg) | Conc. in fish (mg/kg) | Intake from water (mg/kg-d) | from benthic inverts (mg/kg-d) | Intake from fish (mg/kg-d) | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+01 | 0.00E+00 | 5.80E+00 | 2.90E+00 | 0.00E+00 | 7.25E-01 | 3.62E-01 | 0.0E+00 | 7.2E-02 | 3.6E-02 | 1.1E-01 |
| Acenaphthylene | 1.01E+01 | 0.00E+00 | 8.50E-02 | 7.83E-02 | 0.00E+00 | 1.06E-02 | 9.79E-03 | 0.0E+00 | 1.1E-03 | 9.7E-04 | 2.0E-03 |
| Anthracene | 1.11E+01 | 0.00E+00 | 1.00E+00 | 4.67E-01 | 0.00E+00 | 1.25E-01 | 5.83E-02 | 0.0E+00 | 1.1E-02 | 5.3E-03 | 1.7E-02 |
| Benzo(a)anthracene | 1.01E+01 | 0.00E+00 | 2.00E-01 | 1.12E-01 | 0.00E+00 | 2.50E-02 | 1.40E-02 | 0.0E+00 | 2.5E-03 | 1.4E-03 | 3.9E-03 |
| Benzo(a)pyrene | 1.01E+01 | 0.00E+00 | 1.10E-01 | 8.67E-02 | 0.00E+00 | 1.38E-02 | 1.08E-02 | 0.0E+00 | 1.4E-03 | 1.1E-03 | 2.4E-03 |
| Benzo(b)fluoranthene | 1.01E+01 | 0.00E+00 | 2.10E-01 | 1.20E-01 | 0.00E+00 | 2.63E-02 | 1.50E-02 | 0.0E+00 | 2.6E-03 | 1.5E-03 | 4.1E-03 |
| Benzo(g,h,i)perylene | 1.01E+01 | 0.00E+00 | 8.00E-02 | 7.67E-02 | 0.00E+00 | 1.00E-02 | 9.58E-03 | 0.0E+00 | 9.9E-04 | 9.5E-04 | 1.9E-03 |
| Benzo(k)fluoranthene | 1.01E+01 | 0.00E+00 | 6.40E-02 | 7.13E-02 | 0.00E+00 | 8.00E-03 | 8.92E-03 | 0.0E+00 | 7.9E-04 | 8.8E-04 | 1.7E-03 |
| Chrysene | 1.01E+01 | 0.00E+00 | 2.10E-01 | 1.21E-01 | 0.00E+00 | 2.63E-02 | 1.52E-02 | 0.0E+00 | 2.6E-03 | 1.5E-03 | 4.1E-03 |
| Dibenzo(a,h)anthracene | 1.01E+01 | 0.00E+00 | 9.50E-02 | 8.17E-02 | 0.00E+00 | 1.19E-02 | 1.02E-02 | 0.0E+00 | 1.2E-03 | 1.0E-03 | 2.2E-03 |
| Fluoranthene | 1.01E+01 | 0.00E+00 | 3.40E+00 | 1.63E+00 | 0.00E+00 | 4.25E-01 | 2.04E-01 | 0.0E+00 | 4.2E-02 | 2.0E-02 | 6.2E-02 |
| Fluorene | 1.01E+01 | 0.00E+00 | 3.70E+00 | 1.80E+00 | 0.00E+00 | 4.63E-01 | 2.25E-01 | 0.0E+00 | 4.6E-02 | 2.2E-02 | 6.8E-02 |
| Indeno(1,2,3-cd)pyrene | 1.01E+01 | 0.00E+00 | 9.50E-02 | 8.17E-02 | 0.00E+00 | 1.19E-02 | 1.02E-02 | 0.0E+00 | 1.2E-03 | 1.0E-03 | 2.2E-03 |
| Naphthalene | 1.11E+01 | 0.00E+00 | 2.30E+00 | 1.29E+00 | 0.00E+00 | 2.88E-01 | 1.61E-01 | 0.0E+00 | 2.6E-02 | 1.5E-02 | 4.0E-02 |
| Phenanthrene | 1.13E+01 | 0.00E+00 | 6.80E+00 | 3.12E+00 | 0.00E+00 | 8.50E-01 | 3.90E-01 | 0.0E+00 | 7.5E-02 | 3.4E-02 | 1.1E-01 |
| Pyrene | 1.11E+01 | 0.00E+00 | 1.60E+00 | 9.10E-01 | 0.00E+00 | 2.00E-01 | 1.14E-01 | 0.0E+00 | 1.8E-02 | 1.0E-02 | 2.8E-02 |
| Pentachlorophenol | NA | 4.10E-04 | 0.00E+00 | 0.00E+00 | 1.53E-04 | 0.00E+00 | 0.00E+00 | NA | NA | NA | NA |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-04 | NA | 2.02E-06 | 1.62E-06 | NA | 2.52E-07 | 2.02E-07 | NA | 1.8E-03 | 1.4E-03 | 3.2E-03 |
| | | | | | | | PAHs | 0.0E+00 | 3.0E-01 | 1.5E-01 | 4.6E-01 |
| | | | | | | | Pentachlorphenol | NA | NA | NA | NA |
| | | | | | | | TCDD TEQ | NA | 1.8E-03 | 1.4E-03 | 3.2E-03 |

Notes:
See Table 3-9 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Mink**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Mink |
| Pathway: | Consumption of Invertebrates<br>Consumption of Fish<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Body Weight (kg) | 1.02E+00 |
| Invert Ingestion Rate (kg/d): | 5.61E-02 |
| Fish Ingestion Rate (kg/d) | 1.68E-01 |
| Total Dietary Intake (kg/d) | 2.24E-01 |
| Water ingestion rate (L/day) | 7.90E-02 |
| Fish Dry wt./wet wt. CF | 1.00E+00 |
| Sediment Dry wt./wet wt. CF | 6.50E-01 |
| Home range (ha) | 2.66E+02 |
| AUF | 1.00E+00 |
| Invert Dry wt./wet wt. CF | 1.00E+00 |
| SUF | 1.00E+00 |

| Constituent | TRV (mg/kg-d) | Conc. in water (mg/L) | Conc. in benthic inverts (mg/kg) | Avg. Conc. in fish (mg/kg) | Intake from water (mg/kg-d) | Intake from benthic inverts (mg/kg-d) | Intake from fish (mg/kg-d) | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.45E+01 | 0.00E+00 | 5.80E+00 | 2.9E+00 | 0.00E+00 | 3.19E-01 | 4.8E-01 | 0.0E+00 | 2.2E-02 | 3.3E-02 | 5.5E-02 |
| Acenaphthylene | 1.45E+01 | 0.00E+00 | 8.50E-02 | 7.8E-02 | 0.00E+00 | 4.68E-03 | 1.3E-02 | 0.0E+00 | 3.2E-04 | 8.9E-04 | 1.2E-03 |
| Anthracene | NA | 0.00E+00 | 1.00E+00 | 4.7E-01 | 0.00E+00 | 5.50E-02 | 7.7E-02 | NA | NA | NA | NA |
| Benzo(a)anthracene | 9.78E+00 | 0.00E+00 | 2.00E-01 | 1.1E-01 | 0.00E+00 | 1.10E-02 | 1.8E-02 | 0.0E+00 | 1.1E-03 | 1.9E-03 | 3.0E-03 |
| Benzo(a)pyrene | 9.78E+00 | 0.00E+00 | 1.10E-01 | 8.7E-02 | 0.00E+00 | 6.05E-03 | 1.4E-02 | 0.0E+00 | 6.2E-04 | 1.5E-03 | 2.1E-03 |
| Benzo(b)fluoranthene | 9.78E+00 | 0.00E+00 | 2.10E-01 | 1.2E-01 | 0.00E+00 | 1.16E-02 | 2.0E-02 | 0.0E+00 | 1.2E-03 | 2.0E-03 | 3.2E-03 |
| Benzo(g,h,i)perylene | 9.78E+00 | 0.00E+00 | 8.00E-02 | 7.7E-02 | 0.00E+00 | 4.40E-03 | 1.3E-02 | 0.0E+00 | 4.5E-04 | 1.3E-03 | 1.7E-03 |
| Benzo(k)fluoranthene | 9.78E+00 | 0.00E+00 | 6.40E-02 | 7.1E-02 | 0.00E+00 | 3.52E-03 | 1.2E-02 | 0.0E+00 | 3.6E-04 | 1.2E-03 | 1.6E-03 |
| Chrysene | 9.78E+00 | 0.00E+00 | 2.10E-01 | 1.2E-01 | 0.00E+00 | 1.16E-02 | 2.0E-02 | 0.0E+00 | 1.2E-03 | 2.0E-03 | 3.2E-03 |
| Dibenzo(a,h)anthracene | 9.78E+00 | 0.00E+00 | 9.50E-02 | 8.2E-02 | 0.00E+00 | 5.23E-03 | 1.3E-02 | 0.0E+00 | 5.3E-04 | 1.4E-03 | 1.9E-03 |
| Fluoranthene | 2.44E+01 | 0.00E+00 | 3.40E+00 | 1.6E+00 | 0.00E+00 | 1.87E-01 | 2.7E-01 | 0.0E+00 | 7.7E-03 | 1.1E-02 | 1.9E-02 |
| Fluorene | 2.44E+01 | 0.00E+00 | 3.70E+00 | 1.8E+00 | 0.00E+00 | 2.04E-01 | 3.0E-01 | 0.0E+00 | 8.3E-03 | 1.2E-02 | 2.0E-02 |
| Indeno(1,2,3-cd)pyrene | 9.78E+00 | 0.00E+00 | 9.50E-02 | 8.2E-02 | 0.00E+00 | 5.23E-03 | 1.3E-02 | 0.0E+00 | 5.3E-04 | 1.4E-03 | 1.9E-03 |
| Naphthalene | 1.81E+01 | 0.00E+00 | 2.30E+00 | 1.3E+00 | 0.00E+00 | 1.27E-01 | 2.1E-01 | 0.0E+00 | 7.0E-03 | 1.2E-02 | 1.9E-02 |
| Phenanthrene | 1.22E+01 | 0.00E+00 | 6.80E+00 | 3.1E+00 | 0.00E+00 | 3.74E-01 | 5.1E-01 | 0.0E+00 | 3.1E-02 | 4.2E-02 | 7.3E-02 |
| Pyrene | 1.22E+01 | 0.00E+00 | 1.60E+00 | 9.1E-01 | 0.00E+00 | 8.80E-02 | 1.5E-01 | 0.0E+00 | 7.2E-03 | 1.2E-02 | 2.0E-02 |
| Pentachlorophenol | 1.81E+01 | 4.10E-04 | 0.00E+00 | 0.0E+00 | 3.18E-05 | 0.00E+00 | 0.0E+00 | 1.8E-06 | 0.0E+00 | 0.0E+00 | 1.8E-06 |
| 2,3,7,8-TCDD TEQ (mamm) | 7.65E-06 | NA | 1.83E-06 | 1.4E-06 | NA | 1.00E-07 | 2.4E-07 | NA | 1.3E-02 | 3.1E-02 | 4.4E-02 |
| | | | | | | | PAHs | 0.0E+00 | 8.9E-02 | 1.4E-01 | 2.3E-01 |
| | | | | | | | Pentachlorphenol | 1.8E-06 | 0.0E+00 | 0.0E+00 | 1.8E-06 |
| | | | | | | | TCDD TEQ | NA | 1.3E-02 | 3.1E-02 | 4.4E-02 |

Notes:
See Table 3-11 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to American Robin**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | American Robin |
| Pathway: | Consumption of Earthworms<br>Soil Ingestion<br>Consumption of Vegetation<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Body Weight (kg): | 7.90E-02 |
| Total dietary intake (kg/d): | 9.52E-02 |
| Soil Ingestion Rate (kg/d): | 1.13E-03 |
| Veg IR | 4.71E-02 |
| earthworm ir | 4.81E-02 |
| soil dw/ww CF | 6.00E-01 |
| veg dw/ww CF | 2.00E-01 |
| Water ingestion rate (L/d) | 1.11E-02 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 5.00E-01 |
| Home Range | 2.50E-01 |

| Constituent | TRV (mg/kg-d) | Mean Conc. in soil (mg/kg) | Avg Conc. in US Water (mg/L) | earthworms BTF [(mg/kg)/(mg/kg)] | Conc. in earthworms (mg/kg) | Veg BTF [(mg/kg)/(mg/kg)] | Conc. in veg (mg/kg) | Intake from Soil (mg/kg-d) | Intake from water (mg/kg-d) | Intake from earth (mg/kg-d) | Intake from veg (mg/kg-d) | HQ Soil | HQ Water | HQ veg | HQ-earth | Total HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+01 | 6.45E-02 | 0.0E+00 | 8.0E-02 | 5.16E-03 | 4.5E-02 | 2.90E-03 | 4.6E-04 | 0.0E+00 | 1.6E-03 | 1.7E-04 | 4.6E-05 | 0.00E+00 | 1.7E-05 | 1.6E-04 | 2.2E-04 |
| Acenaphthylene | 1.01E+01 | 9.10E-01 | 0.0E+00 | 8.0E-02 | 7.28E-02 | 4.5E-02 | 4.10E-02 | 6.5E-03 | 0.0E+00 | 2.2E-02 | 2.4E-03 | 6.4E-04 | 0.00E+00 | 2.4E-04 | 2.2E-03 | 3.1E-03 |
| Anthracene | 1.11E+01 | 1.78E+00 | 0.0E+00 | 8.0E-02 | 1.42E-01 | 4.5E-02 | 7.99E-02 | 1.3E-02 | 0.0E+00 | 4.3E-02 | 4.8E-03 | 1.1E-03 | 0.00E+00 | 4.3E-04 | 3.9E-03 | 5.5E-03 |
| Benzo(a)anthracene | 1.01E+01 | 6.50E-01 | 0.0E+00 | 3.0E-02 | 1.95E-02 | 2.0E-02 | 1.31E-02 | 4.6E-03 | 0.0E+00 | 5.9E-03 | 7.8E-04 | 4.6E-04 | 0.00E+00 | 7.8E-05 | 5.9E-04 | 1.1E-03 |
| Benzo(a)pyrene | 1.01E+01 | 1.65E+00 | 0.0E+00 | 7.0E-02 | 1.16E-01 | 1.1E-02 | 1.83E-02 | 1.2E-02 | 0.0E+00 | 3.5E-02 | 1.1E-03 | 1.2E-03 | 0.00E+00 | 1.1E-04 | 3.5E-03 | 4.8E-03 |
| Benzo(b)fluoranthene | 1.01E+01 | 1.80E+00 | 0.0E+00 | 7.0E-02 | 1.26E-01 | 1.0E-02 | 1.82E-02 | 1.3E-02 | 0.0E+00 | 3.8E-02 | 1.1E-03 | 1.3E-03 | 0.00E+00 | 1.1E-04 | 3.8E-03 | 5.2E-03 |
| Benzo(g,h,i)perylene | 1.01E+01 | 2.80E+00 | 0.0E+00 | 8.0E-02 | 2.24E-01 | 4.5E-02 | 1.26E-01 | 2.0E-02 | 0.0E+00 | 6.8E-02 | 7.5E-03 | 2.0E-03 | 0.00E+00 | 7.4E-04 | 6.7E-03 | 9.5E-03 |
| Benzo(k)fluoranthene | 1.01E+01 | 6.63E-01 | 0.0E+00 | 8.0E-02 | 5.30E-02 | 1.0E-02 | 6.69E-03 | 4.7E-03 | 0.0E+00 | 1.6E-02 | 4.0E-04 | 4.7E-04 | 0.00E+00 | 4.0E-05 | 1.6E-03 | 2.1E-03 |
| Chrysene | 1.01E+01 | 3.40E+00 | 0.0E+00 | 4.0E-02 | 1.36E-01 | 1.9E-02 | 6.36E-02 | 2.4E-02 | 0.0E+00 | 4.1E-02 | 3.8E-03 | 2.4E-03 | 0.00E+00 | 3.8E-04 | 4.1E-03 | 6.9E-03 |
| Dibenzo(a,h)anthracene | 1.01E+01 | 4.65E-01 | 0.0E+00 | 7.0E-02 | 3.26E-02 | 6.4E-03 | 2.98E-03 | 3.3E-03 | 0.0E+00 | 9.9E-03 | 1.8E-04 | 3.3E-04 | 0.00E+00 | 1.8E-05 | 9.8E-04 | 1.3E-03 |
| Fluoranthene | 1.01E+01 | 5.20E-01 | 0.0E+00 | 8.0E-02 | 4.16E-02 | 4.5E-02 | 2.34E-02 | 3.7E-03 | 0.0E+00 | 1.3E-02 | 1.4E-03 | 3.7E-04 | 0.00E+00 | 1.4E-04 | 1.3E-03 | 1.8E-03 |
| Fluorene | 1.01E+01 | 1.63E-01 | 0.0E+00 | 8.0E-02 | 1.30E-02 | 4.5E-02 | 7.31E-03 | 1.2E-03 | 0.0E+00 | 4.0E-03 | 4.4E-04 | 1.2E-04 | 0.00E+00 | 4.3E-05 | 3.9E-04 | 5.5E-04 |
| Indeno(1,2,3-cd)pyrene | 1.01E+01 | 2.35E+00 | 0.0E+00 | 8.0E-02 | 1.88E-01 | 3.9E-03 | 9.17E-03 | 1.7E-02 | 0.0E+00 | 5.7E-02 | 5.5E-04 | 1.7E-03 | 0.00E+00 | 5.4E-05 | 5.7E-03 | 7.4E-03 |
| Naphthalene | 1.11E+01 | 9.55E-02 | 0.0E+00 | 8.0E-02 | 7.64E-03 | 4.5E-02 | 4.30E-03 | 6.8E-04 | 0.0E+00 | 2.3E-03 | 2.6E-04 | 6.2E-05 | 0.00E+00 | 2.3E-05 | 2.1E-04 | 2.9E-04 |
| Phenanthrene | 1.13E+01 | 2.45E-01 | 0.0E+00 | 8.0E-02 | 1.96E-02 | 4.5E-02 | 1.10E-02 | 1.8E-03 | 0.0E+00 | 6.0E-03 | 6.6E-04 | 1.6E-04 | 0.00E+00 | 5.8E-05 | 5.3E-04 | 7.4E-04 |
| Pyrene | 1.11E+01 | 4.93E-01 | 0.0E+00 | 8.0E-02 | 3.94E-02 | 4.5E-02 | 2.22E-02 | 3.5E-03 | 0.0E+00 | 1.2E-02 | 1.3E-03 | 3.2E-04 | 0.00E+00 | 1.2E-04 | 1.1E-03 | 1.5E-03 |
| Pentachlorophenol | NA | 2.08E+00 | 4.1E-04 | 1.0E+00 | 2.08E+00 | 4.5E-02 | 9.32E-02 | 1.5E-02 | 2.9E-05 | 6.3E-01 | 5.6E-03 | NA | NA | NA | NA | NA |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-04 | 1.53E-04 | NA | 4.4E-01 | 6.73E-05 | 5.6E-03 | 8.56E-07 | 1.1E-06 | NA | 2.0E-05 | 5.1E-08 | 7.8E-03 | NA | 3.6E-04 | 1.5E-01 | 1.5E-01 |
| | | | | | | | | | | | PAHs | 1.3E-02 | 0.0E+00 | 2.6E-03 | 3.7E-02 | 5.2E-02 |
| | | | | | | | | | | | Pentachlorphenol | NA | NA | NA | NA | NA |
| | | | | | | | | | | | TCDD TEQ | 7.8E-03 | NA | 3.6E-04 | 1.5E-01 | 1.5E-0 |

Notes:
See Table 3-9 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Swallow**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

Site: Superior, WI

Area: Off- Property Area

Receptor: Swallow

Pathway: Consumption of Insects
Consumption of Surface Water

| Parameter | Value |
|---|---|
| Body Weight (kg): | 2.00E-02 |
| Total Dietary Intake (kg/d): | 3.52E-02 |
| Insect Ingestion Rate (kg/d): | 3.52E-02 |
| Water Ingestion Rate (L/d): | 4.40E-03 |
| Home Range (ha) | 7.80E+00 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 5.00E-01 |

| Constituent | TRV (mg/kg-d) | Avg Conc. in US Water (mg/L) | Avg. Conc. In US Insects (mg/kg) | Intake from Water (mg/kg-d) | Intake from Insects (mg/kg-d) | TQ-Water | TQ-Insects | Total TQ |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-02 | 1.0E-02 |
| Acenaphthylene | 1.01E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-02 | 1.0E-02 |
| Anthracene | 1.11E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 9.5E-03 | 9.5E-03 |
| Benzo(a)anthracene | 1.01E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-02 | 1.0E-02 |
| Benzo(a)pyrene | 1.01E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-02 | 1.0E-02 |
| Benzo(b)fluoranthene | 1.01E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-02 | 1.0E-02 |
| Benzo(g,h,i)perylene | 1.01E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-02 | 1.0E-02 |
| Benzo(k)fluoranthene | 1.01E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-02 | 1.0E-02 |
| Chrysene | 1.01E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-02 | 1.0E-02 |
| Dibenzo(a,h)anthracene | 1.01E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-02 | 1.0E-02 |
| Fluoranthene | 1.01E+01 | 0.00E+00 | 2.30E-01 | 0.00E+00 | 2.02E-01 | 0.0E+00 | 2.0E-02 | 2.0E-02 |
| Fluorene | 1.01E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-02 | 1.0E-02 |
| Indeno(1,2,3-cd)pyrene | 1.01E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 1.0E-02 | 1.0E-02 |
| Naphthalene | 1.11E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 9.5E-03 | 9.5E-03 |
| Phenanthrene | 1.13E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 9.3E-03 | 9.3E-03 |
| Pyrene | 1.11E+01 | 0.00E+00 | 1.20E-01 | 0.00E+00 | 1.06E-01 | 0.0E+00 | 9.5E-03 | 9.5E-03 |
| Pentachlorophenol | NA | 4.10E-04 | 0.00E+00 | 4.51E-05 | 0.00E+00 | NA | NA | NA |
| 2,3,7,8-TCDD TEQ (aviah | 1.40E-04 | NA | 1.30E-06 | NA | 1.15E-06 | NA | 8.2E-03 | 8.2E-03 |
| | | | | | PAHs | 0.0E+00 | 1.7E-01 | 1.7E-01 |
| | | | | | Pentachlorphenol | NA | NA | NA |
| | | | | | TCDD TEQ | NA | 8.2E-03 | 8.2E-03 |

Notes:
See Table 3-9 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Meadow Vole**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Meadow Vole |
| Pathway: | Soil Ingestion<br>Consumption of Vegetation<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Vegetation Ingestion Rate (kg/d) | 1.15E-02 |
| Body Weight (kg) | 2.24E-02 |
| Total Dietary Intake (kg/d) | 1.15E-02 |
| soil dw/ww CF | 6.00E-01 |
| veg dw/ww CF | 2.00E-01 |
| Soil Ingestion Rate (kg/day) | 2.76E-04 |
| Water Ingestion Rate (L/d) | 4.71E-03 |
| Home Range (ha) | 2.00E-02 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 1.00E+00 |

| Constituent | NOAEL TRV (mg/kg-d) | Mean Conc. in soil (mg/kg) | Veg. BTF [(mg/kg)/(mg/kg)] | Conc. in Veg. (mg/kg) | Mean Conc. In US SW (mg/L) | Intake from Soil (mg/kg-d) | Intake from Veg. (mg/kg-d) | Intake from Water (mg/kg-d) | TQ-Soil | TQ-Veg. | TQ-Water | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 3.42E+01 | 6.45E-02 | 4.50E-02 | 2.90E-03 | 0.00E+00 | 7.94E-04 | 2.98E-04 | 0.00E+00 | 2.3E-05 | 8.7E-06 | 0.0E+00 | 3.2E-05 |
| Acenaphthylene | 3.42E+01 | 9.10E-01 | 4.50E-02 | 4.10E-02 | 0.00E+00 | 1.12E-02 | 4.20E-03 | 0.00E+00 | 3.3E-04 | 1.2E-04 | 0.0E+00 | 4.5E-04 |
| Anthracene | NA | 1.78E+00 | 4.50E-02 | 7.99E-02 | 0.00E+00 | 2.18E-02 | 8.19E-03 | 0.00E+00 | NA | NA | NA | NA |
| Benzo(a)anthracene | 9.78E+00 | 6.50E-01 | 2.02E-02 | 1.31E-02 | 0.00E+00 | 8.00E-03 | 1.35E-03 | 0.00E+00 | 8.2E-04 | 1.4E-04 | 0.0E+00 | 9.6E-04 |
| Benzo(a)pyrene | 9.78E+00 | 1.65E+00 | 1.11E-02 | 1.83E-02 | 0.00E+00 | 2.03E-02 | 1.88E-03 | 0.00E+00 | 2.1E-03 | 1.9E-04 | 0.0E+00 | 2.3E-03 |
| Benzo(b)fluoranthene | 9.78E+00 | 1.80E+00 | 1.01E-02 | 1.82E-02 | 0.00E+00 | 2.21E-02 | 1.86E-03 | 0.00E+00 | 2.3E-03 | 1.9E-04 | 0.0E+00 | 2.5E-03 |
| Benzo(g,h,i)perylene | 9.78E+00 | 2.80E+00 | 4.50E-02 | 1.26E-01 | 0.00E+00 | 3.44E-02 | 1.29E-02 | 0.00E+00 | 3.5E-03 | 1.3E-03 | 0.0E+00 | 4.8E-03 |
| Benzo(k)fluoranthene | 9.78E+00 | 6.63E-01 | 1.01E-02 | 6.69E-03 | 0.00E+00 | 8.15E-03 | 6.86E-04 | 0.00E+00 | 8.3E-04 | 7.0E-05 | 0.0E+00 | 9.0E-04 |
| Chrysene | 9.78E+00 | 3.40E+00 | 1.87E-02 | 6.36E-02 | 0.00E+00 | 4.18E-02 | 6.52E-03 | 0.00E+00 | 4.3E-03 | 6.7E-04 | 0.0E+00 | 4.9E-03 |
| Dibenzo(a,h)anthracene | 9.78E+00 | 4.65E-01 | 6.40E-03 | 2.98E-03 | 0.00E+00 | 5.72E-03 | 3.05E-04 | 0.00E+00 | 5.8E-04 | 3.1E-05 | 0.0E+00 | 6.2E-04 |
| Fluoranthene | 2.44E+01 | 5.20E-01 | 4.50E-02 | 2.34E-02 | 0.00E+00 | 6.40E-03 | 2.40E-03 | 0.00E+00 | 2.6E-04 | 9.8E-05 | 0.0E+00 | 3.6E-04 |
| Fluorene | 2.44E+01 | 1.63E-01 | 4.50E-02 | 7.31E-03 | 0.00E+00 | 2.00E-03 | 7.50E-04 | 0.00E+00 | 8.2E-05 | 3.1E-05 | 0.0E+00 | 1.1E-04 |
| Indeno(1,2,3-cd)pyrene | 9.78E+00 | 2.35E+00 | 3.90E-03 | 9.17E-03 | 0.00E+00 | 2.89E-02 | 9.40E-04 | 0.00E+00 | 3.0E-03 | 9.6E-05 | 0.0E+00 | 3.1E-03 |
| Naphthalene | 1.81E+01 | 9.55E-02 | 4.50E-02 | 4.30E-03 | 0.00E+00 | 1.17E-03 | 4.41E-04 | 0.00E+00 | 6.5E-05 | 2.4E-05 | 0.0E+00 | 8.9E-05 |
| Phenanthrene | 1.22E+01 | 2.45E-01 | 4.50E-02 | 1.10E-02 | 0.00E+00 | 3.01E-03 | 1.13E-03 | 0.00E+00 | 2.5E-04 | 9.3E-05 | 0.0E+00 | 3.4E-04 |
| Pyrene | 1.22E+01 | 4.93E-01 | 4.50E-02 | 2.22E-02 | 0.00E+00 | 6.06E-03 | 2.27E-03 | 0.00E+00 | 5.0E-04 | 1.9E-04 | 0.0E+00 | 6.8E-04 |
| Pentachlorophenol | 1.81E+01 | 2.08E+00 | 4.49E-02 | 9.32E-02 | 4.10E-04 | 2.55E-02 | 9.55E-03 | 8.61E-05 | 1.4E-03 | 5.3E-04 | 4.8E-06 | 1.9E-03 |
| 2,3,7,8-TCDD TEQ (mamm) | 1.81E-05 | 1.62E-04 | 5.60E-03 | 9.07E-07 | NA | 1.99E-06 | 9.30E-08 | NA | 1.1E-01 | 5.1E-03 | NA | 1.2E-01 |
| | | | | | | | | PAHs | 1.9E-02 | 3.3E-03 | 0.0E+00 | 2.2E-02 |
| | | | | | | | | Pentachlorphenol | 1.4E-03 | 5.3E-04 | 4.8E-06 | 1.9E-03 |
| | | | | | | | | TCDD TEQ | 1.1E-01 | 5.1E-03 | NA | 1.2E-01 |

Notes:
See Table 3-11 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Area 2**
**Ecological Risk Calculations**
**Using TRVs Based on LOAELs**

**Evaluation of Potential Risk to Little Brown Bat**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Little Brown Bat |
| Pathway: | Consumption of Invertebrates<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Invert Ingestion Rate (kg/d): | 5.11E-03 |
| Total Dietary Intake (kg/d) | 5.11E-03 |
| Body Weight (kg) | 9.00E-03 |
| Invert Dry wt./wet wt. CF | 1.00E+00 |
| Water Ingestion Rate (L/d) | 1.43E-03 |
| Home range (ha) | 1.00E+01 |
| SUF | 5.00E-01 |
| AUF | 1.00E+00 |

| Constituent | TRV (mg/kg-d) | Mean Conc. In US SW (mg/L) | Mean Conc. in inverts (mg/kg) | Intake from water (mg/kg-d) | Intake from inverts (mg/kg-d) | TQ-water | TQ-inverts | TQ-Total |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 5.04E+01 | 1.00E-03 | 4.33E-02 | 7.93E-05 | 1.23E-02 | 1.57E-06 | 2.44E-04 | 2.46E-04 |
| Acenaphthylene | 5.04E+01 | 1.00E-03 | 2.13E-01 | 7.93E-05 | 6.05E-02 | 1.57E-06 | 1.20E-03 | 1.20E-03 |
| Anthracene | NA | 7.75E-05 | 5.33E-02 | 6.14E-06 | 1.51E-02 | NA | NA | 0.00E+00 |
| Benzo(a)anthracene | 1.44E+01 | 1.00E-05 | 5.33E-02 | 7.93E-07 | 1.51E-02 | 5.51E-08 | 1.05E-03 | 1.05E-03 |
| Benzo(a)pyrene | 1.44E+01 | 4.00E-05 | 5.33E-02 | 3.17E-06 | 1.51E-02 | 2.20E-07 | 1.05E-03 | 1.05E-03 |
| Benzo(b)fluoranthene | 1.44E+01 | 1.27E-04 | 5.10E-02 | 1.01E-05 | 1.45E-02 | 6.98E-07 | 1.00E-03 | 1.01E-03 |
| Benzo(g,h,i)perylene | 1.44E+01 | 3.00E-05 | 5.83E-02 | 2.38E-06 | 1.66E-02 | 1.65E-07 | 1.15E-03 | 1.15E-03 |
| Benzo(k)fluoranthene | 1.44E+01 | 3.20E-05 | 5.33E-02 | 2.54E-06 | 1.51E-02 | 1.76E-07 | 1.05E-03 | 1.05E-03 |
| Chrysene | 1.44E+01 | 7.75E-05 | 5.33E-02 | 6.14E-06 | 1.51E-02 | 4.27E-07 | 1.05E-03 | 1.05E-03 |
| Dibenzo(a,h)anthracene | 1.44E+01 | 1.50E-05 | 5.33E-02 | 1.19E-06 | 1.51E-02 | 8.26E-08 | 1.05E-03 | 1.05E-03 |
| Fluoranthene | 3.60E+01 | 1.33E-04 | 2.23E-01 | 1.05E-05 | 6.34E-02 | 2.92E-07 | 1.76E-03 | 1.76E-03 |
| Fluorene | 3.60E+01 | 1.00E-04 | 4.20E-02 | 7.93E-06 | 1.19E-02 | 2.20E-07 | 3.31E-04 | 3.31E-04 |
| Indeno(1,2,3-cd)pyrene | 1.44E+01 | 3.90E-05 | 5.33E-02 | 3.09E-06 | 1.51E-02 | 2.15E-07 | 1.05E-03 | 1.05E-03 |
| Naphthalene | 2.66E+01 | 1.00E-03 | 7.10E-02 | 7.93E-05 | 2.01E-02 | 2.98E-06 | 7.57E-04 | 7.60E-04 |
| Phenanthrene | 1.80E+01 | 3.00E-04 | 6.27E-02 | 2.38E-05 | 1.78E-02 | 1.32E-06 | 9.88E-04 | 9.89E-04 |
| Pyrene | 1.80E+01 | 1.00E-04 | 5.33E-02 | 7.93E-06 | 1.51E-02 | 4.40E-07 | 8.41E-04 | 8.41E-04 |
| pentachlorophenol | 2.66E+01 | 2.15E-04 | 0.00E+00 | 1.70E-05 | 0.00E+00 | 6.41E-07 | 0.00E+00 | 6.41E-07 |
| 2,3,7,8-TCDD TEQ (Mamm) | 2.66E-05 | NA | 1.90E-06 | NA | 5.40E-07 | NA | 2.03E-02 | 2.03E-02 |
| | | | | | PAHs | 1.04E-05 | 1.46E-02 | 1.46E-02 |
| | | | | | Pentachlorophenol | 6.41E-07 | 0.00E+00 | 6.41E-07 |
| | | | | | TCDD TEQ | NA | 2.03E-02 | 2.03E-02 |

Notes:
See Table 3-11 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit

**Evaluation of Potential Risk to Belted Kingfisher**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

Site: Superior, WI

Area: Off- Property Area

Receptor: Belted Kingfisher

Pathway: Consumption of Invertebrates
Consumption of Fish
Consumption of Surface Water

| Parameter | Value |
|---|---|
| Invert Ingestion Rate (kg/d): | 3.68E-02 |
| Fish Ingestion Rate (kg/d) | 3.68E-02 |
| Total Dietary Intake (kg/d) | 7.37E-02 |
| Water ingestion rate (L/day) | 1.10E-01 |
| Body Weight (kg) | 1.47E-01 |
| Fish Dry wt./wet wt. CF | 1.00E+00 |
| Sediment Dry wt./wet wt. CF | 6.50E-01 |
| Ins Dry wt./wet wt. CF | 1.00E+00 |
| Home range (km shoreline) | 1.16E+00 |
| AUF | 1.00E+00 |
| SUF | 5.00E-01 |

| Constituent | TRV (mg/kg-d) | Conc. in water (mg/L) | Conc. in benthic inverts (mg/kg) | Conc. in fish (mg/kg) | Intake from water (mg/kg-d) | from benthic inverts (mg/kg-d) | Intake from fish (mg/kg-d) | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+01 | 1.00E-03 | 5.80E+00 | 2.90E+00 | 3.73E-04 | 7.25E-01 | 3.62E-01 | 3.70E-05 | 7.18E-02 | 3.58E-02 | 1.1E-01 |
| Acenaphthylene | 1.01E+01 | 1.00E-03 | 8.50E-02 | 7.83E-02 | 3.73E-04 | 1.06E-02 | 9.79E-03 | 3.70E-05 | 1.05E-03 | 9.69E-04 | 2.1E-03 |
| Anthracene | 1.11E+01 | 7.75E-05 | 1.00E+00 | 4.67E-01 | 2.89E-05 | 1.25E-01 | 5.83E-02 | 2.61E-06 | 1.13E-02 | 5.26E-03 | 1.7E-02 |
| Benzo(a)anthracene | 1.01E+01 | 1.00E-05 | 2.00E-01 | 1.12E-01 | 3.73E-06 | 2.50E-02 | 1.40E-02 | 3.70E-07 | 2.48E-03 | 1.38E-03 | 3.9E-03 |
| Benzo(a)pyrene | 1.01E+01 | 4.00E-05 | 1.10E-01 | 8.67E-02 | 1.49E-05 | 1.38E-02 | 1.08E-02 | 1.48E-06 | 1.36E-03 | 1.07E-03 | 2.4E-03 |
| Benzo(b)fluoranthene | 1.01E+01 | 1.27E-04 | 2.10E-01 | 1.20E-01 | 4.73E-05 | 2.63E-02 | 1.50E-02 | 4.69E-06 | 2.60E-03 | 1.49E-03 | 4.1E-03 |
| Benzo(g,h,i)perylene | 1.01E+01 | 3.00E-05 | 8.00E-02 | 7.67E-02 | 1.12E-05 | 1.00E-02 | 9.58E-03 | 1.11E-06 | 9.90E-04 | 9.49E-04 | 1.9E-03 |
| Benzo(k)fluoranthene | 1.01E+01 | 3.20E-05 | 6.40E-02 | 7.13E-02 | 1.19E-05 | 8.00E-03 | 8.92E-03 | 1.18E-06 | 7.92E-04 | 8.83E-04 | 1.7E-03 |
| Chrysene | 1.01E+01 | 7.75E-05 | 2.10E-01 | 1.21E-01 | 2.89E-05 | 2.63E-02 | 1.52E-02 | 2.86E-06 | 2.60E-03 | 1.50E-03 | 4.1E-03 |
| Dibenzo(a,h)anthracene | 1.01E+01 | 1.50E-05 | 9.50E-02 | 8.17E-02 | 5.60E-06 | 1.19E-02 | 1.02E-02 | 5.54E-07 | 1.18E-03 | 1.01E-03 | 2.2E-03 |
| Fluoranthene | 1.01E+01 | 1.33E-04 | 3.40E+00 | 1.63E+00 | 4.95E-05 | 4.25E-01 | 2.04E-01 | 4.90E-06 | 4.21E-02 | 2.02E-02 | 6.2E-02 |
| Fluorene | 1.01E+01 | 1.00E-04 | 3.70E+00 | 1.80E+00 | 3.73E-05 | 4.63E-01 | 2.25E-01 | 3.70E-06 | 4.58E-02 | 2.22E-02 | 6.8E-02 |
| Indeno(1,2,3-cd)pyrene | 1.01E+01 | 3.90E-05 | 9.50E-02 | 8.17E-02 | 1.46E-05 | 1.19E-02 | 1.02E-02 | 1.44E-06 | 1.18E-03 | 1.01E-03 | 2.2E-03 |
| Naphthalene | 1.11E+01 | 1.00E-03 | 2.30E+00 | 1.29E+00 | 3.73E-04 | 2.88E-01 | 1.61E-01 | 3.36E-05 | 2.59E-02 | 1.45E-02 | 4.0E-02 |
| Phenanthrene | 1.13E+01 | 3.00E-04 | 6.80E+00 | 3.12E+00 | 1.12E-04 | 8.50E-01 | 3.90E-01 | 9.91E-06 | 7.52E-02 | 3.45E-02 | 1.1E-01 |
| Pyrene | 1.11E+01 | 1.00E-04 | 1.60E+00 | 9.10E-01 | 3.73E-05 | 2.00E-01 | 1.14E-01 | 3.36E-06 | 1.80E-02 | 1.02E-02 | 2.8E-02 |
| Pentachlorophenol | NA | 2.15E-04 | 0.00E+00 | 0.00E+00 | 8.03E-05 | 0.00E+00 | 0.00E+00 | NA | NA | NA | 0.0E+00 |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-04 | NA | 2.02E-06 | 1.62E-06 | NA | 2.52E-07 | 2.02E-07 | NA | 1.80E-03 | 1.45E-03 | 3.2E-03 |
| | | | | | | | PAHs | 1.5E-04 | 3.0E-01 | 1.5E-01 | 4.6E-01 |
| | | | | | | | Pentachlorophenol | NA | NA | NA | 0.0E+00 |
| | | | | | | | TCDD TEQ | NA | 1.8E-03 | 1.4E-03 | 3.2E-03 |

Notes:
See Table 3-9 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit

**Evaluation of Potential Risk to Mink**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

Site: Superior, WI

Area: Off- Property Area

Receptor: Mink

Pathway: Consumption of Invertebrates
Consumption of Fish
Consumption of Surface Water

| Parameter | Value |
|---|---|
| Body Weight (kg) | 1.02E+00 |
| Invert Ingestion Rate (kg/d): | 5.61E-02 |
| Fish Ingestion Rate (kg/d) | 1.68E-01 |
| Total Dietary Intake (kg/d) | 2.24E-01 |
| Water ingestion rate (L/day) | 7.90E-02 |
| Fish Dry wt./wet wt. CF | 1.00E+00 |
| Sediment Dry wt./wet wt. CF | 6.50E-01 |
| Home range (ha) | 2.66E+02 |
| AUF | 1.00E+00 |
| Invert Dry wt./wet wt. CF | 1.00E+00 |
| SUF | 1.00E+00 |

| Constituent | TRV (mg/kg-d) | Conc. in water (mg/L) | Conc. in benthic inverts (mg/kg) | Avg. Conc. in fish (mg/kg) | Intake from water (mg/kg-d) | Intake from benthic inverts (mg/kg-d) | Intake from fish (mg/kg-d) | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.45E+01 | 1.00E-03 | 5.80E+00 | 2.90E+00 | 7.75E-05 | 3.19E-01 | 4.78E-01 | 5.3E-06 | 2.2E-02 | 3.3E-02 | 5.5E-02 |
| Acenaphthylene | 1.45E+01 | 1.00E-03 | 8.50E-02 | 7.83E-02 | 7.75E-05 | 4.68E-03 | 1.29E-02 | 5.3E-06 | 3.2E-04 | 8.9E-04 | 1.2E-03 |
| Anthracene | NA | 7.75E-05 | 1.00E+00 | 4.67E-01 | 6.01E-06 | 5.50E-02 | 7.70E-02 | NA | NA | NA | 0.0E+00 |
| Benzo(a)anthracene | 9.78E+00 | 1.00E-05 | 2.00E-01 | 1.12E-01 | 7.75E-07 | 1.10E-02 | 1.84E-02 | 7.9E-08 | 1.1E-03 | 1.9E-03 | 3.0E-03 |
| Benzo(a)pyrene | 9.78E+00 | 4.00E-05 | 1.10E-01 | 8.67E-02 | 3.10E-06 | 6.05E-03 | 1.43E-02 | 3.2E-07 | 6.2E-04 | 1.5E-03 | 2.1E-03 |
| Benzo(b)fluoranthene | 9.78E+00 | 1.27E-04 | 2.10E-01 | 1.20E-01 | 9.83E-06 | 1.16E-02 | 1.98E-02 | 1.0E-06 | 1.2E-03 | 2.0E-03 | 3.2E-03 |
| Benzo(g,h,i)perylene | 9.78E+00 | 3.00E-05 | 8.00E-02 | 7.67E-02 | 2.32E-06 | 4.40E-03 | 1.27E-02 | 2.4E-07 | 4.5E-04 | 1.3E-03 | 1.7E-03 |
| Benzo(k)fluoranthene | 9.78E+00 | 3.20E-05 | 6.40E-02 | 7.13E-02 | 2.48E-06 | 3.52E-03 | 1.18E-02 | 2.5E-07 | 3.6E-04 | 1.2E-03 | 1.6E-03 |
| Chrysene | 9.78E+00 | 7.75E-05 | 2.10E-01 | 1.21E-01 | 6.01E-06 | 1.16E-02 | 2.00E-02 | 6.1E-07 | 1.2E-03 | 2.0E-03 | 3.2E-03 |
| Dibenzo(a,h)anthracene | 9.78E+00 | 1.50E-05 | 9.50E-02 | 8.17E-02 | 1.16E-06 | 5.23E-03 | 1.35E-02 | 1.2E-07 | 5.3E-04 | 1.4E-03 | 1.9E-03 |
| Fluoranthene | 2.44E+01 | 1.33E-04 | 3.40E+00 | 1.63E+00 | 1.03E-05 | 1.87E-01 | 2.69E-01 | 4.2E-07 | 7.7E-03 | 1.1E-02 | 1.9E-02 |
| Fluorene | 2.44E+01 | 1.00E-04 | 3.70E+00 | 1.80E+00 | 7.75E-06 | 2.04E-01 | 2.96E-01 | 3.2E-07 | 8.3E-03 | 1.2E-02 | 2.0E-02 |
| Indeno(1,2,3-cd)pyrene | 9.78E+00 | 3.90E-05 | 9.50E-02 | 8.17E-02 | 3.02E-06 | 5.23E-03 | 1.35E-02 | 3.1E-07 | 5.3E-04 | 1.4E-03 | 1.9E-03 |
| Naphthalene | 1.81E+01 | 1.00E-03 | 2.30E+00 | 1.29E+00 | 7.75E-05 | 1.27E-01 | 2.13E-01 | 4.3E-06 | 7.0E-03 | 1.2E-02 | 1.9E-02 |
| Phenanthrene | 1.22E+01 | 3.00E-04 | 6.80E+00 | 3.12E+00 | 2.32E-05 | 3.74E-01 | 5.14E-01 | 1.9E-06 | 3.1E-02 | 4.2E-02 | 7.3E-02 |
| Pyrene | 1.22E+01 | 1.00E-04 | 1.60E+00 | 9.10E-01 | 7.75E-06 | 8.80E-02 | 1.50E-01 | 6.4E-07 | 7.2E-03 | 1.2E-02 | 2.0E-02 |
| Pentachlorophenol | 1.81E+01 | 2.15E-04 | 0.00E+00 | 0.00E+00 | 1.67E-05 | 0.00E+00 | 0.00E+00 | 9.2E-07 | 0.0E+00 | 0.0E+00 | 9.2E-07 |
| 2,3,7,8-TCDD TEQ (mamm) | 7.65E-06 | NA | 1.83E-06 | 1.45E-06 | NA | 1.00E-07 | 2.39E-07 | NA | 1.3E-02 | 3.1E-02 | 4.4E-02 |
| | | | | | | | PAHs | 2.1E-05 | 8.9E-02 | 1.4E-01 | 2.3E-01 |
| | | | | | | | Pentachlorophenol | 9.2E-07 | 0.0E+00 | 0.0E+00 | 9.2E-07 |
| | | | | | | | TCDD TEQ | NA | 1.3E-02 | 3.1E-02 | 4.4E-02 |

Notes:
See Table 3-11 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit

**Evaluation of Potential Risk to American Robin**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | American Robin |
| Pathway: | Consumption of Vegetation<br>Soil Ingestion<br>Consumption of Earthworms<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Body Weight (kg): | 7.90E-02 |
| Total dietary intake (kg/d): | 9.52E-02 |
| Soil Ingestion Rate (kg/d): | 1.13E-03 |
| Veg IR | 4.71E-02 |
| earthworm ir | 4.81E-02 |
| soil dw/ww CF | 6.00E-01 |
| veg dw/ww CF | 2.00E-01 |
| Water ingestion rate (L/d) | 1.11E-02 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 5.00E-01 |
| Home Range | 2.50E-01 |

| Constituent | TRV (mg/kg-d) | Mean Conc. in soil (mg/kg) | Avg Conc. in US Water (mg/L) | earthworms BTF [(mg/kg)/(mg/kg)] | Conc. in earthworms (mg/kg) | Veg BTF [(mg/kg)/(mg/kg)] | Conc. in veg (mg/kg) | Intake from Soil (mg/kg-d) | Intake from water (mg/kg-d) | Intake from earth (mg/kg-d) | Intake from veg (mg/kg-d) | HQ Soil | HQ Water | HQ veg | HQ-earth | Total HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+01 | 1.55E-01 | 1.00E-03 | 8.00E-02 | 1.24E-02 | 4.50E-02 | 6.97E-03 | 1.11E-03 | 7.00E-05 | 3.77E-03 | 4.16E-04 | 1.1E-04 | 6.93E-06 | 4.1E-05 | 3.7E-04 | 5.3E-04 |
| Acenaphthylene | 1.01E+01 | 1.70E-01 | 1.00E-03 | 8.00E-02 | 1.36E-02 | 4.50E-02 | 7.65E-03 | 1.22E-03 | 7.00E-05 | 4.14E-03 | 4.56E-04 | 1.2E-04 | 6.93E-06 | 4.5E-05 | 4.1E-04 | 5.8E-04 |
| Anthracene | 1.11E+01 | 2.47E-01 | 7.75E-05 | 8.00E-02 | 1.98E-02 | 4.50E-02 | 1.11E-02 | 1.77E-03 | 5.43E-06 | 6.01E-03 | 6.63E-04 | 1.6E-04 | 4.89E-07 | 6.0E-05 | 5.4E-04 | 7.6E-04 |
| Benzo(a)anthracene | 1.01E+01 | 1.12E-01 | 1.00E-05 | 3.00E-02 | 3.37E-03 | 2.02E-02 | 2.27E-03 | 8.03E-04 | 7.00E-07 | 1.03E-03 | 1.35E-04 | 8.0E-05 | 6.93E-08 | 1.3E-05 | 1.0E-04 | 1.9E-04 |
| Benzo(a)pyrene | 1.01E+01 | 2.09E-01 | 4.00E-05 | 7.00E-02 | 1.46E-02 | 1.11E-02 | 2.32E-03 | 1.49E-03 | 2.80E-06 | 4.44E-03 | 1.38E-04 | 1.5E-04 | 2.77E-07 | 1.4E-05 | 4.4E-04 | 6.0E-04 |
| Benzo(b)fluoranthene | 1.01E+01 | 2.70E-01 | 1.27E-04 | 7.00E-02 | 1.89E-02 | 1.01E-02 | 2.73E-03 | 1.93E-03 | 8.88E-06 | 5.75E-03 | 1.63E-04 | 1.9E-04 | 8.79E-07 | 1.6E-05 | 5.7E-04 | 7.8E-04 |
| Benzo(g,h,i)perylene | 1.01E+01 | 4.37E-01 | 3.00E-05 | 8.00E-02 | 3.50E-02 | 4.50E-02 | 1.97E-02 | 3.13E-03 | 2.10E-06 | 1.06E-02 | 1.17E-03 | 3.1E-04 | 2.08E-07 | 1.2E-04 | 1.1E-03 | 1.5E-03 |
| Benzo(k)fluoranthene | 1.01E+01 | 1.10E-01 | 3.20E-05 | 8.00E-02 | 8.82E-03 | 1.01E-02 | 1.11E-03 | 7.88E-04 | 2.24E-06 | 2.68E-03 | 6.64E-05 | 7.8E-05 | 2.22E-07 | 6.6E-06 | 2.7E-04 | 3.5E-04 |
| Chrysene | 1.01E+01 | 2.24E-01 | 7.75E-05 | 4.00E-02 | 8.96E-03 | 1.87E-02 | 4.19E-03 | 1.60E-03 | 5.43E-06 | 2.73E-03 | 2.50E-04 | 1.6E-04 | 5.37E-07 | 2.5E-05 | 2.7E-04 | 4.5E-04 |
| Dibenzo(a,h)anthracene | 1.01E+01 | 1.46E-01 | 1.50E-05 | 7.00E-02 | 1.02E-02 | 6.40E-03 | 9.32E-04 | 1.04E-03 | 1.05E-06 | 3.10E-03 | 5.56E-05 | 1.0E-04 | 1.04E-07 | 5.5E-06 | 3.1E-04 | 4.2E-04 |
| Fluoranthene | 1.01E+01 | 1.22E-01 | 1.33E-04 | 8.00E-02 | 9.73E-03 | 4.50E-02 | 5.47E-03 | 8.69E-04 | 9.28E-06 | 2.96E-03 | 3.26E-04 | 8.6E-05 | 9.18E-07 | 3.2E-05 | 2.9E-04 | 4.1E-04 |
| Fluorene | 1.01E+01 | 1.29E-01 | 1.00E-04 | 8.00E-02 | 1.03E-02 | 4.50E-02 | 5.81E-03 | 9.23E-04 | 7.00E-06 | 3.14E-03 | 3.47E-04 | 9.1E-05 | 6.93E-07 | 3.4E-05 | 3.1E-04 | 4.4E-04 |
| Indeno(1,2,3-cd)pyrene | 1.01E+01 | 3.82E-01 | 3.90E-05 | 8.00E-02 | 3.06E-02 | 3.90E-03 | 1.49E-03 | 2.73E-03 | 2.73E-06 | 9.30E-03 | 8.89E-05 | 2.7E-04 | 2.70E-07 | 8.8E-06 | 9.2E-04 | 1.2E-03 |
| Naphthalene | 1.11E+01 | 1.33E-01 | 1.00E-03 | 8.00E-02 | 1.06E-02 | 4.50E-02 | 5.99E-03 | 9.52E-04 | 7.00E-05 | 3.24E-03 | 3.57E-04 | 8.6E-05 | 6.31E-06 | 3.2E-05 | 2.9E-04 | 4.2E-04 |
| Phenanthrene | 1.13E+01 | 9.61E-02 | 3.00E-04 | 8.00E-02 | 7.69E-03 | 4.50E-02 | 4.32E-03 | 6.87E-04 | 2.10E-05 | 2.34E-03 | 2.58E-04 | 6.1E-05 | 1.86E-06 | 2.3E-05 | 2.1E-04 | 2.9E-04 |
| Pyrene | 1.11E+01 | 1.20E-01 | 1.00E-04 | 8.00E-02 | 9.59E-03 | 4.50E-02 | 5.40E-03 | 8.57E-04 | 7.00E-06 | 2.92E-03 | 3.22E-04 | 7.7E-05 | 6.31E-07 | 2.9E-05 | 2.6E-04 | 3.7E-04 |
| Pentachlorophenol | NA | 1.38E+00 | 2.15E-04 | 1.00E+00 | 1.38E+00 | 4.49E-02 | 6.18E-02 | 9.85E-03 | 1.51E-05 | 4.19E-01 | 3.69E-03 | NA | NA | NA | NA | 0.0E+00 |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-04 | 2.81E-05 | NA | 4.40E-01 | 1.24E-05 | 5.60E-03 | 1.57E-07 | 2.01E-07 | NA | 3.76E-06 | 9.39E-09 | 1.4E-03 | NA | 6.7E-05 | 2.7E-02 | 2.8E-02 |
| | | | | | | | | | | | PAHs | 2.1E-03 | 2.7E-05 | 5.0E-04 | 6.6E-03 | 9.3E-03 |
| | | | | | | | | | | | Pentachlorophenol | NA | NA | NA | NA | 0.0E+00 |
| | | | | | | | | | | | TCDD TEQ | 1.4E-03 | NA | 6.7E-05 | 2.7E-02 | 2.8E-02 |

Notes:
See Table 3-9 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit

**Evaluation of Potential Risk to Swallow**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Swallow |
| Pathway: | Consumption of Insects<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Body Weight (kg): | 2.00E-02 |
| Total Dietary Intake (kg/d): | 3.52E-02 |
| Insect Ingestion Rate (kg/d): | 3.52E-02 |
| Water Ingestion Rate (L/d): | 4.40E-03 |
| Home Range (ha) | 7.80E+00 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 5.00E-01 |

| Constituent | TRV (mg/kg-d) | Avg Conc. in US Water (mg/L) | Avg. Conc. In US Insects (mg/kg) | Intake from Water (mg/kg-d) | Intake from Insects (mg/kg-d) | TQ-Water | TQ-Insects | Total TQ |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+01 | 1.00E-03 | 4.33E-02 | 1.10E-04 | 3.81E-02 | 1.1E-05 | 3.8E-03 | 3.8E-03 |
| Acenaphthylene | 1.01E+01 | 1.00E-03 | 2.13E-01 | 1.10E-04 | 1.88E-01 | 1.1E-05 | 1.9E-02 | 1.9E-02 |
| Anthracene | 1.11E+01 | 7.75E-05 | 5.33E-02 | 8.53E-06 | 4.69E-02 | 7.7E-07 | 4.2E-03 | 4.2E-03 |
| Benzo(a)anthracene | 1.01E+01 | 1.00E-05 | 5.33E-02 | 1.10E-06 | 4.69E-02 | 1.1E-07 | 4.6E-03 | 4.6E-03 |
| Benzo(a)pyrene | 1.01E+01 | 4.00E-05 | 5.33E-02 | 4.40E-06 | 4.69E-02 | 4.4E-07 | 4.6E-03 | 4.6E-03 |
| Benzo(b)fluoranthene | 1.01E+01 | 1.27E-04 | 5.10E-02 | 1.39E-05 | 4.49E-02 | 1.4E-06 | 4.4E-03 | 4.4E-03 |
| Benzo(g,h,i)perylene | 1.01E+01 | 3.00E-05 | 5.83E-02 | 3.30E-06 | 5.13E-02 | 3.3E-07 | 5.1E-03 | 5.1E-03 |
| Benzo(k)fluoranthene | 1.01E+01 | 3.20E-05 | 5.33E-02 | 3.52E-06 | 4.69E-02 | 3.5E-07 | 4.6E-03 | 4.6E-03 |
| Chrysene | 1.01E+01 | 7.75E-05 | 5.33E-02 | 8.53E-06 | 4.69E-02 | 8.4E-07 | 4.6E-03 | 4.6E-03 |
| Dibenzo(a,h)anthracene | 1.01E+01 | 1.50E-05 | 5.33E-02 | 1.65E-06 | 4.69E-02 | 1.6E-07 | 4.6E-03 | 4.6E-03 |
| Fluoranthene | 1.01E+01 | 1.33E-04 | 2.23E-01 | 1.46E-05 | 1.97E-01 | 1.4E-06 | 1.9E-02 | 1.9E-02 |
| Fluorene | 1.01E+01 | 1.00E-04 | 4.20E-02 | 1.10E-05 | 3.70E-02 | 1.1E-06 | 3.7E-03 | 3.7E-03 |
| Indeno(1,2,3-cd)pyrene | 1.01E+01 | 3.90E-05 | 5.33E-02 | 4.29E-06 | 4.69E-02 | 4.2E-07 | 4.6E-03 | 4.6E-03 |
| Naphthalene | 1.11E+01 | 1.00E-03 | 7.10E-02 | 1.10E-04 | 6.25E-02 | 9.9E-06 | 5.6E-03 | 5.6E-03 |
| Phenanthrene | 1.13E+01 | 3.00E-04 | 6.27E-02 | 3.30E-05 | 5.51E-02 | 2.9E-06 | 4.9E-03 | 4.9E-03 |
| Pyrene | 1.11E+01 | 1.00E-04 | 5.33E-02 | 1.10E-05 | 4.69E-02 | 9.9E-07 | 4.2E-03 | 4.2E-03 |
| Pentachlorophenol | NA | 2.15E-04 | 0.00E+00 | 2.37E-05 | 0.00E+00 | NA | NA | 0.0E+00 |
| 2,3,7,8-TCDD TEQ (avian | 1.40E-04 | NA | 1.93E-06 | NA | 1.70E-06 | NA | 1.2E-02 | 1.2E-02 |
| | | | | | PAHs | 4.3E-05 | 1.0E-01 | 1.0E-01 |
| | | | | | Pentachlorophenol | NA | NA | 0.0E+00 |
| | | | | | TCDD TEQ | NA | 1.2E-02 | 1.2E-02 |

Notes:
See Table 3-9 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit

**Evaluation of Potential Risk to Meadow Vole**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Meadow Vole |
| Pathway: | Soil Ingestion<br>Consumption of Surface Water<br>Consumption of Vegetation |

| Parameter | Value |
|---|---|
| Vegetation Ingestion Rate (kg/d) | 1.15E-02 |
| Body Weight (kg) | 2.24E-02 |
| Total Dietary Intake (kg/d) | 1.15E-02 |
| soil dw/ww CF | 6.00E-01 |
| veg dw/ww CF | 2.00E-01 |
| Soil Ingestion Rate (kg/day) | 2.76E-04 |
| Water Ingestion Rate (L/d) | 4.71E-03 |
| Home Range (ha) | 2.00E-02 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | |

| Constituent | NOAEL TRV (mg/kg-d) | Mean Conc. in soil (mg/kg) | Veg. BTF [(mg/kg)/(mg/kg)] | Conc. in Veg. (mg/kg) | Mean Conc. In US SW (mg/L) | Intake from Soil (mg/kg-d) | Intake from Veg. (mg/kg-d) | Intake from Water (mg/kg-d) | TQ-Soil | TQ-Veg. | TQ-Water | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 3.42E+01 | 1.55E-01 | 4.50E-02 | 6.97E-03 | 1.00E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Acenaphthylene | 3.42E+01 | 1.70E-01 | 4.50E-02 | 7.65E-03 | 1.00E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Anthracene | NA | 2.47E-01 | 4.50E-02 | 1.11E-02 | 7.75E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | NA | NA | NA | 0.0E+00 |
| Benzo(a)anthracene | 9.78E+00 | 1.12E-01 | 2.02E-02 | 2.27E-03 | 1.00E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(a)pyrene | 9.78E+00 | 2.09E-01 | 1.11E-02 | 2.32E-03 | 4.00E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 9.78E+00 | 2.70E-01 | 1.01E-02 | 2.73E-03 | 1.27E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(g,h,i)perylene | 9.78E+00 | 4.37E-01 | 4.50E-02 | 1.97E-02 | 3.00E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(k)fluoranthene | 9.78E+00 | 1.10E-01 | 1.01E-02 | 1.11E-03 | 3.20E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 9.78E+00 | 2.24E-01 | 1.87E-02 | 4.19E-03 | 7.75E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Dibenzo(a,h)anthracene | 9.78E+00 | 1.46E-01 | 6.40E-03 | 9.32E-04 | 1.50E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Fluoranthene | 2.44E+01 | 1.22E-01 | 4.50E-02 | 5.47E-03 | 1.33E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Fluorene | 2.44E+01 | 1.29E-01 | 4.50E-02 | 5.81E-03 | 1.00E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Indeno(1,2,3-cd)pyrene | 9.78E+00 | 3.82E-01 | 3.90E-03 | 1.49E-03 | 3.90E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Naphthalene | 1.81E+01 | 1.33E-01 | 4.50E-02 | 5.99E-03 | 1.00E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Phenanthrene | 1.22E+01 | 9.61E-02 | 4.50E-02 | 4.32E-03 | 3.00E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Pyrene | 1.22E+01 | 1.20E-01 | 4.50E-02 | 5.40E-03 | 1.00E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Pentachlorophenol | 1.81E+01 | 1.38E+00 | 4.49E-02 | 6.18E-02 | 2.15E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 2,3,7,8-TCDD TEQ (mamm) | 1.81E-05 | 2.95E-05 | 5.60E-03 | 1.65E-07 | NA | 0.00E+00 | 0.00E+00 | NA | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |
| | | | | | | | | PAHs | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| | | | | | | | | Pentachlorophenol | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| | | | | | | | | TCDD TEQ | 0.0E+00 | 0.0E+00 | NA | 0.0E+00 |

Notes:
See Table 3-11 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit

**Area 3**
**Ecological Risk Calculations**
**Using TRVs Based on LOAELs**

**Evaluation of Potential Risk to Little Brown Bat**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Little Brown Bat |
| Pathway: | Consumption of Invertebrates<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Invert Ingestion Rate (kg/d): | 5.11E-03 |
| Total Dietary Intake (kg/d) | 5.11E-03 |
| Body Weight (kg) | 9.00E-03 |
| Invert Dry wt./wet wt. CF | 1.00E+00 |
| Water Ingestion Rate (L/d) | 1.43E-03 |
| Home range (ha) | 1.00E+01 |
| SUF | 5.00E-01 |
| AUF | 1.00E+00 |

| Constituent | TRV (mg/kg-d) | Mean Conc. In DS SW (mg/L) | Mean Conc. in inverts (mg/kg) | Intake from water (mg/kg-d) | Intake from inverts (mg/kg-d) | TQ-water | TQ-inverts | TQ-inverts |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 5.04E+01 | 1.00E-03 | 4.33E-02 | 2.84E-04 | 1.23E-02 | 5.6E-06 | 2.4E-04 | 2.5E-04 |
| Acenaphthylene | 5.04E+01 | 1.00E-03 | 2.13E-01 | 2.84E-04 | 6.05E-02 | 5.6E-06 | 1.2E-03 | 1.2E-03 |
| Anthracene | NA | 5.00E-05 | 5.33E-02 | 1.42E-05 | 1.51E-02 | NA | NA | 0.0E+00 |
| Benzo(a)anthracene | 1.44E+01 | 1.00E-05 | 5.33E-02 | 2.84E-06 | 1.51E-02 | 2.0E-07 | 1.1E-03 | 1.1E-03 |
| Benzo(a)pyrene | 1.44E+01 | 1.00E-05 | 5.33E-02 | 2.84E-06 | 1.51E-02 | 2.0E-07 | 1.1E-03 | 1.1E-03 |
| Benzo(b)fluoranthene | 1.44E+01 | 2.70E-05 | 5.10E-02 | 7.66E-06 | 1.45E-02 | 5.3E-07 | 1.0E-03 | 1.0E-03 |
| Benzo(g,h,i)perylene | 1.44E+01 | 2.75E-05 | 5.83E-02 | 7.80E-06 | 1.66E-02 | 5.4E-07 | 1.1E-03 | 1.1E-03 |
| Benzo(k)fluoranthene | 1.44E+01 | 1.00E-05 | 5.33E-02 | 2.84E-06 | 1.51E-02 | 2.0E-07 | 1.1E-03 | 1.1E-03 |
| Chrysene | 1.44E+01 | 7.75E-05 | 5.33E-02 | 2.20E-05 | 1.51E-02 | 1.5E-06 | 1.1E-03 | 1.1E-03 |
| Dibenzo(a,h)anthracene | 1.44E+01 | 1.50E-05 | 5.33E-02 | 4.26E-06 | 1.51E-02 | 3.0E-07 | 1.1E-03 | 1.1E-03 |
| Fluoranthene | 3.60E+01 | 1.00E-04 | 2.23E-01 | 2.84E-05 | 6.34E-02 | 7.9E-07 | 1.8E-03 | 1.8E-03 |
| Fluorene | 3.60E+01 | 1.00E-04 | 4.20E-02 | 2.84E-05 | 1.19E-02 | 7.9E-07 | 3.3E-04 | 3.3E-04 |
| Indeno(1,2,3-cd)pyrene | 1.44E+01 | 2.75E-05 | 5.33E-02 | 7.80E-06 | 1.51E-02 | 5.4E-07 | 1.1E-03 | 1.1E-03 |
| Naphthalene | 2.66E+01 | 1.00E-03 | 7.10E-02 | 2.84E-04 | 2.01E-02 | 1.1E-05 | 7.6E-04 | 7.7E-04 |
| Phenanthrene | 1.80E+01 | 2.75E-04 | 6.27E-02 | 7.80E-05 | 1.78E-02 | 4.3E-06 | 9.9E-04 | 9.9E-04 |
| Pyrene | 1.80E+01 | 1.00E-04 | 5.33E-02 | 2.84E-05 | 1.51E-02 | 1.6E-06 | 8.4E-04 | 8.4E-04 |
| pentachlorophenol | 2.66E+01 | 2.50E-04 | 0.00E+00 | 7.09E-05 | 0.00E+00 | 2.7E-06 | 0.0E+00 | 2.7E-06 |
| 2,3,7,8-TCDD TEQ (Mamm | 2.66E-05 | NA | 1.90E-06 | NA | 5.40E-07 | NA | 2.0E-02 | 2.0E-02 |
| | | | | | PAHs | 3.3E-05 | 1.5E-02 | 1.5E-02 |
| | | | | | Pentachlorphenol | 2.7E-06 | 0.0E+00 | 2.7E-06 |
| | | | | | TCDD TEQ | NA | 2.0E-02 | 2.0E-02 |

Notes:
See Table 3-11 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Belted Kingfisher**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Belted kingfisher |
| Pathway: | Consumption of Invertebrates<br>Consumption of Fish<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Invert Ingestion Rate (kg/d): | 3.68E-02 |
| Fish Ingestion Rate (kg/d) | 3.68E-02 |
| Total Dietary Intake (kg/d) | 7.37E-02 |
| Water ingestion rate (L/day) | 1.10E-01 |
| Body Weight (kg) | 1.47E-01 |
| Fish Dry wt./wet wt. CF | 1.00E+00 |
| Sediment Dry wt./wet wt. CF | 6.50E-01 |
| Ins Dry wt./wet wt. CF | 1.00E+00 |
| Home range (km shoreline) | 1.16E+00 |
| AUF | 1.00E+00 |
| SUF | 5.00E-01 |

| Constituent | TRV (mg/kg-d) | Conc. in water (mg/kg-d) | Conc. in benthic inverts (mg/kg) | Conc. in fish (mg/kg) | Intake from water (mg/kg-d) | from benthic inverts (mg/kg-d) | Intake from fish (mg/kg-d) | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+01 | 1.00E-03 | 4.60E-01 | 2.13E-01 | 3.73E-04 | 5.75E-02 | 2.67E-02 | 3.7E-05 | 5.7E-03 | 2.6E-03 | 8.4E-03 |
| Acenaphthylene | 1.01E+01 | 1.00E-03 | 1.60E-02 | 2.67E-02 | 3.73E-04 | 2.00E-03 | 3.33E-03 | 3.7E-05 | 2.0E-04 | 3.3E-04 | 5.7E-04 |
| Anthracene | 1.11E+01 | 5.00E-05 | 1.30E-01 | 7.30E-02 | 1.87E-05 | 1.63E-02 | 9.13E-03 | 1.7E-06 | 1.5E-03 | 8.2E-04 | 2.3E-03 |
| Benzo(a)anthracene | 1.01E+01 | 1.00E-05 | 1.70E-01 | 7.17E-02 | 3.73E-06 | 2.13E-02 | 8.96E-03 | 3.7E-07 | 2.1E-03 | 8.9E-04 | 3.0E-03 |
| Benzo(a)pyrene | 1.01E+01 | 1.00E-05 | 8.10E-02 | 4.83E-02 | 3.73E-06 | 1.01E-02 | 6.04E-03 | 3.7E-07 | 1.0E-03 | 6.0E-04 | 1.6E-03 |
| Benzo(b)fluoranthene | 1.01E+01 | 2.70E-05 | 1.90E-01 | 8.27E-02 | 1.01E-05 | 2.38E-02 | 1.03E-02 | 1.0E-06 | 2.4E-03 | 1.0E-03 | 3.4E-03 |
| Benzo(g,h,i)perylene | 1.01E+01 | 2.75E-05 | 3.30E-02 | 3.23E-02 | 1.03E-05 | 4.13E-03 | 4.04E-03 | 1.0E-06 | 4.1E-04 | 4.0E-04 | 8.1E-04 |
| Benzo(k)fluoranthene | 1.01E+01 | 1.00E-05 | 4.40E-02 | 3.38E-02 | 3.73E-06 | 5.50E-03 | 4.23E-03 | 3.7E-07 | 5.4E-04 | 4.2E-04 | 9.6E-04 |
| Chrysene | 1.01E+01 | 7.75E-05 | 8.20E-02 | 4.03E-02 | 2.89E-05 | 1.03E-02 | 5.04E-03 | 2.9E-06 | 1.0E-03 | 5.0E-04 | 1.5E-03 |
| Dibenzo(a,h)anthracene | 1.01E+01 | 1.50E-05 | 4.40E-02 | 3.38E-02 | 5.60E-06 | 5.50E-03 | 4.23E-03 | 5.5E-07 | 5.4E-04 | 4.2E-04 | 9.6E-04 |
| Fluoranthene | 1.01E+01 | 1.00E-04 | 1.10E+00 | 4.53E-01 | 3.73E-05 | 1.38E-01 | 5.66E-02 | 3.7E-06 | 1.4E-02 | 5.6E-03 | 1.9E-02 |
| Fluorene | 1.01E+01 | 1.00E-04 | 2.80E-01 | 1.31E-01 | 3.73E-05 | 3.50E-02 | 1.63E-02 | 3.7E-06 | 3.5E-03 | 1.6E-03 | 5.1E-03 |
| Indeno(1,2,3-cd)pyrene | 1.01E+01 | 2.75E-05 | 4.40E-02 | 3.38E-02 | 1.03E-05 | 5.50E-03 | 4.23E-03 | 1.0E-06 | 5.4E-04 | 4.2E-04 | 9.6E-04 |
| Naphthalene | 1.11E+01 | 1.00E-03 | 4.60E-01 | 1.75E-01 | 3.73E-04 | 5.75E-02 | 2.19E-02 | 3.4E-05 | 5.2E-03 | 2.0E-03 | 7.2E-03 |
| Phenanthrene | 1.13E+01 | 2.75E-04 | 7.40E-01 | 3.59E-01 | 1.03E-04 | 9.25E-02 | 4.48E-02 | 9.1E-06 | 8.2E-03 | 4.0E-03 | 1.2E-02 |
| Pyrene | 1.11E+01 | 1.00E-04 | 3.60E-01 | 1.96E-01 | 3.73E-05 | 4.50E-02 | 2.45E-02 | 3.4E-06 | 4.1E-03 | 2.2E-03 | 6.3E-03 |
| Pentachlorophenol | NA | 2.50E-04 | 0.00E+00 | 0.00E+00 | 9.33E-05 | 0.00E+00 | 0.00E+00 | NA | NA | NA | 0.0E+00 |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-04 | NA | 8.95E-07 | 6.47E-07 | NA | 1.12E-07 | 8.09E-08 | NA | 8.0E-04 | 5.8E-04 | 1.4E-03 |
| | | | | | | | PAHs | 1.4E-04 | 5.0E-02 | 2.4E-02 | 7.4E-02 |
| | | | | | | | Pentachlorphenol | NA | NA | NA | 0.0E+00 |
| | | | | | | | TCDD TEQ | NA | 8.0E-04 | 5.8E-04 | 1.4E-03 |

Notes:
See Table 3-9 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Mink**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Mink |
| Pathway: | Consumption of invertebrates<br>Consumption of fish<br>Consumption of Surface Water |

| Parameter | Value |
|---|---|
| Body Weight (kg) | 1.02E+00 |
| Invert Ingestion Rate (kg/d): | 5.61E-02 |
| Fish Ingestion Rate (kg/d) | 1.68E-01 |
| Total Dietary Intake (kg/d) | 2.24E-01 |
| Water ingestion rate (L/day) | 7.90E-02 |
| Fish Dry wt./wet wt. CF | 1.00E+00 |
| Sediment Dry wt./wet wt. CF | 6.50E-01 |
| Home range (ha) | 2.66E+02 |
| AUF | 1.00E+00 |
| Invert Dry wt./wet wt. CF | 1.00E+00 |
| SUF | 1.00E+00 |

| Constituent | TRV (mg/kg-d) | Conc. in water (mg/L) | Conc. in benthic inverts (mg/kg) | Avg. Conc. in fish (mg/kg) | Intake from water (mg/kg-d) | Intake from benthic inverts (mg/kg-d) | Intake from fish (mg/kg-d) | TQ-water | TQ-benthic inverts | TQ-fish | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.45E+01 | 1.00E-03 | 4.60E-01 | 2.13E-01 | 7.75E-05 | 2.53E-02 | 3.52E-02 | 5.3E-06 | 1.7E-03 | 2.4E-03 | 4.2E-03 |
| Acenaphthylene | 1.45E+01 | 1.00E-03 | 1.60E-02 | 2.67E-02 | 7.75E-05 | 8.80E-04 | 4.40E-03 | 5.3E-06 | 6.1E-05 | 3.0E-04 | 3.7E-04 |
| Anthracene | NA | 5.00E-05 | 1.30E-01 | 7.30E-02 | 3.87E-06 | 7.15E-03 | 1.20E-02 | NA | NA | NA | 0.0E+00 |
| Benzo(a)anthracene | 9.78E+00 | 1.00E-05 | 1.70E-01 | 7.17E-02 | 7.75E-07 | 9.35E-03 | 1.18E-02 | 7.9E-08 | 9.6E-04 | 1.2E-03 | 2.2E-03 |
| Benzo(a)pyrene | 9.78E+00 | 1.00E-05 | 8.10E-02 | 4.83E-02 | 7.75E-07 | 4.46E-03 | 7.98E-03 | 7.9E-08 | 4.6E-04 | 8.2E-04 | 1.3E-03 |
| Benzo(b)fluoranthene | 9.78E+00 | 2.70E-05 | 1.90E-01 | 8.27E-02 | 2.09E-06 | 1.05E-02 | 1.36E-02 | 2.1E-07 | 1.1E-03 | 1.4E-03 | 2.5E-03 |
| Benzo(g,h,i)perylene | 9.78E+00 | 2.75E-05 | 3.30E-02 | 3.23E-02 | 2.13E-06 | 1.82E-03 | 5.34E-03 | 2.2E-07 | 1.9E-04 | 5.5E-04 | 7.3E-04 |
| Benzo(k)fluoranthene | 9.78E+00 | 1.00E-05 | 4.40E-02 | 3.38E-02 | 7.75E-07 | 2.42E-03 | 5.58E-03 | 7.9E-08 | 2.5E-04 | 5.7E-04 | 8.2E-04 |
| Chrysene | 9.78E+00 | 7.75E-05 | 8.20E-02 | 4.03E-02 | 6.01E-06 | 4.51E-03 | 6.66E-03 | 6.1E-07 | 4.6E-04 | 6.8E-04 | 1.1E-03 |
| Dibenzo(a,h)anthracene | 9.78E+00 | 1.50E-05 | 4.40E-02 | 3.38E-02 | 1.16E-06 | 2.42E-03 | 5.58E-03 | 1.2E-07 | 2.5E-04 | 5.7E-04 | 8.2E-04 |
| Fluoranthene | 2.44E+01 | 1.00E-04 | 1.10E+00 | 4.53E-01 | 7.75E-06 | 6.05E-02 | 7.47E-02 | 3.2E-07 | 2.5E-03 | 3.1E-03 | 5.5E-03 |
| Fluorene | 2.44E+01 | 1.00E-04 | 2.80E-01 | 1.31E-01 | 7.75E-06 | 1.54E-02 | 2.16E-02 | 3.2E-07 | 6.3E-04 | 8.8E-04 | 1.5E-03 |
| Indeno(1,2,3-cd)pyrene | 9.78E+00 | 2.75E-05 | 4.40E-02 | 3.38E-02 | 2.13E-06 | 2.42E-03 | 5.58E-03 | 2.2E-07 | 2.5E-04 | 5.7E-04 | 8.2E-04 |
| Naphthalene | 1.81E+01 | 1.00E-03 | 4.60E-01 | 1.75E-01 | 7.75E-05 | 2.53E-02 | 2.89E-02 | 4.3E-06 | 1.4E-03 | 1.6E-03 | 3.0E-03 |
| Phenanthrene | 1.22E+01 | 2.75E-04 | 7.40E-01 | 3.59E-01 | 2.13E-05 | 4.07E-02 | 5.92E-02 | 1.7E-06 | 3.3E-03 | 4.9E-03 | 8.2E-03 |
| Pyrene | 1.22E+01 | 1.00E-04 | 3.60E-01 | 1.96E-01 | 7.75E-06 | 1.98E-02 | 3.23E-02 | 6.4E-07 | 1.6E-03 | 2.7E-03 | 4.3E-03 |
| Pentachlorophenol | 1.81E+01 | 2.50E-04 | 0.00E+00 | 0.00E+00 | 1.94E-05 | 0.00E+00 | 0.00E+00 | 1.1E-06 | 0.0E+00 | 0.0E+00 | 1.1E-06 |
| 2,3,7,8-TCDD TEQ (mamm) | 7.65E-06 | NA | 8.00E-07 | 5.92E-07 | NA | 4.40E-08 | 9.77E-08 | NA | 5.8E-03 | 1.3E-02 | 1.9E-02 |
| | | | | | | | PAHs | 2.0E-05 | 1.5E-02 | 2.2E-02 | 3.7E-02 |
| | | | | | | | Pentachlorphenol | 1.1E-06 | 0.0E+00 | 0.0E+00 | 1.1E-06 |
| | | | | | | | TCDD TEQ | NA | 5.8E-03 | 1.3E-02 | 1.9E-02 |

Notes:
See Table 3-11 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to American Robin**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | American Robin |
| Pathway: | Consumption of Earthworms<br>Soil Ingestion<br>Consumption of Surface Water<br>Consumption of Vegetation |

| Parameter | Value |
|---|---|
| Body Weight (kg): | 7.90E-02 |
| Total dietary intake (kg/d): | 9.52E-02 |
| Soil Ingestion Rate (kg/d): | 1.13E-03 |
| Veg IR | 4.71E-02 |
| earthworm ir | 4.81E-02 |
| soil dw/ww CF | 6.00E-01 |
| veg dw/ww CF | 2.00E-01 |
| Water ingestion rate (L/d) | 1.11E-02 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 5.00E-01 |
| Home Range | 2.50E-01 |

| Constituent | TRV (mg/kg-d) | Mean Conc. in soil* (mg/kg) | Avg Conc. in US Water (mg/L) | earthworms BTF [(mg/kg)/(mg/kg)] | Conc. in earthworms (mg/kg) | Veg BTF [(mg/kg)/(mg/kg)] | Conc. in veg (mg/kg) | Intake from Soil (mg/kg-d) | Intake from water (mg/kg-d) | Intake from earth (mg/kg-d) | Intake from veg (mg/kg-d) | HQ Soil | HQ Water | HQ veg | HQ-earth | Total HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+01 | 1.55E-01 | 1.00E-03 | 8.00E-02 | 1.24E-02 | 4.50E-02 | 6.97E-03 | 1.11E-03 | 7.00E-05 | 3.77E-03 | 4.16E-04 | 1.1E-04 | 6.93E-06 | 4.1E-05 | 3.7E-04 | 5.3E-04 |
| Acenaphthylene | 1.01E+01 | 1.70E-01 | 1.00E-03 | 8.00E-02 | 1.36E-02 | 4.50E-02 | 7.65E-03 | 1.22E-03 | 7.00E-05 | 4.14E-03 | 4.56E-04 | 1.2E-04 | 6.93E-06 | 4.5E-05 | 4.1E-04 | 5.8E-04 |
| Anthracene | 1.11E+01 | 2.47E-01 | 5.00E-05 | 8.00E-02 | 1.98E-02 | 4.50E-02 | 1.11E-02 | 1.77E-03 | 3.50E-06 | 6.01E-03 | 6.63E-04 | 1.6E-04 | 3.15E-07 | 6.0E-05 | 5.4E-04 | 7.6E-04 |
| Benzo(a)anthracene | 1.01E+01 | 1.12E-01 | 1.00E-05 | 3.00E-02 | 3.37E-03 | 2.02E-02 | 2.27E-03 | 8.03E-04 | 7.00E-07 | 1.03E-03 | 1.35E-04 | 8.0E-05 | 6.93E-08 | 1.3E-05 | 1.0E-04 | 1.9E-04 |
| Benzo(a)pyrene | 1.01E+01 | 2.09E-01 | 1.00E-05 | 7.00E-02 | 1.46E-02 | 1.11E-02 | 2.32E-03 | 1.49E-03 | 7.00E-07 | 4.44E-03 | 1.38E-04 | 1.5E-04 | 6.93E-08 | 1.4E-05 | 4.4E-04 | 6.0E-04 |
| Benzo(b)fluoranthene | 1.01E+01 | 2.70E-01 | 2.70E-05 | 7.00E-02 | 1.89E-02 | 1.01E-02 | 2.73E-03 | 1.93E-03 | 1.89E-06 | 5.75E-03 | 1.63E-04 | 1.9E-04 | 1.87E-07 | 1.6E-05 | 5.7E-04 | 7.8E-04 |
| Benzo(g,h,i)perylene | 1.01E+01 | 4.37E-01 | 2.75E-05 | 8.00E-02 | 3.50E-02 | 4.50E-02 | 1.97E-02 | 3.13E-03 | 1.93E-06 | 1.06E-02 | 1.17E-03 | 3.1E-04 | 1.91E-07 | 1.2E-04 | 1.1E-03 | 1.5E-03 |
| Benzo(k)fluoranthene | 1.01E+01 | 1.10E-01 | 1.00E-05 | 8.00E-02 | 8.82E-03 | 1.01E-02 | 1.11E-03 | 7.88E-04 | 7.00E-07 | 2.68E-03 | 6.64E-05 | 7.8E-05 | 6.93E-08 | 6.6E-06 | 2.7E-04 | 3.5E-04 |
| Chrysene | 1.01E+01 | 2.24E-01 | 7.75E-05 | 4.00E-02 | 8.96E-03 | 1.87E-02 | 4.19E-03 | 1.60E-03 | 5.43E-06 | 2.73E-03 | 2.50E-04 | 1.6E-04 | 5.37E-07 | 2.5E-05 | 2.7E-04 | 4.5E-04 |
| Dibenzo(a,h)anthracene | 1.01E+01 | 1.46E-01 | 1.50E-05 | 7.00E-02 | 1.02E-02 | 6.40E-03 | 9.32E-04 | 1.04E-03 | 1.05E-06 | 3.10E-03 | 5.56E-05 | 1.0E-04 | 1.04E-07 | 5.5E-06 | 3.1E-04 | 4.2E-04 |
| Fluoranthene | 1.01E+01 | 1.22E-01 | 1.00E-04 | 8.00E-02 | 9.73E-03 | 4.50E-02 | 5.47E-03 | 8.69E-04 | 7.00E-06 | 2.96E-03 | 3.26E-04 | 8.6E-05 | 6.93E-07 | 3.2E-05 | 2.9E-04 | 4.1E-04 |
| Fluorene | 1.01E+01 | 1.29E-01 | 1.00E-04 | 8.00E-02 | 1.03E-02 | 4.50E-02 | 5.81E-03 | 9.23E-04 | 7.00E-06 | 3.14E-03 | 3.47E-04 | 9.1E-05 | 6.93E-07 | 3.4E-05 | 3.1E-04 | 4.4E-04 |
| Indeno(1,2,3-cd)pyrene | 1.01E+01 | 3.82E-01 | 2.75E-05 | 8.00E-02 | 3.06E-02 | 3.90E-03 | 1.49E-03 | 2.73E-03 | 1.93E-06 | 9.30E-03 | 8.89E-05 | 2.7E-04 | 1.91E-07 | 8.8E-06 | 9.2E-04 | 1.2E-03 |
| Naphthalene | 1.11E+01 | 1.33E-01 | 1.00E-03 | 8.00E-02 | 1.06E-02 | 4.50E-02 | 5.99E-03 | 9.52E-04 | 7.00E-05 | 3.24E-03 | 3.57E-04 | 8.6E-05 | 6.31E-06 | 3.2E-05 | 2.9E-04 | 4.2E-04 |
| Phenanthrene | 1.13E+01 | 9.61E-02 | 2.75E-04 | 8.00E-02 | 7.69E-03 | 4.50E-02 | 4.32E-03 | 6.87E-04 | 1.93E-05 | 2.34E-03 | 2.58E-04 | 6.1E-05 | 1.70E-06 | 2.3E-05 | 2.1E-04 | 2.9E-04 |
| Pyrene | 1.11E+01 | 1.20E-01 | 1.00E-04 | 8.00E-02 | 9.59E-03 | 4.50E-02 | 5.40E-03 | 8.57E-04 | 7.00E-06 | 2.92E-03 | 3.22E-04 | 7.7E-05 | 6.31E-07 | 2.9E-05 | 2.6E-04 | 3.7E-04 |
| Pentachlorophenol | NA | 1.38E+00 | 2.50E-04 | 1.00E+00 | 1.38E+00 | 4.49E-02 | 6.18E-02 | 9.85E-03 | 1.75E-05 | 4.19E-01 | 3.69E-03 | NA | NA | NA | NA | 0.0E+00 |
| 2,3,7,8-TCDD TEQ (avian) | 1.40E-04 | 2.81E-05 | NA | 4.40E-01 | 1.24E-05 | 5.60E-03 | 1.57E-07 | 2.01E-07 | NA | 3.76E-06 | 9.39E-09 | 1.4E-03 | NA | 6.7E-05 | 2.7E-02 | 2.8E-02 |
| | | | | | | | | | | | PAHs | 2.1E-03 | 2.6E-05 | 5.0E-04 | 6.6E-03 | 9.3E-03 |
| | | | | | | | | | | | Pentachlorophenol | NA | NA | NA | NA | 0.0E+00 |
| | | | | | | | | | | | TCDD TEQ | 1.4E-03 | NA | 6.7E-05 | 2.7E-02 | 2.8E-02 |

Notes:
See Table 3-9 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Swallow**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

Site: Superior, WI

Area: Off- Property Area

Receptor: Swallow

Pathway: Consumption of Insects
Consumption of Surface Water

| Parameter | Value |
|---|---|
| Body Weight (kg): | 2.00E-02 |
| Total Dietary Intake (kg/d): | 3.52E-02 |
| Insect Ingestion Rate (kg/d): | 3.52E-02 |
| Water Ingestion Rate (L/d): | 4.40E-03 |
| Home Range (ha) | 7.80E+00 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 5.00E-01 |

| Constituent | TRV (mg/kg-d) | Avg Conc. in DS Water (mg/L) | Avg. Conc. In US Insects (mg/kg) | Intake from Water (mg/kg-d) | Intake from Insects (mg/kg-d) | TQ-Water | TQ-Insects | Total TQ |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.01E+01 | 1.00E-03 | 4.33E-02 | 1.10E-04 | 3.81E-02 | 1.1E-05 | 3.8E-03 | 3.8E-03 |
| Acenaphthylene | 1.01E+01 | 1.00E-03 | 2.13E-01 | 1.10E-04 | 1.88E-01 | 1.1E-05 | 1.9E-02 | 1.9E-02 |
| Anthracene | 1.11E+01 | 5.00E-05 | 5.33E-02 | 5.50E-06 | 4.69E-02 | 5.0E-07 | 4.2E-03 | 4.2E-03 |
| Benzo(a)anthracene | 1.01E+01 | 1.00E-05 | 5.33E-02 | 1.10E-06 | 4.69E-02 | 1.1E-07 | 4.6E-03 | 4.6E-03 |
| Benzo(a)pyrene | 1.01E+01 | 1.00E-05 | 5.33E-02 | 1.10E-06 | 4.69E-02 | 1.1E-07 | 4.6E-03 | 4.6E-03 |
| Benzo(b)fluoranthene | 1.01E+01 | 2.70E-05 | 5.10E-02 | 2.97E-06 | 4.49E-02 | 2.9E-07 | 4.4E-03 | 4.4E-03 |
| Benzo(g,h,i)perylene | 1.01E+01 | 2.75E-05 | 5.83E-02 | 3.03E-06 | 5.13E-02 | 3.0E-07 | 5.1E-03 | 5.1E-03 |
| Benzo(k)fluoranthene | 1.01E+01 | 1.00E-05 | 5.33E-02 | 1.10E-06 | 4.69E-02 | 1.1E-07 | 4.6E-03 | 4.6E-03 |
| Chrysene | 1.01E+01 | 7.75E-05 | 5.33E-02 | 8.53E-06 | 4.69E-02 | 8.4E-07 | 4.6E-03 | 4.6E-03 |
| Dibenzo(a,h)anthracene | 1.01E+01 | 1.50E-05 | 5.33E-02 | 1.65E-06 | 4.69E-02 | 1.6E-07 | 4.6E-03 | 4.6E-03 |
| Fluoranthene | 1.01E+01 | 1.00E-04 | 2.23E-01 | 1.10E-05 | 1.97E-01 | 1.1E-06 | 1.9E-02 | 1.9E-02 |
| Fluorene | 1.01E+01 | 1.00E-04 | 4.20E-02 | 1.10E-05 | 3.70E-02 | 1.1E-06 | 3.7E-03 | 3.7E-03 |
| Indeno(1,2,3-cd)pyrene | 1.01E+01 | 2.75E-05 | 5.33E-02 | 3.03E-06 | 4.69E-02 | 3.0E-07 | 4.6E-03 | 4.6E-03 |
| Naphthalene | 1.11E+01 | 1.00E-03 | 7.10E-02 | 1.10E-04 | 6.25E-02 | 9.9E-06 | 5.6E-03 | 5.6E-03 |
| Phenanthrene | 1.13E+01 | 2.75E-04 | 6.27E-02 | 3.03E-05 | 5.51E-02 | 2.7E-06 | 4.9E-03 | 4.9E-03 |
| Pyrene | 1.11E+01 | 1.00E-04 | 5.33E-02 | 1.10E-05 | 4.69E-02 | 9.9E-07 | 4.2E-03 | 4.2E-03 |
| Pentachlorophenol | NA | 2.50E-04 | 0.00E+00 | 2.75E-05 | 0.00E+00 | NA | NA | 0.0E+00 |
| 2,3,7,8-TCDD TEQ (avian | 1.40E-04 | NA | 1.93E-06 | NA | 1.70E-06 | NA | 1.2E-02 | 1.2E-02 |
| | | | | | PAHs | 4.0E-05 | 1.0E-01 | 1.0E-01 |
| | | | | | Pentachlorphenol | NA | NA | 0.0E+00 |
| | | | | | TCDD TEQ | NA | 1.2E-02 | 1.2E-02 |

Notes:
See Table 3-9 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.

**Evaluation of Potential Risk to Meadow Vole**
**Beazer East, Inc.**
**Off-Site Portion of Koppers Inc. Facility**
**Superior, WI**

| | |
|---|---|
| Site: | Superior, WI |
| Area: | Off- Property Area |
| Receptor: | Meadow Vole |
| Pathway: | Soil Ingestion<br>Consumption of Surface Water<br>Consumption of Vegetation |

| Parameter | Value |
|---|---|
| Vegetation Ingestion Rate (kg/d) | 1.15E-02 |
| Body Weight (kg) | 2.24E-02 |
| Total Dietary Intake (kg/d) | 1.15E-02 |
| soil dw/ww CF | 6.00E-01 |
| veg dw/ww CF | 2.00E-01 |
| Soil Ingestion Rate (kg/day) | 2.76E-04 |
| Water Ingestion Rate (L/d) | 4.71E-03 |
| Home Range (ha) | 2.00E-02 |
| Area Use Factor | 1.00E+00 |
| Seasonal Use Factor | 1.00E+00 |

| Constituent | NOAEL TRV (mg/kg-d) | Mean Conc. in soil* (mg/kg) | Veg. BTF [(mg/kg)/(mg/kg)] | Conc. in Veg. (mg/kg) | Mean Conc. In DS SW (mg/L) | Intake from Soil (mg/kg-d) | Intake from Veg. (mg/kg-d) | Intake from Water (mg/kg-d) | TQ-Soil | TQ-Veg. | TQ-Water | Total TQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 3.42E+01 | 1.55E-01 | 4.50E-02 | 6.97E-03 | 1.00E-03 | 1.90E-03 | 7.14E-04 | 2.10E-04 | 5.57E-05 | 2.09E-05 | 6.14E-06 | 8.27E-05 |
| Acenaphthylene | 3.42E+01 | 1.70E-01 | 4.50E-02 | 7.65E-03 | 1.00E-03 | 2.09E-03 | 7.84E-04 | 2.10E-04 | 6.12E-05 | 2.29E-05 | 6.14E-06 | 9.02E-05 |
| Anthracene | NA | 2.47E-01 | 4.50E-02 | 1.11E-02 | 5.00E-05 | 3.04E-03 | 1.14E-03 | 1.05E-05 | NA | NA | NA | 0.00E+00 |
| Benzo(a)anthracene | 9.78E+00 | 1.12E-01 | 2.02E-02 | 2.27E-03 | 1.00E-05 | 1.38E-03 | 2.33E-04 | 2.10E-06 | 1.41E-04 | 2.38E-05 | 2.15E-07 | 1.65E-04 |
| Benzo(a)pyrene | 9.78E+00 | 2.09E-01 | 1.11E-02 | 2.32E-03 | 1.00E-05 | 2.57E-03 | 2.37E-04 | 2.10E-06 | 2.62E-04 | 2.43E-05 | 2.15E-07 | 2.87E-04 |
| Benzo(b)fluoranthene | 9.78E+00 | 2.70E-01 | 1.01E-02 | 2.73E-03 | 2.70E-05 | 3.32E-03 | 2.79E-04 | 5.67E-06 | 3.40E-04 | 2.86E-05 | 5.80E-07 | 3.69E-04 |
| Benzo(g,h,i)perylene | 9.78E+00 | 4.37E-01 | 4.50E-02 | 1.97E-02 | 2.75E-05 | 5.38E-03 | 2.02E-03 | 5.78E-06 | 5.50E-04 | 2.06E-04 | 5.90E-07 | 7.57E-04 |
| Benzo(k)fluoranthene | 9.78E+00 | 1.10E-01 | 1.01E-02 | 1.11E-03 | 1.00E-05 | 1.36E-03 | 1.14E-04 | 2.10E-06 | 1.39E-04 | 1.17E-05 | 2.15E-07 | 1.51E-04 |
| Chrysene | 9.78E+00 | 2.24E-01 | 1.87E-02 | 4.19E-03 | 7.75E-05 | 2.76E-03 | 4.30E-04 | 1.63E-05 | 2.82E-04 | 4.39E-05 | 1.66E-06 | 3.27E-04 |
| Dibenzo(a,h)anthracene | 9.78E+00 | 1.46E-01 | 6.40E-03 | 9.32E-04 | 1.50E-05 | 1.79E-03 | 9.56E-05 | 3.15E-06 | 1.83E-04 | 9.77E-06 | 3.22E-07 | 1.93E-04 |
| Fluoranthene | 2.44E+01 | 1.22E-01 | 4.50E-02 | 5.47E-03 | 1.00E-04 | 1.50E-03 | 5.61E-04 | 2.10E-05 | 6.13E-05 | 2.30E-05 | 8.61E-07 | 8.51E-05 |
| Fluorene | 2.44E+01 | 1.29E-01 | 4.50E-02 | 5.81E-03 | 1.00E-04 | 1.59E-03 | 5.96E-04 | 2.10E-05 | 6.51E-05 | 2.44E-05 | 8.61E-07 | 9.04E-05 |
| Indeno(1,2,3-cd)pyrene | 9.78E+00 | 3.82E-01 | 3.90E-03 | 1.49E-03 | 2.75E-05 | 4.70E-03 | 1.53E-04 | 5.78E-06 | 4.81E-04 | 1.56E-05 | 5.90E-07 | 4.97E-04 |
| Naphthalene | 1.81E+01 | 1.33E-01 | 4.50E-02 | 5.99E-03 | 1.00E-03 | 1.64E-03 | 6.14E-04 | 2.10E-04 | 9.05E-05 | 3.39E-05 | 1.16E-05 | 1.36E-04 |
| Phenanthrene | 1.22E+01 | 9.61E-02 | 4.50E-02 | 4.32E-03 | 2.75E-04 | 1.18E-03 | 4.43E-04 | 5.78E-05 | 9.69E-05 | 3.63E-05 | 4.73E-06 | 1.38E-04 |
| Pyrene | 1.22E+01 | 1.20E-01 | 4.50E-02 | 5.40E-03 | 1.00E-04 | 1.48E-03 | 5.53E-04 | 2.10E-05 | 1.21E-04 | 4.53E-05 | 1.72E-06 | 1.68E-04 |
| Pentachlorophenol | 1.81E+01 | 1.38E+00 | 4.50E-02 | 6.20E-02 | 2.50E-04 | 1.69E-02 | 6.36E-03 | 5.25E-05 | 9.36E-04 | 3.51E-04 | 2.90E-06 | 1.29E-03 |
| 2,3,7,8-TCDD TEQ (mamm) | 1.81E-05 | 2.95E-05 | 5.60E-03 | 1.65E-07 | NA | 3.62E-07 | 1.69E-08 | NA | 2.00E-02 | 9.34E-04 | NA | 2.10E-02 |
| | | | | | | | | PAHs | 2.9E-03 | 5.7E-04 | 3.6E-05 | 3.5E-03 |
| | | | | | | | | Pentachlorphenol | 9.4E-04 | 3.5E-04 | 2.9E-06 | 1.3E-03 |
| | | | | | | | | TCDD TEQ | 2.0E-02 | 9.3E-04 | NA | 2.1E-02 |

Notes:
See Table 3-11 for TRV sources
NA: not available
All non detected compounds were included at half of the detection limit
For media that were not sampled in this area, the data from Area 2 were used.