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MEMORANDUM ON EXPOSURE SCENARIOS AND ASSUMPTIONS KOPPERS POND KENTUCKY AVENUE WELLFIELD SITE, OPERABLE UNIT 4 HORSEHEADS, NEW YORK

Submitted to:

The Koppers Pond RI/FS Group

Submitted by:

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List of Acronyms

BHHRA	Baseline Human Health Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	Chemicals of Concern
COPCs	Chemicals of Potential Concern
CSMs	Conceptual Site Models
CTE	Central Tendency Exposure
EWB	Elmira Water Board
RAGS	Risk Assessment Guidance for Superfund
MESA	Memorandum on Exposure Scenarios and Assumptions
NYSDOH	New York State Department of Health
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
USEPA	U.S. Environmental Protection Agency
VOCs	Volatile Organic Compounds

MEMORANDUM ON EXPOSURE SCENARIOS AND ASSUMPTIONS KOPPERS POND KENTUCKY AVENUE WELLFIELD SITE, OPERABLE UNIT 4 HORSEHEADS, NEW YORK

1.0 INTRODUCTION

Under a Settlement Agreement entered with the U.S. Environmental Protection Agency (USEPA), the Koppers Pond RI/FS Group is conducting a remedial investigation and feasibility study (RI/FS) of Koppers Pond as Operable Unit 4 of the Kentucky Avenue Wellfield Superfund Site, which is located within the Village of Horseheads and the Town of Horseheads in Chemung County, New York (Figure 1). The Kentucky Avenue Well is a municipal water supply well owned by the Elmira Water Board (EWB) that was used as part of the EWB system to furnish potable water to local communities. The Kentucky Avenue Well was closed in 1980 when it was found that the groundwater produced from this well contained trichloroethylene. In 1983, USEPA included the Kentucky Avenue Wellfield Site on the National Priorities List for response actions under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

1.1 Objective

As set forth in the Settlement Agreement and its attached Statement of Work, a Baseline Human Health Risk Assessment (BHHRA) will be conducted in accordance with guidance promulgated under CERCLA as amended by the Superfund Amendment and Reauthorization Act and implemented by the National Contingency Plan. As part of the BHHRA and in accordance with the Settlement Agreement, this Memorandum on Exposure Scenarios and Assumptions (MESA) has been prepared to: (1) further develop the conceptual site model (CSM); (2) outline potential exposure scenarios; (3) identify potentially exposed receptors and pathways; and (4) discuss the exposure assumptions that will be used in the BHHRA. Pathways and receptors that will not be considered in the BHHRA are identified along with the rationale for their exclusion.

Section 2 summarizes the CSM for this site, which includes the potential receptors, exposure pathways, and preliminary exposure assumptions. Sections 3 and 4 provide a summary of the MESA and references, respectively. Attachment A contains five of the USEPA Risk Assessment Guidance under Superfund (RAGS) Part D tables relevant to this MESA.

2.0 CONCEPTUAL SITE MODEL

The CSM provides a technical overview of the exposure assessment in a site-specific format that indicates likely sources of chemicals of concern (COCs), transport mechanisms, exposure pathways, and potential receptors. A preliminary CSM was submitted to USEPA on February 19, 2007, pursuant to the Settlement Agreement (Koppers Pond RI/FS Group, 2007a). Based on comments received from USEPA on that submittal, an updated preliminary CSM was presented in the Revised RI/FS Work Plan (Koppers Pond RI/FS Group, 2007b). These preliminary CSMs outline the physical characteristics of the study area, including land use and hydrology; the nature and extent of the COCs, including potential sources of the COCs; and the potential transport pathways of site-related chemicals. Key points from these CSMs, which have been updated as new or additional information is developed, are summarized below:

- Koppers Pond is a shallow, flow-through lake with typical water depths of approximately two to five feet and an open water area that covers eight acres. The pond bottom is comprised of soft, mucky (silty) sediments.

- The origin of the pond is not well documented. It is situated in a previously low-lying, wet area that apparently began to fill with water with the onset of discharges from the former Westinghouse plant, which began operating in 1952, and industrial development on the south side of the area that began around 1953.

- The Industrial Drainageway begins approximately 2,300 feet to the north-northwest of Koppers Pond at the outlet of the "Chemung Street Outfall" (Figure 2). This drainageway carries discharges from the former Westinghouse Horseheads plant site and other upstream areas into Koppers Pond.

- Two outlet streams flow from the southern end of Koppers Pond and merge about 500 feet downstream to a single outlet channel that flows past the Hardinge, Inc. (Hardinge) plant site and into Halderman Hollow Creek. From there, the creek flows through mixed industrial, commercial, and residential areas and discharges into Newtown Creek approximately three miles south of Koppers Pond.

- Metals, pesticides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) have been detected in pond sediments. Metals and pesticides have been found in the surface water of the pond. Metals and PCBs have been detected in fish tissue.

- Historical sources of metals to the pond include the Industrial Drainageway fed by permitted discharges from the former Westinghouse Horseheads plant site, as well as from urban and industrial runoff. Ongoing sources include runoff and, to some extent, industrial discharges, although these discharges have been reduced with many of the past operations no longer discharging to the Drainageway.

- The source of the PCBs found in Koppers Pond sediment has not been determined.

- The pond is situated on property owned by Hardinge, the Village of Horseheads, and the EWB. The pond is surrounded by an area of vacant and active industrial property. To the north and northeast is the Old Horseheads Landfill, to the south is the Kentucky Avenue Well site, to the southeast is the Hardinge facility, to the east is Fairway Spring Company, and to the west is a Norfolk Southern railroad right-of-way with active tracks.

- The Norfolk Southern right-of-way runs to the west of the Industrial Drainageway and to the east of this drainage channel are the Chemung County Department of Public Works maintenance facility and the Old Horseheads Landfill.

- Koppers Pond is not enclosed by fencing; however, access is impeded by the railroad tracks and by the adjacent industrial/governmental properties that are partially fenced. Nevertheless, the presence of litter and off-road vehicle tracks suggest that periodic trespassing occurs in the area. There have been observations of individuals bank fishing in Koppers Pond, but there is no evidence of swimming in the pond.

- No recreational or other use of the pond is authorized by any of the property owners. "No Trespassing" signs are posted at the Hardinge property, and the Village and Town of Horseheads have begun more aggressive efforts to discourage trespassing. Such measures include posting "No Trespassing" signs and increased police patrols.

- Because of PCB levels in fish found in 1988 sampling, the New York State Department of Health (NYSDOH) issued a fish advisory for Koppers Pond. The NYSDOH advisory, which is still in effect, is for carp with a recommendation to eat no more than one meal per month and for infants, children under the age of 15, and women of childbearing age to eat no fish from Koppers Pond.

The CSM for Operable Unit 4 is presented as Figure 3. Given the current understanding of the likely source areas, as well as fate and transport mechanisms, the most appropriate potentially complete exposure pathways for the BHHRA are represented by the following:

- Dermal contact and incidental ingestion of surface water (pond) during wading events related to trespassing or fishing activity;

- Dermal contact and incidental ingestion of pond sediment during wading events related to trespassing or fishing activity;

- Dermal contact and incidental ingestion of surface water (outlet channel) during wading events related to trespassing;

- Dermal contact and incidental ingestion of sediment in the outlet channel during wading events related to trespassing; and

- Consumption of fish taken from Koppers Pond.

Given the current understanding of the identified source areas and fate and transport mechanisms, the most appropriate potentially incomplete exposure pathways, and the rationale for their exclusion from the BHHRA, are represented by the following:

- *Incidental ingestion and dermal contact with surface water while swimming*: Swimming will not be considered as an exposure pathway for this risk assessment because Koppers Pond is not operated as a recreational area, has limited access, and has no evidence of swimming activity. The silty bottom, shallow depth, and restrictions on trespassing make the pond generally unattractive for swimming.

- *Inhalation of vapors or particulates*: For Operable Unit 3, CDM (1995) reported that volatile organic compounds (VOCs) were detected in both surface water and sediment. However, based on their criteria for the selection of chemicals of potential concern, CDM (1995) did not quantitatively evaluate inhalation of any VOCs in the Operable Unit 3 HHRA. Similarly, based on results of the recent sampling and criteria for the selection of chemicals of potential concern, inhalation of VOCs will not be evaluated in this BHHRA. Sediment areas are not expected to dry out; therefore, no suspended particles are anticipated and thus inhalation of particulates is an incomplete pathway.

2.1 Potential Receptors

The potentially exposed receptors by exposure medium and pathway are discussed below.

2.1.1 Incidental Ingestion of Surface Water

Teenage trespassers may be exposed to COCs via incidental ingestion of surface water while wading in Koppers Pond or in the outlet channels. Likely receptors are limited to teenagers (12 to 18 years old) who might trespass on an infrequent basis. Because the area is not an established recreational destination and access is restricted, young children alone, adults, or adults with young children are anticipated to visit the area very rarely, if at all. In reviewing the site circumstances with USEPA, agreement was reached that, for the BHHRA, the area is considered unsuitable for young children. If adults are in the area, it would be on a less-frequent basis than the teenager trespassing events. Therefore, the more conservative approach is to evaluate the teenager as the more sensitive, receptor for this pathway.

2.1.2 Dermal Contact with Surface Water

Similar to ingestion of surface water, potential exposure is limited to teenagers (12 to 18 years old) who might trespass on an infrequent basis. Teenage trespassers also may be exposed to COCs via dermal contact with surface water while wading in Koppers Pond or in the outlet channels.

2.1.3 Incidental Ingestion of Sediment

Teenage trespassers may be exposed to COCs via incidental ingestion of near-shore pond sediment. Receptors are limited to teenagers (12 to 18 years old) who might trespass on an infrequent basis. Teenage trespassers also might be in contact with the sediment from the outlet channels via incidental ingestion.

2.1.4 Dermal Contact with Sediment

Teenage trespassers may be exposed to COCs via dermal contact with near-shore pond sediment. Receptors are limited to teenagers (12 to 18 years old) who might trespass on an infrequent basis. Teenage trespassers also might be in contact with the sediment from the outlet channels via dermal contact.

2.1.5 Fish Consumption

Koppers Pond currently has restrictions to discourage trespassing and a fish consumption advisory for carp. Nonetheless, based on observations during the May 2008 field investigation, it is used at times as a local pond for casual fishermen. Informal interviews with the local fishermen that were encountered at the pond and other field observations revealed that they are generally catch-and-release anglers, focusing predominantly on the bass that are present in the

pond. The taking of fish from Koppers Pond for preparation of family meals would seem unlikely or an infrequent event, particularly because there are a number of more desirable fisheries located nearby (e.g., trout streams, Finger Lakes). Nevertheless, potential risks from fish consumption will be evaluated for the young child, older child (adolescent), and adult.

2.2 Intake Assumptions

The formulae and assumptions used to determine COC intake are provided in summary form by exposure pathway/medium.

2.2.1 Common Parameters

Exposure parameters common across all direct contact exposure pathways are summarized below in Table 1. Chemical-specific values (e.g., permeability constants, absorption factors) will be provided once the proposed sampling is complete and compounds of potential concern (COPCs) have been identified. Standard references (e.g., EPA, 2004) will be used for this information. Pathway-specific exposure parameter values, including those parameters recommended for fish consumption, follow this section.

Table 1. Common Exposure Parameters for Direct-Contact Pathways

	Teenage Trespasser	Source
Body weight (kg)	57.2	EPA, 1997
Exposure duration (yrs)	6	Based on age of teenager (12 – 18 years old)
Exposure frequency (days/yr)	24	4 days/month for 6 months per year (CDM, 1995)
Averaging time – carcinogenic (days)	25,550	EPA, 1989
Averaging time - noncarcinogenic (days)	2,190	Equal to the exposure duration (EPA, 1989)

2.2.2 Incidental Ingestion of Surface Water While Wading

Intake from incidental ingestion of surface water while wading will be calculated by the following equation:

$$\text{Intake (mg/kg-d)} = C_w \times IgR_{sw} \times ET \times EF \times ED \times ABS_o \times (1/BW) \times (1/AT)$$

Where:

C_w	=	Chemical concentration in water (mg/L),
IgR_{sw}	=	Ingestion rate for surface water (liters/hour),
ET	=	Exposure time (hours/day),
EF	=	Exposure frequency (days/year),
ED	=	Exposure duration (years),
ABS_o	=	Chemical-specific oral absorption factor (unitless),
BW	=	Body weight (kg),
AT_c	=	Carcinogenic averaging time (days), and
AT_{nc}	=	Non-carcinogenic averaging time (days).

Pathway-specific exposure parameters are provided below:

The incidental ingestion rate for surface water (IgR_{sw}) is assumed to be 0.025 liters/hour which is one-half the default swimming contact rate of 0.05 liters/hour (EPA, 1989). This rate is chosen given there is less opportunity to swallow water when wading than when swimming.

Exposure time (ET) for wading is assumed to be 1.6 hours/day based on the age-specific amount of time spent outdoors for teenagers (EPA, 2006, Table 9-76).

2.2.3 Dermal Contact with Surface Water While Wading

Intake from dermal contact with surface water while wading will be calculated by the following equation (EPA, 2004):

Intake (mg/kg-day) = DA_{event} x SA x EV x EF x ED x (1/BW) x (1/AT)

and

$DA_{event\text{-}organic}$ = $$2FA * Kp * Csw\sqrt{\frac{6\tau_{event} * t_{event}}{\pi}}$$

$DA_{event\text{-}inorganic}$ = $K_p * C_{sw} * t$

Where:

DA_{event}	=	Absorbed dose per event (mg/cm^2-event),
FA	=	Fraction absorbed (unitless),
K_p	=	Chemical-specific dermal permeability coefficient (cm/hr),
C_{sw}	=	Chemical concentration in surface water (mg/cm^3),
τ event	=	Lag time per event (hr/event),
t	=	Event duration (hr/event),
π	=	Constant (unitless),
SA	=	Exposed skin surface area (cm^2),
EV	=	Number of events per day (event/day),
EF	=	Exposure frequency (days/year),
ED	=	Exposure duration (years),
BW	=	Body weight (kg), and
AT	=	Averaging time (days).

Pathway-specific exposure parameters are provided below:

The skin surface area (SA) for the teenage trespasser is assumed to be 4,029 cm^2 based on the age-specific mean surface area of hands, lower legs, and feet (EPA, 2004).

The number of events per day (EV) is assumed to be one.

2.2.4 Incidental Ingestion of Sediment

Intake from incidental ingestion of sediment by teenage trespasser will be calculated by the following equation:

Intake (mg/kg-d) = C_s x IgR_{sed} x EF x ED x ABS_o x (1/BW) x (1/AT)

Where:

C_s = Chemical concentration in sediment (mg/kg),

IgR_{sed} = Ingestion rate of sediment (mg/day),

EF = Exposure frequency (days/year),

ED = Exposure duration (years),

ABS_o = Chemical-specific oral absorption factor (unitless),

BW = Body weight (kg),

AT_c = Carcinogenic averaging time (days), and

AT_{nc} = Non-carcinogenic averaging time (days).

Pathway-specific exposure parameters are provided below:

The ingestion rate for sediment (IgR_{sed}) is assumed to be 50 mg/day (EPA, 1997).

2.2.5 Dermal Contact with Sediment

Intake from dermal contact with sediment by teenage trespasser will be calculated by the following equation:

$$\text{Intake (mg/kg-d)} = C_{sed} \times SA \times AF \times ABS_d \times EF \times ED \times (1/BW) \times (1/AT)$$

Where:

C_{sed} = Chemical concentration in sediment (mg/kg),

SA = Exposed skin surface area (cm^2/day),

AF = Adherence factor (mg/cm^2-day),

EF = Exposure frequency (days/year),

ED = Exposure duration (years),

ABS_d = Chemical-specific dermal absorption factor (unitless),

BW = Body weight (kg),

AT_c = Carcinogenic averaging time (days), and

AT_{nc} = Non-carcinogenic averaging time (days).

Pathway-specific exposure parameters are provided below:

The skin surface area (SA) for the teenage trespasser is assumed to be 4,029 cm^2 based on the age-specific mean surface area of hands, lower legs and feet (EPA, 2004).

As described during discussions with the USEPA, individuals that might be engaged in fishing or other trespassing activities at Koppers Pond are standing or walking along the bank of the pond, which, at points of access for fishing, is grass-covered and relatively dry. It is not a situation of wading in a reedy area. Therefore, contact with sediment is limited, and it is reasonable to assume an adherence factor (AF) of 0.07 mg/cm^2-day for the teenage trespasser based on the residential adherence factor for an adult recommended by EPA (2004, Exhibit 3-5).

2.2.6 Fish Consumption

Intake from fish consumption will be calculated by the following equation:

$$\text{Intake (mg/kg-d)} = C_{fish} \times IgR_{fish} \times AF \times EF \times ED \times ABS_f \times (1/BW) \times (1/AT)$$

Where:

C_{fish} = Chemical concentration in fish (mg/kg),

IgR_{fish} = Fish consumption rate (kg/day),

AF = Adjustment factor (unitless)

EF = Exposure frequency (days/year),

ED = Exposure duration (years),

ABS_f = Chemical-specific oral absorption factor (unitless),

BW = Body weight (kg),

AT_c = Carcinogenic averaging time (days), and

AT_{nc} = Non-carcinogenic averaging time (days).

Pathway-specific exposure parameters are provided below:

Body weights for the adult, older child and young child are 70, 34.5 and 16.6 kg, respectively (EPA, 1997).

Based on discussions with USEPA, the following fish consumption rates (IgR_{fish}) will be used in evaluating the RME individual (rates in parenthesis are proposed for the CTE evaluation):

- Adults – 25 (16) grams/day
- Adolescents – 16 (11) grams/day
- Young child - 8 (5) grams/day

These rates assume that the productivity of Koppers Pond can sustain these rates over the assumed exposure period. We reserve the option to conduct a more realistic fish consumption scenario for Koppers Pond and to present this scenario in the uncertainty section of the Risk Characterization. If we elect to proceed with the alternative fish consumption scenario, then we will collect and/or analyze additional data to provide the scientific basis in support for our evaluation. The alternative evaluation is likely to include the following components:

- Evaluating the fish productivity of Koppers Pond and determining whether the pond can "support" anglers consuming at the default EPA rate on a sustainable basis;
- Examining the 1992 and 1996 New York Angler Survey to determine whether we could develop consumption rates for waterbodies of similar size and characteristics as Koppers Pond (if the more recent 2007-2008 NY angler survey is publically ; and,
- Relating the potential fish consumption rates (EPA defaults or pond-specific) to the productivity of Koppers Pond.

Adjustment factors (AFs) such as cooking loss and local consumption may be relevant to the characterization of the fish exposure pathway. These are briefly discussed below:

<u>Cooking Loss</u>: For certain COCs (e.g., PCBs), cooking loss has been demonstrated to be an important consideration for the characterization of potential risks from fish consumption (Hori et al., 2005; EPA, 1999; Wilson et al., 1998). Cooking loss, which can vary by species and cooking method, has been reported for PCBs to range from 0 to 74 percent (Zabik et al., 1995; 1996). Based on discussions with USEPA, no adjustment will be made for cooking loss for the RME individual, and a 20% loss from cooking will be used for the CTE evaluation.

<u>Local Consumption</u>: It is not likely that the total amount of recreationally caught fish that is consumed would be caught from Koppers Pond. As discussed above, while access to the pond is restricted, and fish productivity is likely impacted due to factors such as the shallow depth and

reduced dissolved oxygen content during some months of the year, casual conversation with individuals fishing along the bank indicates that fish are caught in Koppers Pond but that they are generally caught for sport, returned to the pond, and not consumed (i.e., most anglers reportedly practice catch and release fishing). In addition, recreational anglers also have the opportunity to choose more desirable fisheries that are nearby (e.g., trout streams, Finger Lakes). Although it is very conservative to assume that the total amount of recreationally caught fish that is consumed comes from Koppers Pond, no fraction for local consumption will be used for the RME individual. However, we reserve the option to conduct a more realistic fish consumption scenario for Koppers Pond and to present this scenario as the CTE or in the uncertainty section of the Risk Characterization. If we elect to proceed with the alternative fish consumption scenario, then we will collect and/or analyze additional data to provide the scientific basis in support a local consumption factor

The exposure frequency (EF) for fish consumption is 365 days when using an annualized daily consumption rate. The exposure durations (EDs) for adult, older child and young child are 18, 6 and 6 years, respectively. These durations total 30 years, which is recommended by EPA (1989). Noncarcinogenic averaging times are 6570, 2190, and 2190 days, based on the respective EDs.

3.0 SUMMARY

In accordance with the requirements of the RI/FS Work Plan, this MESA comprises a conceptual site model, a description of potential exposure pathways and receptors for the Site, and intake assumptions. Tables 0, 1 and 4.1 through 4.3 outlining exposure pathways and assumptions, are formatted in accordance with EPA RAGS Part D (2001) protocols and are presented in Attachment A.

4.0 REFERENCES

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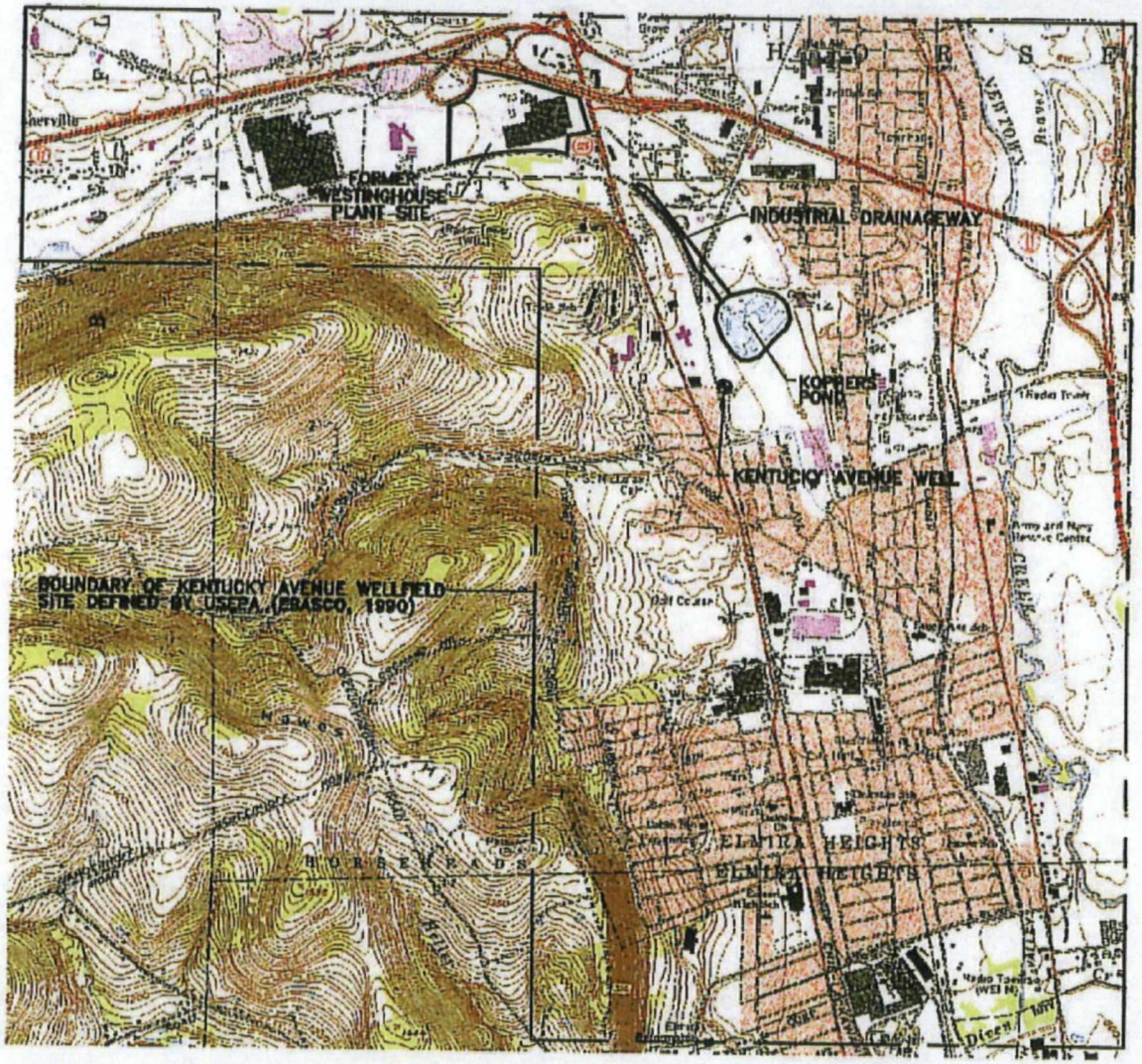
Zabik, M.E., A. Booren, M.J. Zabik, R.Welch, and H. Humphrey. 1996. Pesticide residues, PCBs and PAHs in baked, charbroiled, salt boiled and smoked Great Lakes lake trout. Food Chemistry. 55: 231-239.

FIGURES

DRAWING NUMBER 07502B1



SCALE

0 2000 4000 FEET

QUADRANGLE LOCATION

REFERENCE:
MODIFIED FROM U.S GEOLOGICAL SURVEY HORSEHEADS, NEW YORK, AND ELMIRA, NEW YORK-PENNSYLVANIA, QUADRANGLES, PHOTOREVISED 1978.

FIGURE 1

SITE LOCATION MAP

KENTUCKY AVENUE WELLFIELD SITE – OU4
HORSEHEADS, NEW YORK

PREPARED FOR

KOPPERS POND RI/FS GROUP

CUMMINGS RITER CONSULTANTS, INC.	DRAWING NUMBER 07502B1
DRAWN BY: T.E. McKee	DATE: 1-31-07
CHECKED BY: W.C. Smith	DATE: 2-19-07
APPROVED BY: W.C. Smith	DATE: 2-19-07

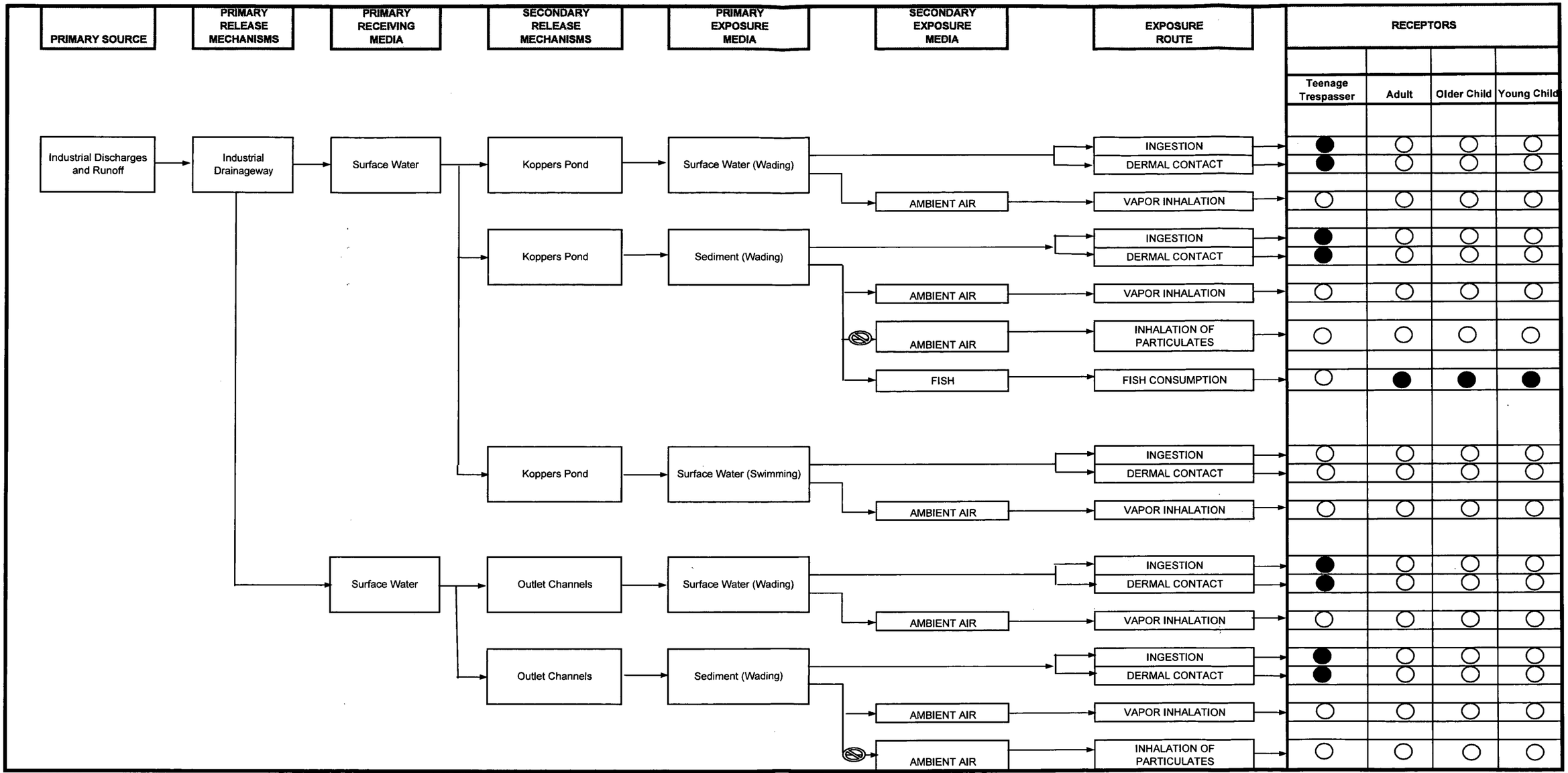
PLOT SCALE: 1=1

FIGURE 2
SITE PLAN
KENTUCKY AVE. WELLFIELD SITE - OU4
HORSEHEADS, NEW YORK

CUMMINGS RITER CONSULTANTS INC.

Prepared For:
KOPPERS POND R/FS GROUP

Figure 3
Conceptual Site Model
Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4, Horseheads, New York



LEGEND

- ○ Exposure Pathway Evaluated and Incomplete
- ● Exposure Pathway Evaluated and Complete
- ⊘ Transport Pathway Incomplete

Attachment A
USEPA RAGS Part D (2001)

Tables A-0, A-1, A-4.1, A-4.2, A-4.3a, A-4.3b, A-4.3c

ATTACHMENT A TABLES

Table A-0 Site Risk Assessment Identification Information - Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4, Horseheads, NY

Table A-1 Selection of Exposure Pathways - Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4, Horseheads, NY

Table A-4.1 Exposure Intake Calculation Values - Incidental Ingestion of, and Dermal Contact with Surface Water - Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4

Table A-4.2 Exposure Intake Calculation Values - Incidental Ingestion of, and Dermal Contact with Sediment - Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4

Table A-4.3a Exposure Intake Calculation Values - Consumption of Fish from Koppers Pond and the Outlet Creek (adult) - Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4

Table A-4.3b Exposure Intake Calculation Values - Consumption of Fish from Koppers Pond and the Outlet Creek (older child) - Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4

Table A-4.3c Exposure Intake Calculation Values - Consumption of Fish from Koppers Pond and the Outlet Creek (young child) - Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4

TABLE A-0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

KOPPER'S POND KENTUCKY AVENUE WELLFIELD SUPERFUND SITE, OPERABLE UNIT 4

Site Name/OU:	Koppers Pond Kentucky Avenue Wellfield Superfund Site, Operable Unit 4, Horseheads, New York
Region:	II
EPA ID Number:	NYD980650667
State:	New York
Status:	
Federal Facility (Y/N):	
EPA Project Manager:	
EPA Risk Assessor:	
Prepared by (Organization):	AMEC Earth & Environmental, Inc.
Prepared for (Organization):	Koppers Pond RI/FS Group
Document Title:	Memorandum on Exposure Scenarios and Assumptions (MESA)
Document Date:	Revised - 06/08/2009
Probabilistic Risk Assessment (Y/N):	No
Comments:	

Table A-1
Selection of Exposure Pathways
Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4, Horseheads, NY

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
CURRENT/FUTURE	Surface Water	Surface Water	Koppers Pond Outlet Channel	Teenage Trespasser/Wader	Teen: 12 - 18 yrs	Dermal Contact Incidental Ingestion	Quant	Although the area is posted 'No Trespassing' and access is limited by railroad tracks, there is evidence (e.g., litter and tracks of all-terrain vehicles) of use. It is assumed that teenage trespassers are the most likely individuals that visit the area. Because the pond is not an established recreational destination and access is restricted, young children alone, adults, or adults with young children would not typically visit the area.
CURRENT/FUTURE	Surface Water	Surface Water	Koppers Pond	Teenage Trespasser/Swimmer	Teen: 12 - 18 yrs	Dermal Contact Incidental Ingestion	None	The pond is not operated as a recreational area and has limited access. It is assumed that only wading or other incidental contact with surface water occurs.
CURRENT/FUTURE	Sediment	Sediment	Koppers Pond Outlet Channel	Teenage Trespasser/Wader	Teen: 12 - 18 yrs	Dermal Contact Incidental Ingestion Dermal Contact Incidental Ingestion	Quant	Although the area is posted 'No Trespassing' and access is limited by railroad tracks, there is evidence (e.g., litter and tracks of all-terrain vehicles) of use. It is assumed that teenage trespassers are the most likely individuals that visit the area. Because the pond is not an established recreational destination and access is restricted, young children alone, adults, or adults with young children would not typically visit the area.
CURRENT/FUTURE	Sediment	Vapor Particulate Vapor Particulate	Koppers Pond Outlet Channel	Teenage Trespasser/Wader	Teen: 12 - 18 yrs	Inhalation Inhalation	None	Based on results of the HHRA of Operable Unit III (CDM, 1995), volatile organic compounds, if present, will likely be detected at low frequencies and at concentrations that do not pose a concern. Sediment areas are not expected to dry out; therefore, no suspended particles are anticipated. With these rationales, inhalation of vapor and particulate are considered incomplete pathways.
CURRENT/FUTURE	Sediment	Fish	Fish	Young child, older child and adult	Young child: 1 - 6 yrs Older child: 7 - 13 yrs Adult: >13 yrs	Ingestion	Quant	Due to restricted access and fish advisory, recreational anglers are not likely to prefer Koppers Pond over more desirable fisheries that are nearby. Informal interviews with the local fishermen that were encountered at the pond and other field observations revealed that they are generally catch-and-release anglers, focusing predominantly on the bass that are present in the pond. Nevertheless, it is assumed that the receptors are young and older children and adults.

Table A-4.1
Exposure Intake Calculation Values
Incidental Ingestion of, and Dermal Contact with Surface Water
Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Incidental Ingestion	Teenage Trespasser	Teen: 12 - 18 years	Surface Water, Wading: Koppers Pond and Outlet Channel	C_{sw}	Chemical Concentration in Surface Water	Chem-specific	mg/L		Intake (mg/kg-day) = C_{sw} x IgR_{sw} x ET x EF x ED x ABS_o x 1/BW x 1/AT
				IgR_{sw}	Ingestion Rate - Surface Water	0.025	L/hr	Professional judgement - 1/2 default swimming contact rate (EPA, 1989)	
				ABS_o	Oral Absorption Factor	Chem-specific	unitless		
				ET	Exposure Time	1.6	hr/day	Age-specific amount of time spent outdoors for teenagers (EPA, 2006, Table 9-76)	
				EF	Exposure Frequency	24	days/yr	Four days per month for six months per year (CDM, 1995)	
				ED	Exposure Duration	6	yrs	Age-adjusted exposure duration (EPA, 1989)	
				BW	Body Weight	57.2	kg	Mean body weight ages 12-18 for male/female (EPA, 1997)	
				AT_{nc}	Averaging Time (noncancer)	2190	days	ED x 365 days/yr (EPA, 1989)	
				AT_c	Averaging Time (cancer)	25550	days	365 days x 70 yrs (EPA, 1989)	
Dermal Contact	Teenage Trespasser	Teen: 12 - 18 years	Surface Water, Wading: Koppers Pond and Outlet Channel	C_{sw}	Chemical Concentration in Surface	Chem-specific	mg/L		Intake (mg/kg-day) = DA_{event} x SA x EV x EF x ED x 1/BW x 1/AT
				DA_{event}	Absorbed Dose per event	calculated	mg/cm^2-event		
				FA	Fraction Absorbed	Chem-specific	unitless		
				K_p	Dermal permeability coefficient	Chem-specific	cm/hr		
				t_{event}	Lag Time per event	Chem-specific	hr/event		
				π	Constant	3.14	unitless		Where: $DA_{event\text{-}organic} = 2FA * Kp * Csw \sqrt{\frac{6\tau_{event} * t_{event}}{\pi}}$
				SA	Exposed Skin Surface Srea	4,029	cm^2	Age-specific mean surface area of hands, lower legs and feet (EPA, 2004)	
				EV	Number of Events per day	1	event/day	Professional judgement	
				EF	Exposure Frequency	24	days/yr	Four days per month for six months per year (CDM, 1995)	$DA_{event\text{-}inorganic} = K_p$ x C_{sw} x t
				ED	Exposure Duration	6	yrs	Age-adjusted exposure duration (EPA, 1989)	
				BW	Body Weight	57.2	kg	Mean body weight ages 12-18 for male/female (EPA, 1997)	
				AT_{nc}	Averaging Time (noncancer)	2190	days	ED x 365 days/yr (EPA, 1989)	
				AT_c	Averaging Time (cancer)	25550	days	365 days x 70 yrs (EPA, 1989)	

Table A-4.2
Exposure Intake Calculation Values
Incidental Ingestion of, and Dermal Contact with Sediment
Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Incidental Ingestion	Teenage Trespasser	Teen: 12 - 18 years	Sediment, Wading: Koppers Pond and Outlet Channel	C_s	Chemical Concentration in Sediment	Chem-specific	mg/kg		Intake (mg/kg-day) = C_s x IgR_{sed} x EF x ED x ABS_o x 1/BW x 1/AT
				IgR_{sed}	Ingestion Rate	50	mg/day	Soil ingestion rate for older children and adults (EPA, 1997)	
				ABS_o	Oral Absorption Factor	Chem-specific	unitless		
				EF	Exposure Frequency	24	days/yr	Four days per month for six months per year (CDM, 1995)	
				ED	Exposure Duration	6	yrs	Age-adjusted exposure duration (EPA, 1989)	
				BW	Body Weight	57.2	kg	Mean body weight ages 12-18 for male/female (EPA, 1997)	
				AT_{nc}	Averaging Time (noncancer)	2190	days	ED x 365 days/yr (EPA, 1989)	
				AT_c	Averaging Time (cancer)	25550	days	365 days x 70 yrs (EPA, 1989)	
Dermal Contact	Teenage Trespasser	Teen: 12 - 18 years	Sediment, Wading: Koppers Pond and Outlet Channel	C_s	Chemical Concentration in Sediment	Chem-specific	mg/kg		Intake (mg/kg-day) = C_s x SA x AF x ABS_d x EF x ED x 1/BW x 1/AT
				SA	Exposed Skin Surface Area	4,029	cm^2/day	Age-specific mean surface area of hands, lower legs and feet (EPA, 2004)	
				ABS_d	Dermal Absorption Factor	Chem.-specific	unitless		
				AF	Adherence Factor	0.07	mg/cm^2-day	Residential adherence factor for an adult (EPA, 2004, Exhibit 3-5)	
				EF	Exposure Frequency	24	days/yr	Four days per month for six months per year (CDM, 1995)	
				ED	Exposure Duration	6	yrs	Age-adjusted exposure duration (EPA, 1989)	
				BW	Body Weight	57.2	kg	Mean body weight ages 12-18 for male/female (EPA, 1997)	
				AT_{nc}	Averaging Time (noncancer)	2190	days	ED x 365 days/yr (EPA, 1989)	
				AT_c	Averaging Time (cancer)	25550	days	365 days x 70 yrs (EPA, 1989)	

Table A-4.3a
Exposure Intake Calculation Values
Consumption of Fish from Koppers Pond and the Outlet Creek,
Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value		Units	Rationale/ Reference	Intake Equation/ Model Name
						RME	CTE			
Fish Ingestion	Adult	Adult: >13 yrs	Fish: Koppers Pond and Outlet Channel	C_{fish}	Chemical Concentration in Fish	Chem.-specific	Chem.-specific	mg/kg		Intake (mg/kg-day) = C_{fish} x IgR_{fish} x AF x EF x ED x 1/BW x 1/AT
				IgR_{fish}	Fish Consumption Rate	0.025	0.016	kg/day	EPA, Region 2	
				EF	Exposure Frequency	365	365	days/yr	Based on a daily consumption rate	
				ED	Exposure Duration	18	18	yrs	Age-adjusted exposure duration: 30 yrs - 12 yrs (total duration of child exposures)	
				ABS_f	Oral Absorption Factor	Chem-specific	Chem-specific	unitless		
				AF	Ajustment Factor					
					cooking loss	no loss	20%	unitless	EPA, Region 2	
					local consumption	1	to be determined	unitless	Professional judgment	
				BW	Body Weight	70	70	kg	Default adult body weight (EPA, 1989)	
				AT_{nc}	Averaging Time (noncancer)	6570	6570	days	ED x 365 days/yr (EPA, 1989)	
				AT_c	Averaging Time (cancer)	25550	25550	days	365 days x 70 yrs (EPA, 1989)	

Table A-4.3b
Exposure Intake Calculation Values
Consumption of Fish from Koppers Pond and the Outlet Creek,
Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value		Units	Rationale/ Reference	Intake Equation/ Model Name
						RME	CTE			
Fish Ingestion	Older child	Older child: 7 - 13 yrs	Fish: Koppers Pond and Outlet Channel	C_{fish}	Chemical Concentration in Fish	Chem.-specific	Chem.-specific	mg/kg		Intake (mg/kg-day) = C_{fish} x IgR_{fish} x AF x EF x ED x 1/BW x 1/AT
				IgR_{fish}	Fish Consumption Rate	0.016	0.011	kg/day	EPA, Region 2	
				EF	Exposure Frequency	365	365	days/yr	Based on a daily consumption rate	
				ED	Exposure Duration	6	6	yrs	Age-adjusted exposure duration (EPA, 1989)	
				ABS_f	Oral Absorption Factor	Chem-specific	Chem-specific	unitless		
				AF	Ajustment Factor					
					cooking loss	no loss	20%	unitless	EPA, Region 2	
					local consumption	1	to be determined	unitless	Professional judgment	
				BW	Body Weight	34.5	34.5	kg	Default adult body weight (EPA, 1989)	
				AT_{nc}	Averaging Time (noncancer)	2190	2190	days	ED x 365 days/yr (EPA, 1989)	
				AT_c	Averaging Time (cancer)	25550	25550	days	365 days x 70 yrs (EPA, 1989)	

Table A-4.3c
Exposure Intake Calculation Values
Consumption of Fish from Koppers Pond and the Outlet Creek,
Koppers Pond Kentucky Avenue Wellfield Site, Operable Unit 4

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value		Units	Rationale/ Reference	Intake Equation/ Model Name
						RME	CTE			
Fish Ingestion	Young child	Youngr child: 1 - 6 yrs	Fish: Koppers Pond and Outlet Channel	C_{fish}	Chemical Concentration in Fish	Chem.-specific	Chem.-specific	mg/kg		Intake (mg/kg-day) = C_{fish} x IgR_{fish} x AF x EF x ED x 1/BW x 1/AT
				IgR_{fish}	Fish Consumption Rate	0.008	0.005	kg/day	EPA, Region 2	
				EF	Exposure Frequency	365	365	days/yr	Based on a daily consumption rate	
				ED	Exposure Duration	6	6	yrs	Age-adjusted exposure duration (EPA, 1989)	
				ABS_f	Oral Absorption Factor	Chem-specific	Chem-specific	unitless		
				AF	Ajustment Factor					
					cooking loss	no loss	20%	unitless	EPA, Region 2	
					local consumption	1	to be determined	unitless	Professional judgment	
				BW	Body Weight	16.6	16.6	kg	Default adult body weight (EPA, 1989)	
				AT_{nc}	Averaging Time (noncancer)	2190	2190	days	ED x 365 days/yr (EPA, 1989)	
				AT_c	Averaging Time (cancer)	25550	25550	days	365 days x 70 yrs (EPA, 1989)	