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U.S. Army
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HUMAN HEALTH RISK ASSESSMENT
GE/HOUSATONIC RIVER SITE
REST OF RIVER

VOLUME IIIA
APPENDIX B
PHASE 2 DIRECT CONTACT RISK ASSESSMENT
TEXT AND TABLES

DCN: GE-021105-ACMT

February 2005

Environmental Remediation Contract
GE/Housatonic River Project
Pittsfield, Massachusetts

Contract No. DACW33-00-D-0006

Task Order 0003

04P-1690-3A

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GENERAL ELECTRIC (GE)/HOUSATONIC RIVER PROJECT
PITTSFIELD, MASSACHUSETTS

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Prepared for

U.S. Army Corps of Engineers
New England District
Concord, Massachusetts

and

U.S. Environmental Protection Agency
New England Region
Boston, Massachusetts

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LIST OF ACRONYMS

2,3,7,8-TCDD	2,3,7,8–tetrachlorodibenzo-p-dioxin
ADD	average daily dose
AF	adherence factor
AhR	aryl hydrocarbon receptor
AST	aboveground storage tank
AT	averaging time
ATV	all-terrain vehicle
BB&L	Blasland, Bouck and Lee, Inc.
BEHA	Bureau of Environmental Health Assessment
bgs	below ground surface
BW	body weight
CAD	computer-aided design
CDD	chlorodibenzo-p-dioxin
CDF	chlorodibenzofuran
CF	conversion factor
COPC	contaminant of potential concern
CSF	cancer slope factor
CSM	conceptual site model
CTDEP	Connecticut Department of Environmental Protection
CTE	central tendency exposure
DBA	dependency bounds analysis
DOJ	U.S. Department of Justice
DQI	data quality indicator
DQO	data quality objective
EA	exposure area
ED	exposure duration
EF	exposure frequency
EFH	Exposure Factors Handbook
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EPRI	Electric Power Research Institute
ET	exposure time
FEMA	Federal Emergency Management Agency
FI	fraction ingested
GE	General Electric Company

LIST OF ACRONYMS
(Continued)

GIS	Geographic Information System
HEAST	Health Effects Assessment Summary Tables
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
HRA	Housatonic River Area
HRR	Housatonic River Restoration, Inc.
IDW	inverse distance weighting
IR	ingestion rate
IRIS	Integrated Risk Information System
IRW	incidental water ingestion rate
JDCL	John Decker Canoe Launch
LADD	lifetime average daily dose
LNAPL	light non-aqueous phase liquid
LOAEL	lowest observed adverse effect level
MassWildlife	Massachusetts Division of Fisheries and Wildlife
MCA	Monte Carlo analysis
MDEM	Massachusetts Department of Environmental Management
MDEP	Massachusetts Department of Environmental Protection
mg/kg	milligram per kilogram
mg/kg-d	milligram per kilogram per day
NAPL	nonaqueous phase liquid
NAS	National Academy of Sciences
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NOAEL	no observed adverse effect level
p-box	probability box
PAH	polycyclic aromatic hydrocarbon
PBA	probability bounds analysis
PRA	probabilistic risk assessment
PSA	Primary Study Area
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxin
PCDF	polychlorinated dibenzofuran
PRG	Preliminary Remediation Goal

LIST OF ACRONYMS
(Continued)

QAPP	Quality Assurance Project Plan
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RE	regression error
RfD	reference dose
RME	reasonable maximum exposure
RPD	relative percent difference
SA	surface area
SAB	Science Advisory Board
SI	Supplemental Investigation
SIWP	Supplemental Investigation Work Plan
SQL	sample quantitation limit
SRBC	screening risk-based concentration
SVOC	semivolatile organic compound
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TEF	toxic equivalency factor
TEQ	toxic equivalence
THQ	target hazard quotient
tPCB	total PCB
TR	target risk
UCL	upper confidence limit
USGS	United States Geological Survey
UST	underground storage tank
VOC	volatile organic compound
WESTON	Weston Solutions, Inc.
WHO	World Health Organization
WML	Washington Mountain Lake
WWTP	wastewater treatment plant

PHASE 2 DIRECT CONTACT RISK ASSESSMENT EXECUTIVE SUMMARY

The Housatonic River, its sediment, and associated floodplain have been contaminated with polychlorinated biphenyls (PCBs) and other hazardous substances released from the General Electric Company (GE) facility located in Pittsfield, MA. The entire site, known as the General Electric/Housatonic River Site, consists of the 254-acre (103-hectare) GE manufacturing facility; the Housatonic River and its floodplain from Pittsfield, MA, to Long Island Sound; former river oxbows that have been filled with material originating at the facility; neighboring commercial properties; Allendale School; Silver Lake; and other properties or areas that have become contaminated as a result of GE's facility operations.

In September 1998, after years of scientific investigations and regulatory actions, a comprehensive agreement was reached between GE and various governmental entities, including the U.S. Environmental Protection Agency (EPA), the Massachusetts Department of Environmental Protection (MDEP), the U.S. Department of Justice (DOJ), the Connecticut Department of Environmental Protection (CTDEP), and the City of Pittsfield. The agreement provides for the investigation and cleanup of the Housatonic River and associated areas. The agreement has been documented in a Consent Decree between all parties that was entered by the Federal court in October 2000. Under the terms of the Consent Decree, EPA conducted the human health and ecological risk assessments, and is conducting a modeling study of PCB transport and fate for the Housatonic River below the confluence of the East and West Branches ("Rest of River").

The "Rest of River," which this document addresses, is the portion of the river from the confluence of the East and West Branches of the Housatonic River (the confluence) in Pittsfield, to the Massachusetts border with Connecticut, a distance of approximately 54 miles (87 km), and beyond into Connecticut to Long Island Sound. The total distance from the confluence to Long Island Sound is approximately 139 miles (224 km). In addition to the river proper, the Rest of River includes the associated riverbank and floodplain extending laterally to the 1-ppm total PCB (tPCB) isopleth. Between the confluence and the Woods Pond Dam, the 1-ppm tPCB isopleth is approximately equivalent to the 10-year floodplain.

RISK ASSESSMENT OVERVIEW

The Human Health Risk Assessment (HHRA) represents an important component of the U.S. Environmental Protection Agency's Supplemental Investigation of the Rest of River, along with the Ecological Risk Assessment and Modeling Study. It provides a comprehensive evaluation of health risks associated with uses of the river, its banks, and floodplain under baseline conditions (i.e., no action) for current and future uses. This evaluation will be considered in:

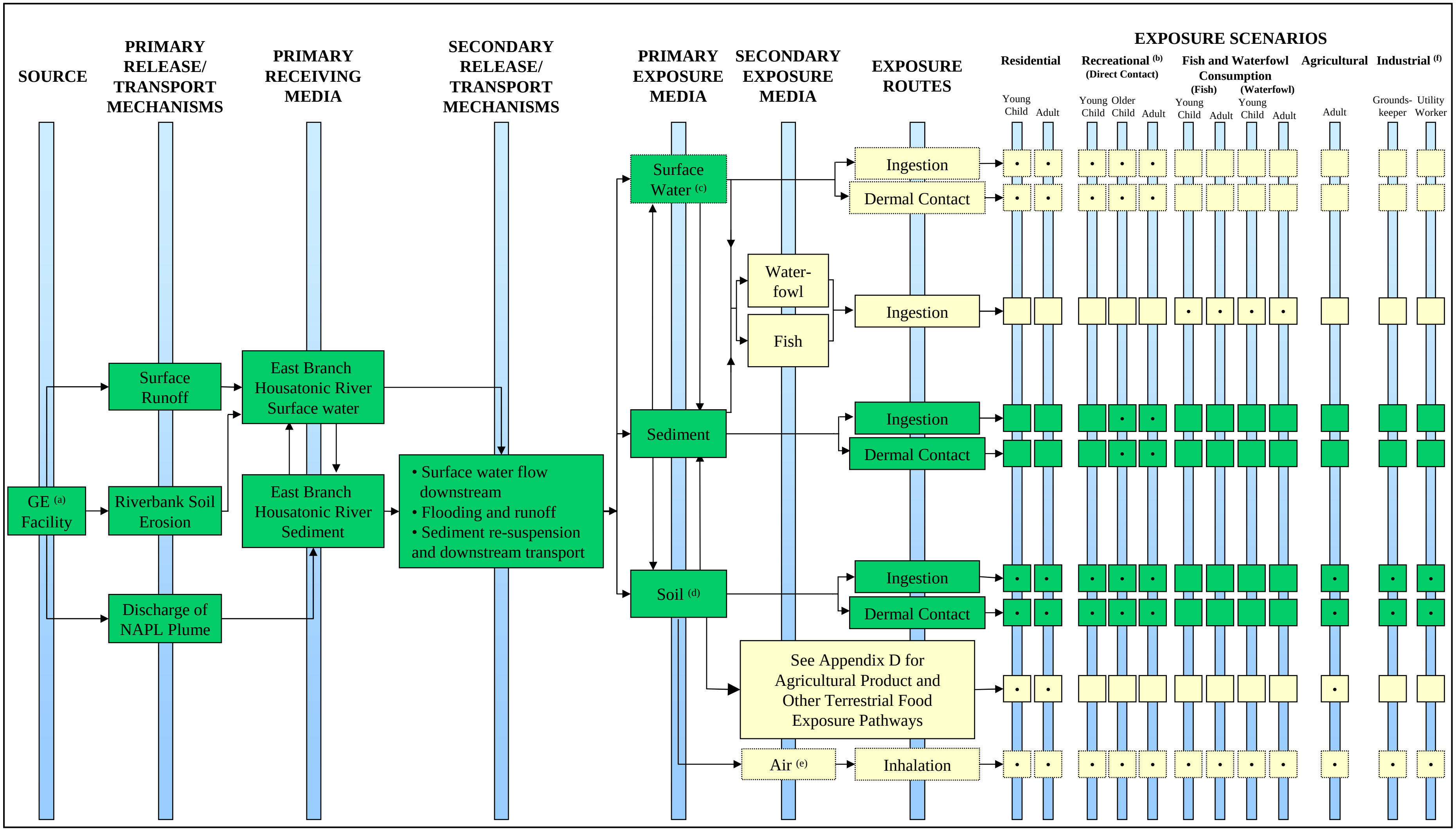
- Determining the need for remedial action.
- Setting media protection goals for contaminants of concern.

This volume, Phase 2 Direct Contact Risk Assessment (Appendix B), is a technical appendix of the HHRA for the Rest of River portion of the GE/Housatonic River Site. The report and technical appendices provide a comprehensive examination of health risks associated with uses of the river; its banks and floodplain for identified current recreational, residential, agricultural, and commercial/industrial uses of the site; and uses that might reasonably be expected in the future. The risk assessment was performed in accordance with EPA policies and procedures. This technical appendix was organized according to the standard EPA risk assessment approach and includes hazard identification, toxicity assessment, exposure assessment, risk characterization, and uncertainty analysis sections. Both point estimate and probabilistic approaches were used to evaluate potential cancer risks and noncancer health effects from direct contact exposure.

Figure ES-1 presents the conceptual site model (CSM) for the HHRA, with the direct contact pathways, which are the focus of this appendix, highlighted. The CSM depicts the pathways from the source of contamination through the various environmental media to exposure to individuals categorized by activity and age group.

OVERVIEW OF DIRECT CONTACT RISK ASSESSMENT

This appendix provides detailed evaluations of the cancer and noncancer health risks associated with direct contact exposure to contaminants of potential concern (COPCs) in soil and sediment



• = Complete exposure pathway

= Incomplete exposure pathway

= Not evaluated quantitatively.

= Pathways of concern.

NAPL = nonaqueous phase liquid.

(a) = Includes all facility-related sources such as site soils, Unkamet Brook, Silver Lake, former oxbows, fill areas, etc.

(b) = There are seven variations of the recreational scenario, including: general recreation, ATV/dirt and mountain biker, marathon canoeist, recreational canoeist, angler, waterfowl hunter, and sediment exposure. The scenario selected will depend on the medium and exposure area of concern being evaluated.

(c) = Chemical concentrations in surface water were compared to conservative, site-specific screening risk based concentrations (SRBCs) as an initial screening step. Results of the screening process indicated chemical concentrations in surface water below levels of human health concern. Thus, direct contact to surface water was not evaluated quantitatively.

(d) = Includes floodplain and riverbank soil.

(e) = Air sampling conducted at various points along the Lower River resulted in low concentrations of PCBs. An additional sampling and screening level risk assessment was performed. Results of the screening process indicated chemical concentrations in air below levels of human health concern. Thus, inhalation of air was not evaluated quantitatively.

(f) = A construction worker was considered, but not evaluated quantitatively. It was assumed that given the lack of roads in the floodplain and the restrictions on building in the floodplain, that a utility worker would be a more conservative exposure scenario.

Direct Contact Human Health Risk Assessment
GE/Housatonic River Site,
Rest of River

Figure ES-1

Conceptual Site Model

using both point estimate and probabilistic methodologies. The point estimate assessment includes all exposure areas (EAs) with tPCB concentrations that exceeded screening risk-based concentrations (SRBCs) as described in the Phase 1 Direct Contact Screening Risk Assessment (Appendix A). The probabilistic assessment evaluates exposure associated with the recreational exposure pathways only.

Because of the large area of concern and the number of properties to be evaluated for direct contact exposure along the Rest of River, the direct contact portion of the HHRA was conducted in two phases. The Phase 1 risk assessment consisted of a conservative, risk-based screening of floodplain and riverbank soil and sediment on the basis of potential human exposure from direct contact (i.e., incidental ingestion and dermal contact) to tPCBs. Phase 1 was conducted to eliminate from further consideration those properties that had tPCB concentrations below levels of concern.

The Phase 2 Direct Contact Risk Assessment evaluated the potential risk to individuals (children and adults) who come in contact with contaminated soil and sediment at areas that were not eliminated in Phase 1. Both floodplain and riverbank soil were evaluated for each EA. Given the large area of floodplain to be evaluated for direct contact, EAs were developed based on the following considerations:

- Exposure areas did not extend beyond the boundaries of the site, as defined by the Consent Decree. The site extends laterally to the 1-ppm PCB isopleth, which is approximated by the 10-year floodplain in Reaches 5 and 6, and the 100-year floodplain in Reaches 7 through 9 (the 10-year floodplain has not been mapped for these downstream reaches).

- Individual tax parcels (portion within floodplain) were the starting point for defining individual EAs. These parcels were kept intact, subdivided, or combined with adjacent parcels based on the following criteria:

  - Similarity of land use.
  - Similarity of ownership.
  - Number of available soil samples.

A total of 90 separate EAs were identified and evaluated for risk associated with direct contact with soil in Reaches 5 through 7. A total of eight sediment EAs, which consisted of reaches of river and/or impoundments, were evaluated for risk associated with direct contact exposure to sediment.

Eleven exposure scenarios were developed for activities within the four land use classifications: residential, recreational, agricultural, and commercial/industrial. These scenarios are described in detail in Section 4. At least one exposure scenario was evaluated for each EA. However, in many cases, multiple activities could plausibly occur within a single EA. To simplify the process for evaluating the large number of exposure areas that were retained after the Phase 1 assessment, only the exposure scenario(s) and receptor(s) that would result in the greatest exposure and resulting risk at a particular exposure area were selected for evaluation. Evaluation of the activity with the greatest exposure was performed to ensure the assessment was protective of all activities that may reasonably occur in the exposure area.

In addition, several EAs where distinct activities could occur at different locations within the area were divided into subareas. In these cases, a risk assessment was conducted for the specific activity in the subarea. In addition, a risk assessment was conducted for the exposure area as a whole.

A single sediment exposure scenario was developed to evaluate exposure from a variety of different activities that could result in contact with sediment, such as launching canoes, wading, swimming, fishing, waterfowl hunting, and other related activities. Each of these activities results in a similar exposure scenario, so it is not necessary to develop separate scenarios for each activity. The exposure assumptions used to calculate risk were protective of all activities that could result in sediment exposure.

HAZARD IDENTIFICATION

The purpose of the hazard identification is to identify the data available to assess risks, to summarize the relevant data, and to identify contaminants of potential concern (COPCs) for the direct contact exposure pathways.

Data

The strategy used by EPA to sample for COPCs in all media was presented in the Supplemental Investigation Work Plan (SIWP) (WESTON, 2000a). The SIWP described the sampling approach for soil and sediment as well as the initial strategy for human health-related sampling and other sampling programs. The HHRA is based on all applicable soil and sediment data from the Supplemental Investigation (SI) sampling as well as data from locations selected by EPA and the Massachusetts Department of Environmental Protection (MDEP) during the Phase 1 and Phase 2 site investigations. The agencies identified these samples through an iterative process in which the results from each round of sampling were reviewed and additional locations were selected based on the likelihood of exposure, the degree of contamination, and the need to fill data gaps. In addition to the data collected in support of EPA's SI, historical data collected by GE and other government agencies, and more recent data collected by GE and provided to EPA in monthly data base exchanges, were also considered in the analysis.

COPC Selection

PCBs were retained as the primary COPC, based on the history of release of PCBs from the facility, the results of the Phase 1 screening assessment, and the extent of PCB contamination throughout the Rest of River. Dioxins/furans were also included as a COPC based on contaminant concentrations, site-wide occurrence, and the association of these compounds, particularly furans, with the manufacture and heating of PCBs, which occurred at the facility. Accordingly, the remainder of the COPC screening process focused on Appendix IX compounds other than PCBs and dioxins/furans.

Because of the large number of individual parcels and exposure areas within the study area, an initial contaminant-screening step (COPC selection) was conducted to evaluate all of the contaminant concentration data available for soil and sediment in Reaches 5 and 6, the Primary Study Area (PSA), to determine which COPCs (in addition to tPCBs and dioxins/furans) to retain for the Phase 2 analysis.

The COPC screening approach included:

- A comparison to EPA Region 9 Preliminary Remediation Goals (PRGs).

- A review of the frequency of detection, the frequency of PRG exceedance, and the degree of PRG exceedance.
- A comparison to site-specific background concentrations.
- A comparison to generic background concentrations developed by MDEP (MDEP, 2002).

The comparisons to background were considered when determining if naturally occurring and anthropogenic chemicals would be quantitatively versus qualitatively evaluated for risk (EPA, 2002a).

Other than PCBs and dioxins/furans, all chemicals detected in soil and sediment were eliminated from the quantitative risk characterization.

DOSE-RESPONSE ASSESSMENT

The purpose of the dose-response assessment is to identify the toxicity values for assessing potential human cancer risks and noncancer health effects. These toxicity values include cancer slope factors (CSFs) for estimating excess lifetime cancer risk and chronic reference doses (RfDs) for estimating noncancer hazard. In the risk characterization step, estimated COPC doses from direct contact are combined with these dose-response values to calculate potential cancer risk and noncancer hazard. The Direct Contact Risk Assessment focuses on tPCBs; however, the contribution of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) toxic equivalence (TEQ) was also assessed in the uncertainty analysis.

Toxicity values for tPCBs were obtained from the *Integrated Risk Information System* (IRIS) (EPA, 2004). For mixtures like the highly chlorinated tPCB mixture at the site, EPA recommends using an upper-bound CSF of 2.0 per mg/kg-d and a central estimate CSF of 1.0 per mg/kg-d. The IRIS database provides oral RfDs for Aroclor 1016 (0.00007, or 7E-05 mg/kg-d) and Aroclor 1254 (0.00002, or 2E-05 mg/kg-d). The mixture at the site most closely resembles Aroclor 1260, with minor contributions from Aroclor 1254 (WESTON, 2002), but no RfD is available for Aroclor 1260. With respect to chlorine content and environmental persistence, the PCB mixture at this site more closely resembles Aroclor 1254 than Aroclor 1016. Therefore, the RfD for Aroclor 1254 was used.

Toxicity values for 2,3,7,8-TCDD are not published in IRIS. Instead, the CSF published in Health Effects Assessment Summary Tables (HEAST) (EPA, 1997) was used to assess the risk of developing cancer. No RfD is available for dioxin and furans; therefore, noncancer hazard from exposure to these compounds was not evaluated.

EXPOSURE ASSESSMENT

The purpose of the exposure assessment is to estimate the nature, extent, and magnitude of potential exposure of adults and children to COPCs in soil and sediment in the Rest of River, considering both current and future uses.

The exposure assessment included several steps:

- Evaluating the exposure setting, including describing local land and water uses and identifying potentially exposed human populations.
- Developing the conceptual site model (CSM), including sources, release mechanisms, transport and receiving media, exposure media, exposure scenarios, exposure routes, and potentially exposed populations.
- Calculating contaminant exposure point concentrations (EPC) for each of the exposure scenarios and routes.
- Identifying the exposure scenarios, models, and parameters with which to calculate the exposure doses.

For the point estimate assessment, the reasonable maximum exposure (RME) and the central tendency exposure (CTE) scenarios are presented to provide a range of exposure estimates. The RME, an estimate of the high-end of exposure in a population, is based on a combination of the high-end and central estimates of exposure parameters representing the 90th percentile or greater of actual expected exposure. The CTE is the central tendency (i.e., average) exposure, which uses average exposure parameters to calculate an average exposure to an individual. Both the RME and CTE analyses are presented for each exposure scenario.

For the probabilistic assessment, EPA guidance recommends a sequential “tiered” approach. Each tier is evaluated and the results are used to influence the succeeding tiers. According to this approach, increasingly complex models and data are used to further quantify the effects of uncertainty regarding risk model input variables on the risk assessment results.

The Direct Contact Risk Assessment is composed of two tiers. The point estimate risk models represent the first tier of the risk assessment. One-dimensional Monte Carlo analog and probability bounds analyses comprise the second tier. One-dimensional refers to a probabilistic modeling approach that characterizes variability or uncertainty. The resulting second-tier risk analysis consists of a probability distribution of risk, and plausible extreme uncertainty bounds on that risk distribution, for the recreational exposure pathways.

Current and Future Land Uses

The Direct Contact Risk Assessment evaluated potential risks associated with the current and reasonably anticipated future uses of the Housatonic River and its floodplain. Current land and river uses formed the basis for the evaluation of existing (i.e., baseline) conditions. Future land and river uses formed the basis for the evaluation of risks associated with future use of the site. Information about land use trends is important to formulate realistic assumptions regarding reasonably anticipated future land use, to clarify how these assumptions apply to the baseline risk assessment, and to develop alternatives in the remedy selection process (EPA, 1995).

Potentially Exposed Human Populations

Based on the known or plausible current and future land and water uses, four populations (receptors) were identified for evaluation in this risk assessment:

- Adult and child residents.
- Adult and child recreational users, including hikers, hunters and anglers, waders, campers, picnickers, all terrain vehicle (ATV)/dirt and mountain bike riders, and boaters.
- Adult and child farmers.
- Outdoor utility workers and groundskeepers.

Because of differences in behavior between children and adults and the specific exposure scenarios being evaluated, young children, older children, and adults were evaluated by considering these three age groups separately for the non-residential exposure scenarios. The younger child’s age was defined to range from 1 through 6 years. The older child’s age was defined to range from 7 through 18 years of age, and the adult was defined to be 19 years and older (EPA, 2002).

Exposure Scenarios and Routes of Exposure

Based on the current and reasonably anticipated future land uses, the activities common in the area, and the known transport of PCB contamination to various media, four primary exposure scenarios were identified for soil and sediment exposure: residential, recreational, agricultural, and commercial/industrial.

Seven variations of the recreational scenario and two variations of the commercial/industrial scenario were evaluated to estimate the exposure associated with these types of activities in greater detail. These scenarios were developed, in part, based on discussions and information received from the community. The variations of the recreational scenario were:

- General recreation.
- ATV/dirt and mountain bike riding.
- Marathon canoeist.
- Recreational canoeist/boater.
- Angler.
- Waterfowl hunter.
- Sediment exposure.

The variations of the commercial/industrial scenario were:

- Groundskeeper.
- Utility worker.

There were also two alternatives considered for future residential exposure that differ based on whether the area included an actual or potential lawn area. A single scenario was used to evaluate risks for farmers. All of the scenarios evaluate soil exposures, with the exception of the sediment exposure scenario, which considered sediment exposure from a composite of recreational activities including wading, swimming, fishing, waterfowl hunting, canoeing, and other related activities.

The construction worker scenario was not considered a complete exposure pathway because flooding and the Massachusetts Wetlands Protection Act preclude major construction in the floodplain. Therefore, it was eliminated from further evaluation in the risk assessment.

Table ES-1 summarizes the exposure scenarios, the receptors (people potentially exposed to contamination), and the media evaluated.

Table ES-1

Summary of the Exposure Scenarios Evaluated in the Direct Contact Risk Assessment

	Media		Receptors		
Exposure Scenarios	**Soil**	**Sediment**	**Young Child (1 through 6 years)**	**Older Child (7 through 18 years)**	**Adult**
Residential*	√		√	√	√
Recreational					
General recreation exposure	√		√	√	√
ATV/Dirt and mountain bike riding	√			√	
Marathon canoeist	√				√
Recreational canoeist/boater	√			√	√
Angler	√			√	√
Waterfowl hunter	√			√	√
Sediment exposure		√		√	√
Farmer	√				√
Commercial/Industrial					
Groundskeeper	√				√
Utility worker	√				√

* The residential exposure scenario includes receptors ages 1 through 45 years (MDPH, 2001).

Selection of Exposure Area-Specific Exposure Scenarios

Point estimate risk assessments were performed for each EA in the Phase 2 Direct Contact Risk Assessment. In many cases, multiple activities could plausibly occur at a particular exposure area. To simplify the process for evaluating the large number of exposure areas that were retained after the Phase 1 assessment, only the exposure scenario(s) and receptor(s) that would result in the greatest exposure and resulting risk at the particular exposure area were selected for evaluation (i.e., the most conservative assumptions). Evaluation of the activity with the greatest exposure was performed to ensure that the assessment was protective of all activities that might reasonably occur in the exposure area.

In addition, several exposure areas were divided into subareas based on the observation that distinct activities could occur at specific locations within the exposure area. In these cases, a risk assessment was conducted for the activity in the subarea. In addition, a risk assessment was conducted for the exposure area as a whole.

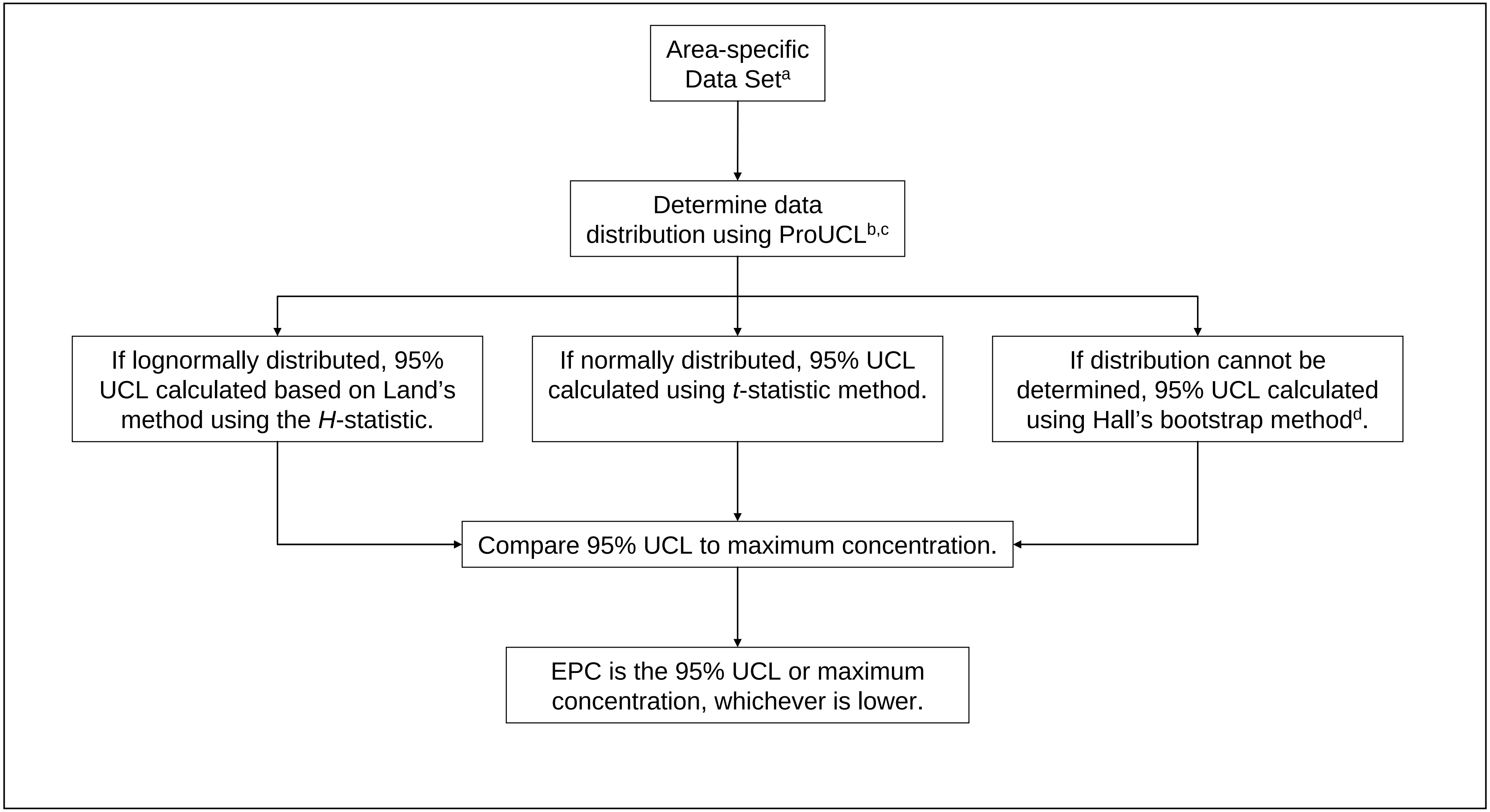
Exposure Point Concentrations

An exposure point concentration (EPC) is a conservative estimate of the mean concentration to which a receptor is assumed to be exposed during each exposure event in an exposure scenario. The EPC for each exposure area (or subarea) is the 95% upper confidence limit (UCL) of the mean, or the maximum detected concentration, whichever was lower. This method is consistent with EPA policy for accounting for the uncertainty associated with estimating the true mean concentration (EPA, 1992b). For floodplain soil in Reaches 5 and 6, the concentrations used in the UCL calculations were those derived after spatial weighting was conducted, and use-weighting factors were applied. For soil in Reach 7 and for sediment EPCs, the measured concentration data were used directly in the UCL calculation.

If the data were normally distributed, the UCL was computed using the *t*-statistic. If the data were lognormally distributed, the UCL was based on Land's method using the *H*-statistic. If the data were neither normal nor lognormal in distribution, a modified bootstrap procedure devised by Hall (Hall, 1988) that takes account of bias and skewness was used. Section 4.4 describes the different approaches used to calculate EPCs. Figure ES-2 presents a flow chart of the EPC calculation methods.

Reaches 5 and 6 Floodplain Soil

A spatial weighting approach was used in Reaches 5 and 6 to generate a surface of interpolated tPCB data from which EPCs were calculated. Spatial weighting is an appropriate and useful tool



Notes:

[a] For Reaches 5 and 6 soil, the EPCs were typically calculated based on spatially and use weighted tPCB concentrations (see Section 4.4.1). For Reach 7 soil and the sediment data, the EPCs were calculated using measured tPCB concentrations (see Sections 4.4.2 and 4.4.3).

[b] For samples sizes less than 50, the Shapiro-Wilk test (alpha=0.05) was used. For sample sizes greater than or equal to 50, the Lilliefors test (alpha=0.05) was used (EPA, 2004a).

[c] For Reaches 5 and 6 soil, the data distribution was based on the spatially and use-weighted data points.

[d] The degrees of freedom were based on the number of actual measured data points.

95% UCL = 95% upper confidence limit of the mean.
EPC = exposure point concentration.

Direct Contact Human Health Risk Assessment
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Figure ES-2

Exposure Point Concentration
Calculation Method Flow Chart

for interpolating data in the floodplain, because of the size of the floodplain and the assumption that concentrations are spatially correlated due to the conceptual model of PCB fate and transport via contaminated sediment transported during flood events.

The spatially weighted surface of tPCB concentrations in the Reaches 5 and 6 floodplain was generated from the measured concentrations in floodplain soil samples using the inverse distance weighting (IDW) procedure contained in ArcView Spatial Analyst (Environmental Systems Research Institute, Inc. [ESRI], 1996). The basic IDW approach was modified to include information on the habitat types delineated in the floodplain as part of the Ecological Characterization (WESTON, 2004, Appendix A).

PCBs were transported onto the floodplain during storm events that have occurred over the last 70 years. The frequency and extent of such inundations at a particular location in the floodplain is governed by the topographic and hydrologic factors that also control the distribution of wetland habitats. Accordingly, it was appropriate to consider data from similar habitat types in conducting the spatial weighting exercise. The use of habitat-restricted spatial weighting also reduced the effect of nonrandom sampling and the clustering of samples in areas of known or suspected high PCB concentrations.

After evaluation and several test runs, it was determined that a 3-square-meter (3-m^2) grid produced spatially weighted surfaces that were adequate for the resolution of concentration boundaries for the purposes of determining exposures. The 3-m^2 grid was populated from the PCB sample data with interpolated PCB data using the standard IDW algorithm in ArcView Spatial Analyst (ESRI, 1996).

Further, for the purpose of the Direct Contact Risk Assessment, the habitats were classified according to the ease of access for various receptors and were assigned one of the following categories: walkable, wadable, difficult to access, and boatable. Use-weighting factors were established for each of the accessibility categories (boatable was assigned a factor of 0) based on the likelihood of use within the 7-month period when the ground is not frozen or snow covered. The use-weighting factors, which reflect the likelihood that an individual would access a particular habitat within an exposure area, are summarized below.

- Walkable—Habitats included within the walkable category were considered the most desirable for recreational users and were assigned a use-weighting factor of 1.0 for the assumed 7-month exposure period.

- Difficult to access and wadable—Habitats with these categories are too flooded to access during part of the 7-month period, and are less attractive and more difficult to access during times when they are not flooded. The duration of flooding varies from year to year. In general, it was assumed that habitats included in the difficult to access category were flooded or otherwise inaccessible for 1 of the 7 months, and habitats included in the wadable category were flooded or otherwise inaccessible for 2 of the 7 months. Therefore, the maximum use-weighting factor for the difficult to access category was 0.86 (6 months accessible/7-month exposure period) and for the wadable category was 0.71 (5 months accessible/7-month exposure period).

  These factors were further reduced based on the assumption that most users would find habitats in these categories less desirable to recreate in than the habitats in the walkable category, even during times when they were not flooded. An estimate of the amount of time spent in the walkable category, compared to difficult to access or wadable, was based on estimates of use by professional ecologists and by HRA residents who engage in upland hunting. Upland hunting is considered the activity most likely to lead to contact with soil in difficult to access or wadable areas, and thus it is reasonable to assume that the use of these areas would be lower for other users. The ecologists estimated, and the upland hunters agreed, that they would frequent habitats in the walkable category at least four times more often than habitats in the difficult to access and wadable categories. Therefore an “accessibility” factor of 0.25 was applied to difficult to access areas and wadable areas. The result of the combined “flooding” and “accessibility” factors is the use-weighting factor. The maximum use-weighting factor for difficult to access areas (0.86 x 0.25) is 0.22, and the maximum use-weighting factor for wadable areas (0.71 x 0.25) is 0.18. Rounded to one significant figure, the use-weighting factor is 0.2 for both categories.

The one exception to the use-weighting approach was the waterfowl hunter. No use-weighting factors were applied for this exposure scenario based on the assumption that a waterfowl hunter will contact all areas as part of typical hunting activities. Consequently, all use categories for the waterfowl hunter were given a factor of 1.0.

The exposure point concentration calculation is based on the assumption that a receptor contacts the soil randomly throughout the exposure area. This use-weighting approach was used as a practical alternative to modifying exposure frequency values for each accessibility category within each exposure area. The exposure frequency was kept constant within each exposure area, but the relative contribution to the EPC from wadable and difficult-to-access areas was reduced to simplify the overall analysis at the numerous EAs. This approach results in the same exposure as applying exposure frequency modifications at each accessibility category.

Reach 7 Soil

Spatial weighting was not used to calculate EPCs in Reach 7. Habitats and other features were not delineated in Reach 7 at the resolution that was available for Reaches 5 and 6, and the IDW approach could not be applied. Instead, the 95% UCLs were calculated using the measured soil data in each EA or subarea, with no spatial weighting or use-weighting factors.

Sediment

Sediment was evaluated in three large area groupings in Reaches 5 and 6, and five impoundment areas in Reaches 7 and 8. These groupings were selected for three reasons: (1) activities involving sediment contact, such as canoeing, take place over large stretches of river; (2) there has been documented movement of sediment during high-flow periods; and (3) although small-scale variability in contaminant concentrations has been observed, reach-wide central tendencies are relatively stable. Thus, the exposure areas were selected based on river conditions and likely activities. Data collected from locations up to 20 feet (6 meters) from the shoreline were used in the calculation of the EPCs for impoundments. This was based on the assumption that receptors were not likely to come into contact on a regular basis with sediment beyond this distance from shoreline. All sediment data collected at free-flowing areas of the river were used in the development of the EPCs, given the greater accessibility of these areas.

Identification of Exposure Models and Parameters

The exposure dose was represented as the daily intake of a COPC an individual receives through each exposure pathway (e.g., soil ingestion and dermal contact). Doses were calculated based on two different averaging times:

- Average daily doses (ADDs), in which the doses were averaged over the assumed exposure duration, were used to evaluate noncancer health effects.
- Lifetime average daily doses (LADDs), in which the doses were averaged over a 70-year lifetime, were used to evaluate potential cancer risks.

Exposure doses were expressed as either administered (oral) or absorbed (dermal) doses in milligrams of contaminant per kilogram of body weight per day (mg/kg-d). The general equation for calculating a contaminant dose by any exposure pathway is shown below.

$$\text{Dose (Intake, mg/kg-d)} = (C \times CR \times EFD)/(BW \times AT)$$

Where:

C = Exposure concentration of a contaminant in medium (soil or sediment) contacted during the exposure period, and expressed as amount of contaminant per weight of medium (e.g., mg contaminant/kg in soil).

CR = Contact rate, expressed as the amount of medium contacted per unit of time (e.g., mg soil/day).

EFD = Exposure frequency and duration; describes how long and how often exposure occurs. Usually calculated using two terms:

EF = Exposure frequency (days/year).

ED = Exposure duration (years).

BW = Body weight; the average body weight over the exposure period (kg).

AT = Averaging time; period over which exposure is averaged (days).

The ADD or LADD for each contaminant and pathway was used in conjunction with the contaminant-specific CSF and RfD to calculate the cancer risks and the potential for noncancer health effects, respectively.

The calculated exposure to soil or sediment is a function of the contaminant concentration, frequency and duration of exposure (i.e., days/year and total years), the amount ingested, and the amount absorbed through the skin. The latter is dependent upon the amount of skin exposed, the amount of soil or sediment that adheres to the skin, and the absorption properties of the contaminant. The following exposure parameters were used to calculate the doses:

- Body weight (BW).
- Averaging time (AT) – cancer and noncancer.
- Exposure frequency (EF).
- Exposure duration (ED).
- Ingestion rate (IR).
- Fraction ingested (FI).
- Exposed skin surface area (SA).

- Skin adherence factor (AF).
- Dermal absorption factor (ABS_d).
- Concentration (C) of contaminant in soil or sediment.

To the extent possible, site-specific data were used to derive exposure parameters, including exposure frequency and duration.

POINT ESTIMATE RISK CHARACTERIZATION

The purpose of the risk characterization is to integrate the information developed in the exposure assessment and the dose-response assessment into an evaluation of the potential health risks from direct contact exposure for each exposure scenario in each EA. Both cancer risks and noncancer health effects were evaluated for the RME and CTE scenarios using point estimate and probabilistic (recreational scenarios only) methodologies for the current land use and reasonably anticipated future land use. The probabilistic methods used included a one-dimensional Monte Carlo analysis and a probability bounds analysis.

The one-dimensional Monte Carlo cancer and noncancer models are generalizations of the models used in the point estimate approach, the only difference being that probability distributions are used in place of many of the point estimate inputs. Probability bounds were calculated for the one-dimensional Monte Carlo simulations. Probability bounds analysis (PBA) is a combination of the methods of standard interval analysis and classical probability theory. The probability bounds are presented as intervals or p-boxes which comprehensively bound the variability and uncertainty in the distribution of risk.

A dependency bounds analysis (DBA) was used to consider any and all possible dependencies that may exist between the exposure variables. The DBA propagates these possible dependencies through the risk calculations. When all the variables are assumed to be independent of one another, the dependency bounds analysis results in the same risk distribution as the Monte Carlo simulation. A sensitivity analysis, using correlation analysis, was conducted to provide additional information on the uncertainty of input variables used in the probabilistic assessment.

Point estimate cancer risks were calculated using the following equation:

$$Risk = LADD * CSF$$

Where:

Risk = Excess lifetime cancer risk, or the risk of developing an extra cancer due to the evaluated exposure over the course of a 70-year lifetime.

LADD = Lifetime average daily dose; intake averaged over a 70-year lifetime (mg contaminant/kg-body weight per day).

CSF = Contaminant- and route-specific cancer slope factor $(mg/kg\text{-}d)^{-1}$.

For the point estimate HQs, the RME and CTE point estimate LADDs were multiplied by the CSF. For the probabilistic methods, cancer risks were calculated by multiplying the LADD distributions by the CSF.

Cancer risks were summed across the incidental ingestion and dermal contact pathways for each receptor and exposure scenario to yield a cumulative lifetime risk. The EPA cancer risk range identified in the National Contingency Plan (NCP) (EPA, 1990) is 1 in 1,000,000 (expressed as 1E-06) to 1 in 10,000 (expressed as 1E-04) over the course of a 70-year lifetime. Where the cumulative site risk to an individual based on the RME exceeds the 1E-04 excess lifetime cancer risk, action is generally warranted at a site. For sites where the cumulative site risk to an individual based on the RME is less than 1E-04, action generally is not warranted, but may be warranted if a chemical-specific standard that defines acceptable risk is violated or if there are noncancer effects or an adverse environmental impact that warrants action. EPA may also decide that a lower level of risk is unacceptable and that action is warranted where, for example, there are uncertainties in the risk assessment results. Once EPA has decided to take an action, EPA has expressed a preference for cleanups achieving the more protective end of the range (i.e., 1E-06), although strategies achieving reductions in site risks anywhere in the risk range may be deemed acceptable by EPA (EPA, 1991).

Noncancer effects are described using the hazard index (HI), which is calculated by summing the hazard quotients (HQs) for tPCBs for both incidental ingestion and dermal contact. An HQ is the ratio of the exposure duration-averaged daily dose (ADD) to the contaminant-specific RfD. The HQ-RfD relationship is calculated using the following equation:

$$HQ = ADD/RfD$$

Where:

HQ = Hazard quotient.

ADD = Average daily dose; estimated daily intake averaged over the exposure period (mg/kg-d).

RfD = Reference dose (mg/kg-d).

For the point estimate HQs, the point estimate ADD was divided by the RfD. For the probabilistic methods, the ADD distribution was divided by the RfD.

HQs for incidental ingestion and dermal contact were summed to calculate HIs for each scenario for each receptor (age group). HIs of less than 1 indicate that adverse health effects associated with the exposure scenario are unlikely to occur. EPA considers action when the HI exceeds 1.

Point Estimate Results

For the point estimate evaluation, risk assessments were conducted for approximately 150 soil and sediment EAs and subareas. Each of these risk assessments includes a brief site description, a description of the current and future uses, the scenario(s) evaluated, and summary tables presenting the point estimate risks. In addition, each EA has a figure that illustrates the area, delineates areas with tPCB concentrations greater than or equal to 50 mg/kg, and summarizes the data used in the assessment. The section below summarizes the point estimate risk results, by exposure scenario, associated with the activities that occur in the Rest of River area. The detailed risk assessments for each EA and subarea are presented in Section 5. The following sections provide an overview of the cancer risk and noncancer hazard by exposure media for tPCBs only. The contribution to cancer risks from TEQ is discussed in the uncertainty analysis.

Point Estimate Risks from Floodplain Soil Exposure

Exposure to PCB-contaminated soil can occur through a variety of exposure scenarios. Figures ES-3 and ES-4 present a summary of the range of tPCB cancer risks for each soil exposure scenario, how these risks compare to the EPA risk range, and how the risks from the scenarios compare to each other for the RME and CTE, respectively. Similarly, Figures ES-5 and ES-6 present a summary of the range of tPCB HIs for each soil exposure scenario, how they compare

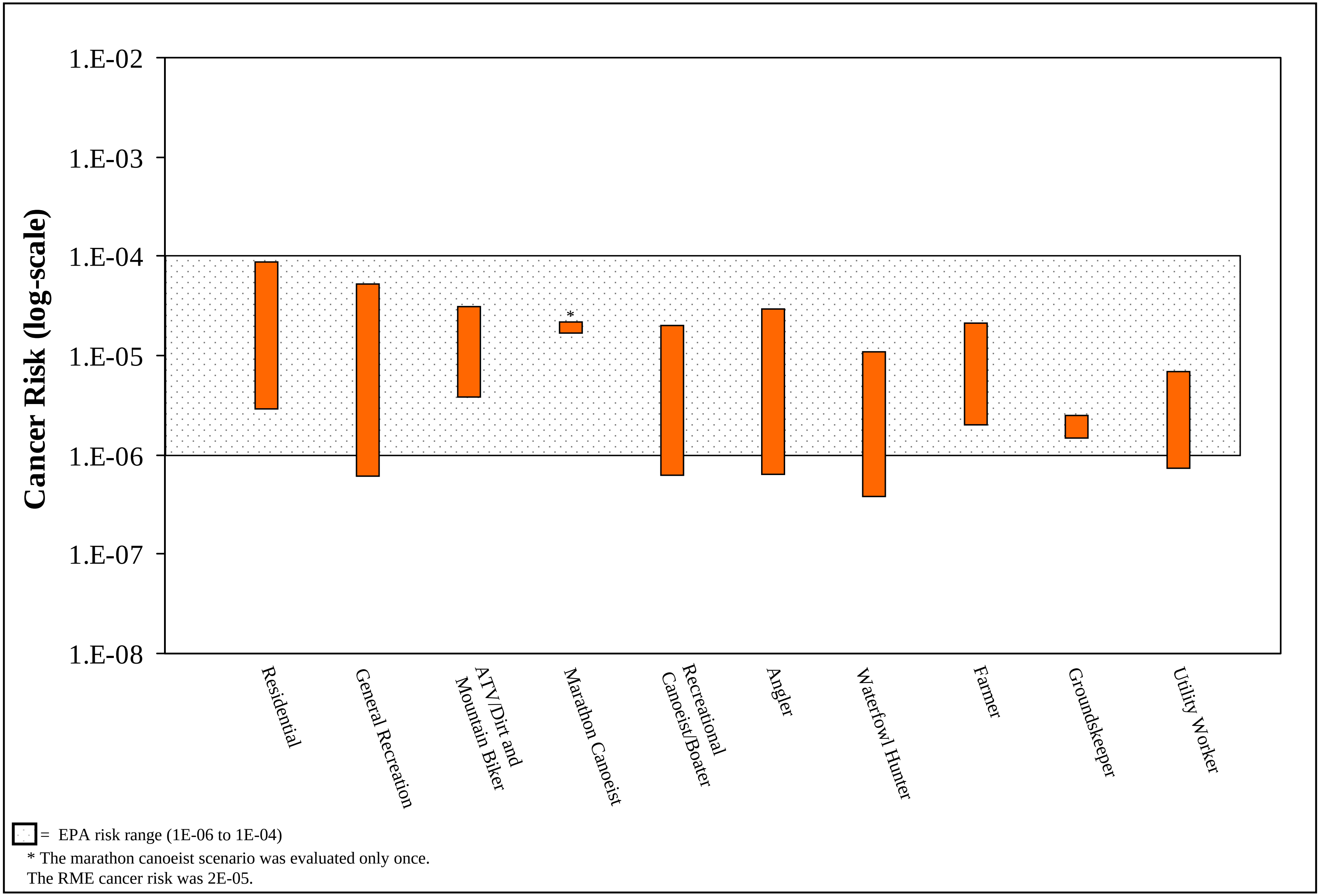

Figure ES-3 Summary of the Ranges of the tPCB RME Cancer Risks from Exposure to Soil

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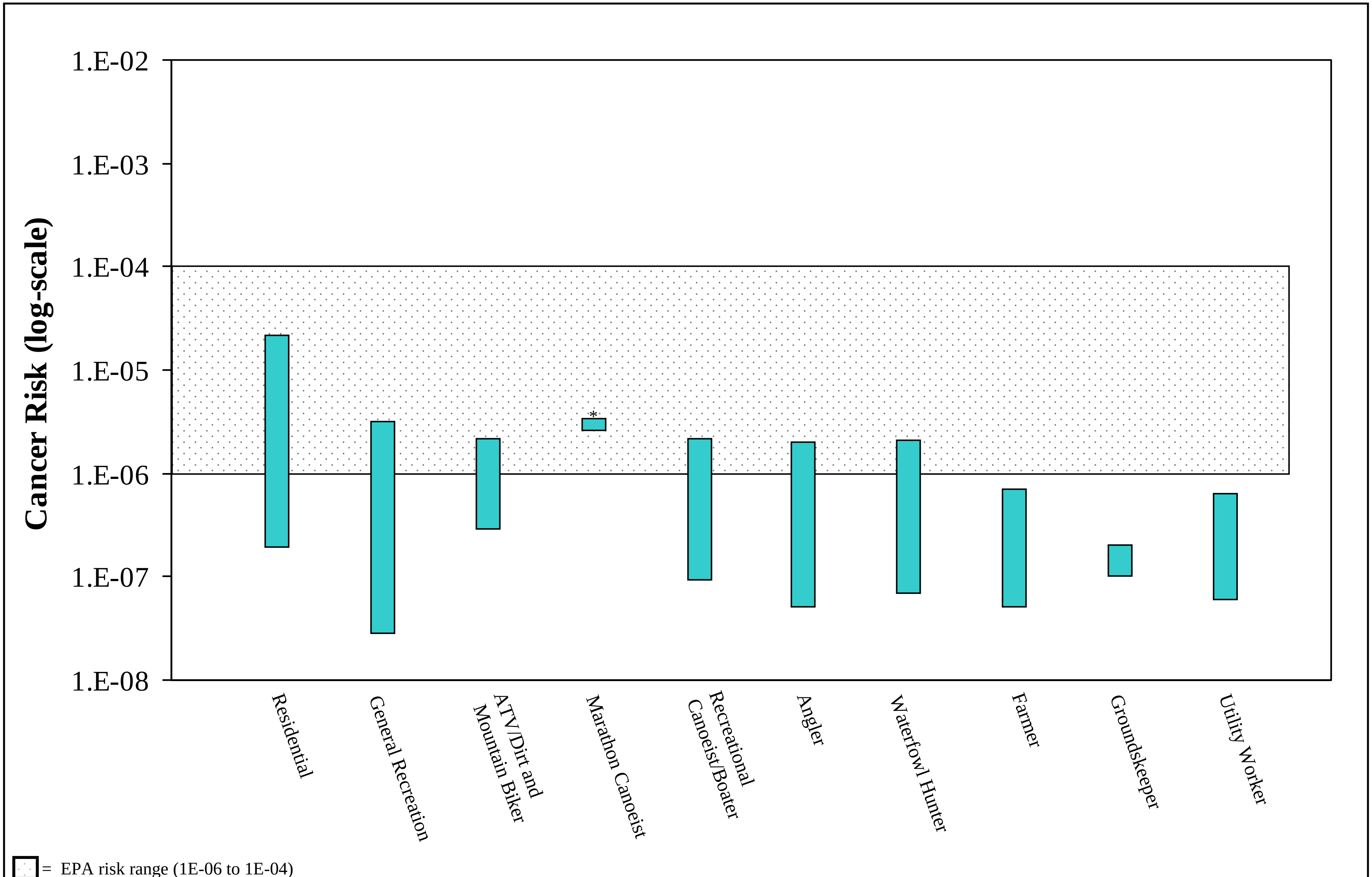
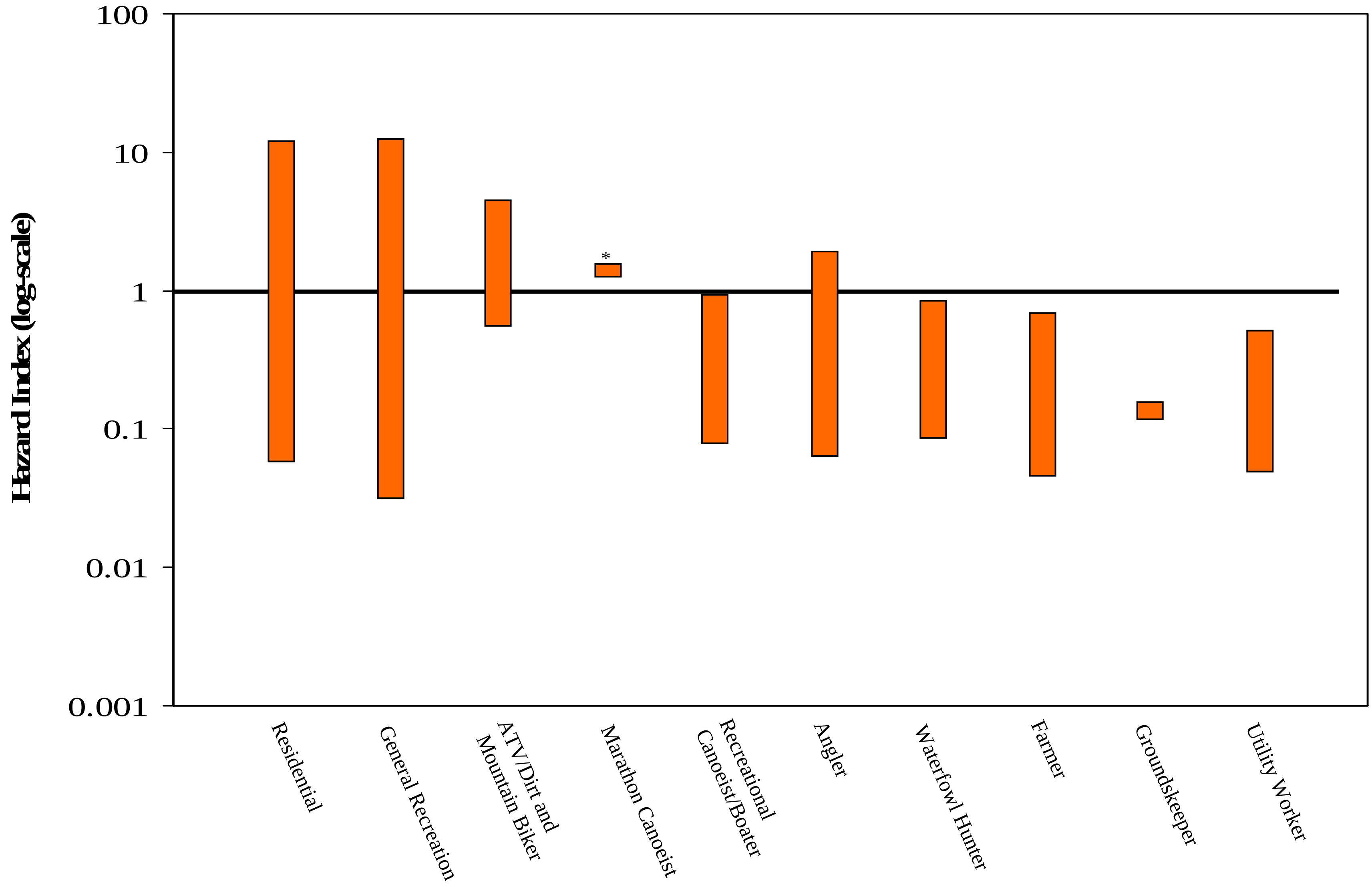


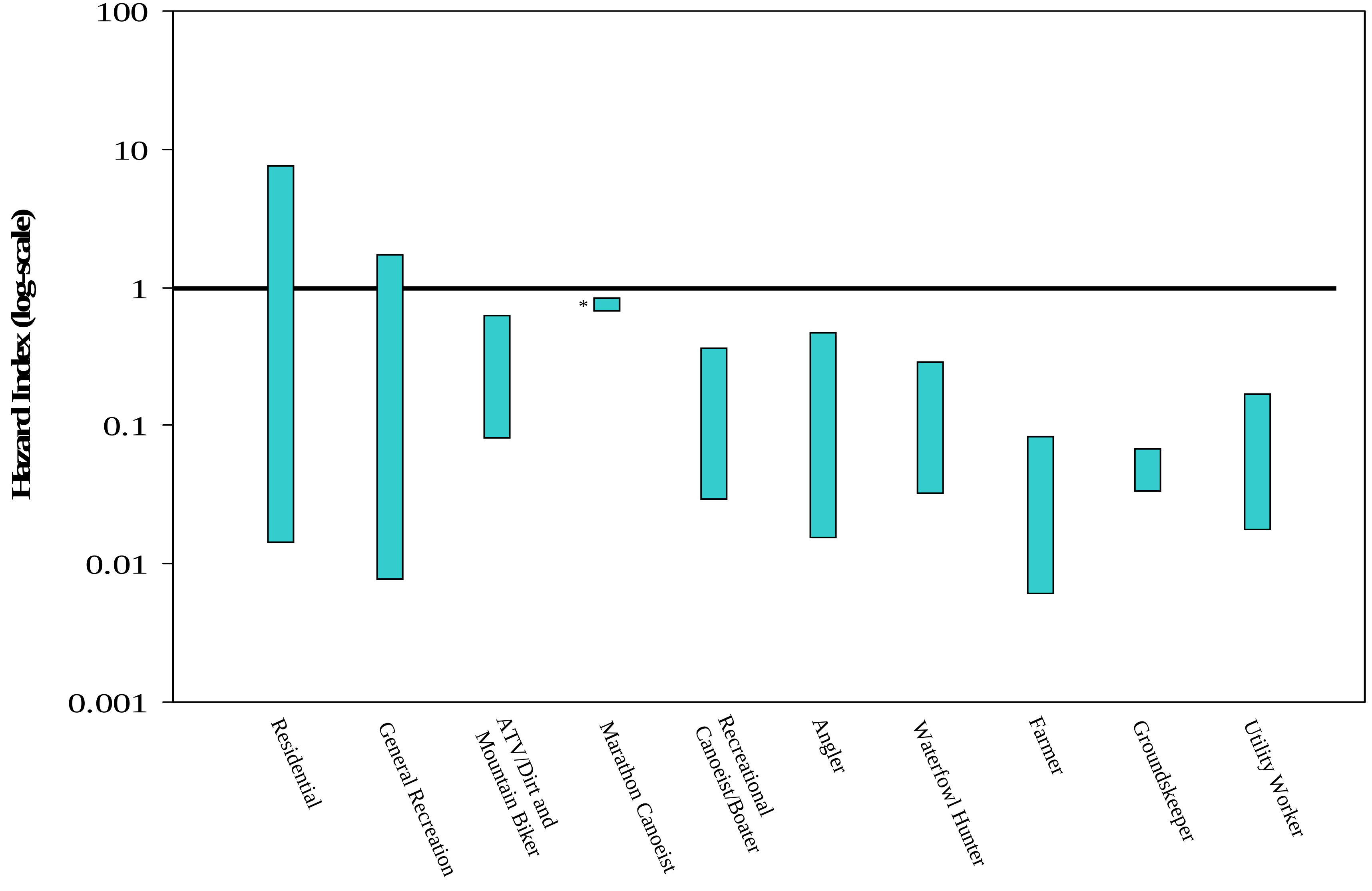
* The marathon canoeist scenario was evaluated only once.
The CTE cancer risk was 3E-06.

Figure ES-4 Summary of the Ranges of the tPCB CTE Cancer Risks from Exposure to Soil



* The marathon canoeist scenario was evaluated only once.
The RME hazard index was 1.4.

Figure ES-5 Summary of the Ranges of the tPCB RME Hazard Indices from Exposure to Soil



* The marathon canoeist scenario was evaluated only once.
The CTE hazard index was 0.77.

Figure ES-6 Summary of the Ranges of the tPCB CTE Hazard Indices from Exposure to Soil

to the EPA benchmark, and how the HIs associated with each of the scenarios compare to one another for the RME and CTE, respectively.

As shown in Figures ES-3 and ES-4, all of the soil exposure scenarios had tPCB cancer risks within or less than the EPA risk range. None of the cancer risks exceeded 1E-04. As shown in Figure ES-5, 5 of the 10 soil exposure scenarios had a number of tPCB RME hazard indices greater than 1. The scenarios with all RME hazard indices less than 1 for all EAs were the recreational canoeist/boater, waterfowl hunter, farmer, groundskeeper, and utility worker scenarios. As shown in Figure ES-6, only the residential and general recreation exposure scenarios had at least one CTE hazard index greater than 1.

Point Estimate Risks from Sediment Exposure

Sediment exposure can occur through a variety of recreational exposure scenarios. Sediment exposure was evaluated at eight sediment exposure areas: three in Reaches 5 and 6 and five in Reaches 7 and 8. Figure ES-7 provides an overview of the results for cancer risks, including the ranges of tPCB cancer risks by sediment exposure area, how they compare to the EPA risk range, and how the risks from the various sediment exposure areas compare to each other. As shown in Figure ES-7, all of the sediment areas had RME and CTE cancer risks for tPCB within or below the EPA risk range. Sediment Area 3 (Woods Pond) has the greatest risk.

Figure ES-8 provides an overview of the results for noncancer effects, including the range of tPCB HIs by sediment exposure area, how they compare to the EPA benchmark, and how the risks from the various areas compare to each other. As shown in Figure ES-8, two of the eight sediment areas (3 and 7) had RME HIs greater than 1. The maximum RME HI was 3.5 for the older child at Sediment Area 3. None of the sediment areas had CTE HIs greater than 1.

PROBABILISTIC RISK CHARACTERIZATION

Cancer risk and noncancer hazard results from the probabilistic risk assessment are summarized in tabular format (Table ES-2 and Table ES-3). Table ES-2 shows cancer risks by selected percentiles. Each cell of the table shows the results of the MCA analog analysis (MCA), dependency bounds analysis (DBA, in brackets), and probability bounds analysis (PBA, in brackets). For example, in the 95th percentile for the adult angler, the MCA analog analysis

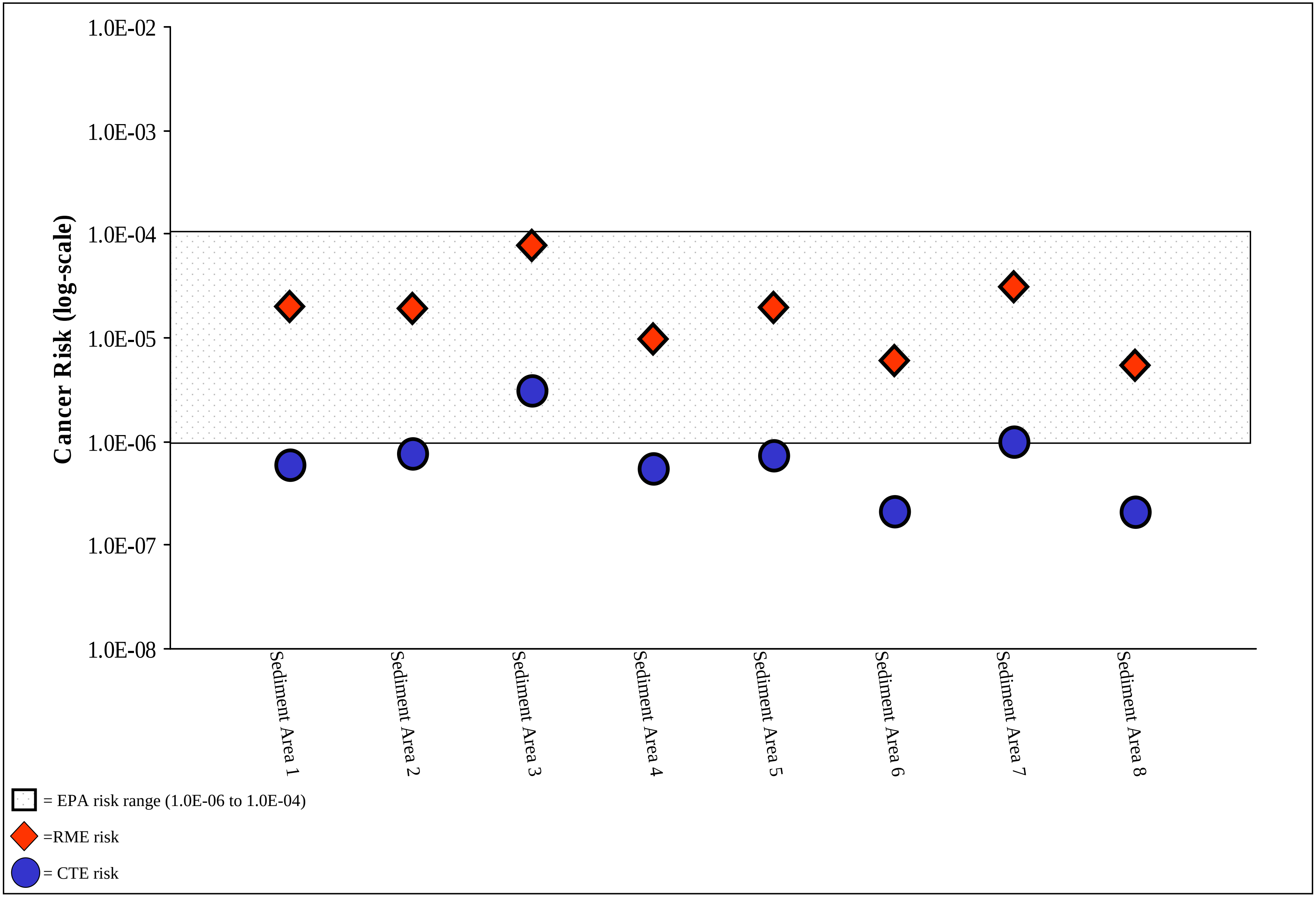


Figure ES-7 Summary of the Range of tPCB Cancer Risks from Direct Contact Exposure to Sediment

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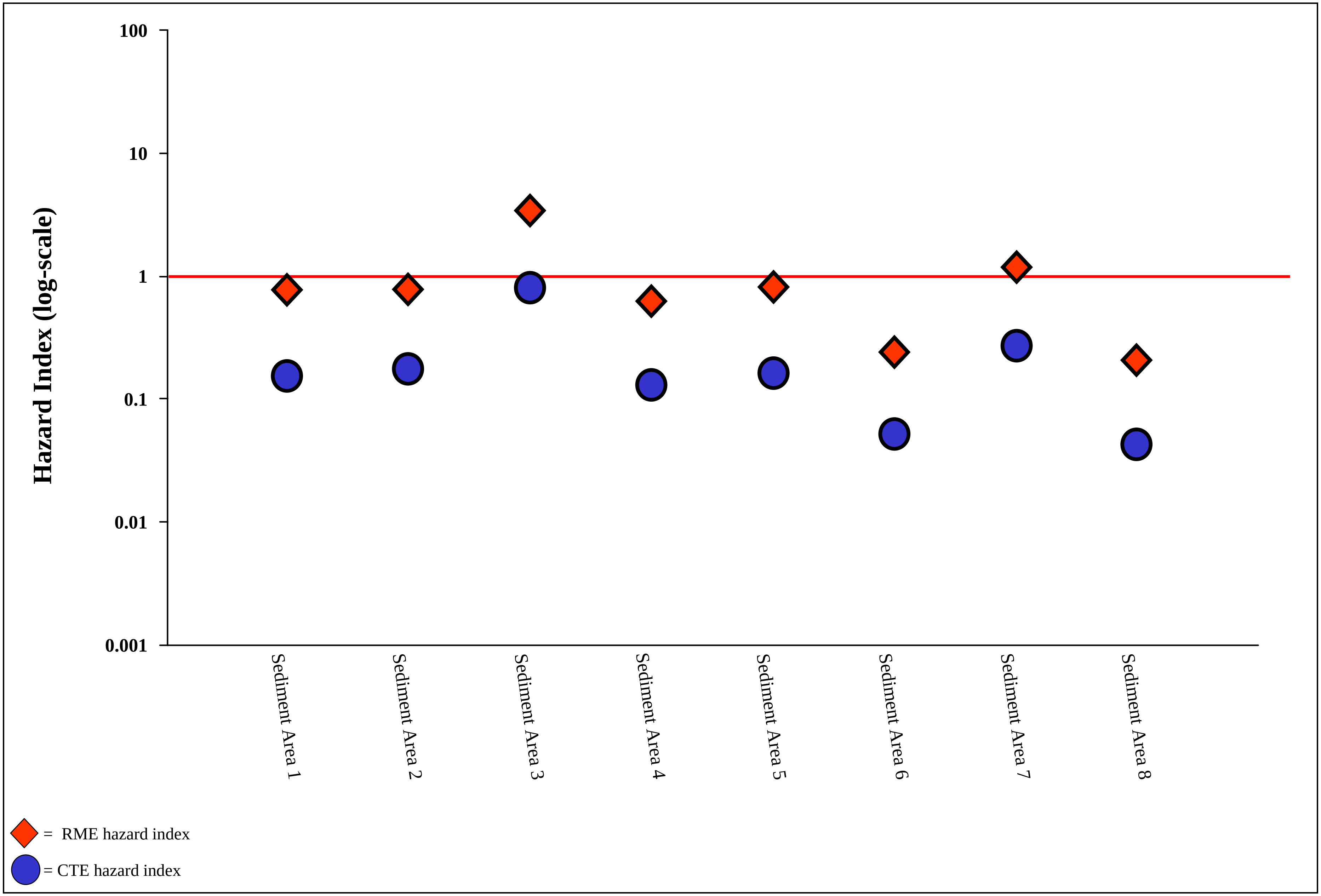

Figure ES-8 Summary of the Range of tPCB Hazard Indices from Direct Contact Exposure to Sediment

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Table ES-2
Cancer Risk Results of the Probability Bounds Risk Analysis, One-Dimensional Monte Carlo Analog Analysis and Dependency Bounds (at assumed tPCB EPC of 1 mg/kg)

Exposure Scenario	Receptor	Analysis	Cancer risk percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
General Recreation	Young Child	MCA	3E-08	6E-08	1E-07	2E-07	2E-07	3E-07
		DBA	[8E-09, 1E-07]	[2E-08, 2E-07]	[3E-08, 3E-07]	[4E-08, 4E-07]	[5E-08, 5E-07]	[6E-08, 7E-07]
		PBA	[3E-10, 3E-06]	[8E-10, 4E-06]	[2E-09, 6E-06]	[3E-09, 6E-06]	[3E-09, 7E-06]	[4E-09, 7E-06]
	Older Child	MCA	1E-08	3E-08	6E-08	1E-07	1E-07	2E-07
		DBA	[2E-09, 8E-08]	[5E-09, 1E-07]	[1E-08, 2E-07]	[2E-08, 3E-07]	[2E-08, 4E-07]	[3E-08, 7E-07]
		PBA	[4E-11, 2E-06]	[1E-10, 2E-06]	[3E-10, 3E-06]	[4E-10, 5E-06]	[5E-10, 6E-06]	[6E-10, 7E-06]
	Adult	MCA	2E-08	6E-08	1E-07	3E-07	4E-07	7E-07
		DBA	[2E-09, 1E-07]	[8E-09, 3E-07]	[2E-08, 5E-07]	[4E-08, 8E-07]	[5E-08, 1E-06]	[6E-08, 2E-06]
		PBA	[7E-11, 2E-06]	[3E-10, 5E-06]	[1E-09, 9E-06]	[2E-09, 2E-05]	[3E-09, 2E-05]	[4E-09, 2E-05]
ATV/Dirt and Mountain Biker	Older Child	MCA	3E-08	5E-08	9E-08	1E-07	2E-07	3E-07
		DBA	[8E-09, 1E-07]	[2E-08, 2E-07]	[3E-08, 3E-07]	[5E-08, 4E-07]	[5E-08, 5E-07]	[7E-08, 7E-07]
		PBA	[2E-10, 1E-06]	[5E-10, 2E-06]	[8E-10, 2E-06]	[1E-09, 3E-06]	[1E-09, 3E-06]	[2E-09, 4E-06]
Angler	Older Child	MCA	7E-09	2E-08	5E-08	1E-07	2E-07	7E-07
		DBA	[1E-09, 3E-08]	[4E-09, 6E-08]	[1E-08, 1E-07]	[3E-08, 3E-07]	[4E-08, 6E-07]	[9E-08, 2E-06]
		PBA	[3E-11, 4E-07]	[7E-11, 8E-07]	[2E-10, 2E-06]	[3E-10, 3E-06]	[5E-10, 5E-06]	[1E-09, 2E-05]
	Adult	MCA	2E-08	5E-08	1E-07	3E-07	6E-07	2E-06
		DBA	[4E-09, 7E-08]	[1E-08, 2E-07]	[3E-08, 4E-07]	[8E-08, 9E-07]	[1E-07, 2E-06]	[3E-07, 6E-06]
		PBA	[2E-11, 1E-06]	[6E-11, 2E-06]	[2E-10, 5E-06]	[5E-10, 9E-06]	[9E-10, 2E-05]	[2E-09, 6E-05]
Waterfowl Hunter	Older Child	MCA	2E-09	5E-09	1E-08	2E-08	4E-08	6E-08
		DBA	[4E-10, 9E-09]	[1E-09, 2E-08]	[3E-09, 3E-08]	[7E-09, 6E-08]	[1E-08, 9E-08]	[2E-08, 1E-07]
		PBA	[3E-11, 2E-07]	[7E-11, 3E-07]	[1E-10, 3E-07]	[2E-10, 3E-07]	[2E-10, 4E-07]	[3E-10, 4E-07]
	Adult	MCA	1E-08	3E-08	6E-08	1E-07	2E-07	4E-07
		DBA	[2E-09, 5E-08]	[5E-09, 1E-07]	[1E-08, 2E-07]	[3E-08, 4E-07]	[5E-08, 6E-07]	[7E-08, 8E-07]
		PBA	[2E-11, 1E-06]	[6E-11, 1E-06]	[1E-10, 2E-06]	[4E-10, 2E-06]	[5E-10, 2E-06]	[8E-10, 2E-06]
Recreational Canoeist/Boater	Older Child	MCA	4E-08	8E-08	2E-07	3E-07	5E-07	8E-07
		DBA	[7E-09, 2E-07]	[2E-08, 3E-07]	[5E-08, 5E-07]	[8E-08, 8E-07]	[1E-07, 9E-07]	[1E-07, 2E-06]
		PBA	[9E-11, 5E-06]	[2E-10, 7E-06]	[3E-10, 9E-06]	[5E-10, 1E-05]	[6E-10, 1E-05]	[7E-10, 1E-05]
	Adult	MCA	6E-08	2E-07	4E-07	9E-07	1E-06	2E-06
		DBA	[8E-09, 3E-07]	[3E-08, 7E-07]	[8E-08, 1E-06]	[1E-07, 2E-06]	[2E-07, 3E-06]	[2E-07, 4E-06]
		PBA	[1E-10, 6E-06]	[5E-10, 1E-05]	[1E-09, 2E-05]	[3E-09, 4E-05]	[4E-09, 4E-05]	[5E-09, 5E-05]
Sediment	Older Child	MCA	2E-08	5E-08	1E-07	2E-07	3E-07	5E-07
		DBA	[5E-09, 1E-07]	[1E-08, 2E-07]	[3E-08, 3E-07]	[6E-08, 5E-07]	[7E-08, 6E-07]	[1E-07, 9E-07]
		PBA	[6E-11, 2E-06]	[1E-10, 3E-06]	[2E-10, 5E-06]	[2E-10, 5E-06]	[3E-10, 6E-06]	[3E-10, 7E-06]
	Adult	MCA	4E-08	1E-07	3E-07	6E-07	9E-07	1E-06
		DBA	[6E-09, 2E-07]	[2E-08, 4E-07]	[6E-08, 8E-07]	[1E-07, 1E-06]	[1E-07, 2E-06]	[2E-07, 3E-06]
		PBA	[1E-10, 3E-06]	[3E-10, 6E-06]	[8E-10, 1E-05]	[1E-09, 2E-05]	[2E-09, 2E-05]	[2E-09, 3E-05]

Table ES-3
Noncancer Hazard Results of the Probability Bounds Risk Analysis, One-Dimensional Monte Carlo Analog Analysis and Dependency Bounds (at assumed tPCB EPC of 1 mg/kg)

Exposure Scenario	Receptor	Analysis	Noncancer hazard percentiles 25%	50%	75%	RME range 90%	95%	99%
General Recreation	Young Child	MCA	0.021	0.033	0.050	0.070	0.084	0.12
		DBA	[0.010, 0.041]	[0.017, 0.062]	[0.026, 0.090]	[0.035, 0.12]	[0.040, 0.15]	[0.048, 0.21]
		PBA	[0.00049, 0.87]	[0.0014, 1.2]	[0.0029, 1.6]	[0.0045, 1.8]	[0.0054, 1.9]	[0.0065, 2.0]
	Older Child	MCA	0.0055	0.0094	0.015	0.024	0.031	0.056
		DBA	[0.0022, 0.013]	[0.0045, 0.021]	[0.0086, 0.031]	[0.014, 0.046]	[0.019, 0.06]	[0.033, 0.10]
		PBA	[0.000074, 0.24]	[0.00021, 0.35]	[0.00045, 0.45]	[0.00070, 0.71]	[0.00083, 0.86]	[0.0010, 0.98]
	Adult	MCA	0.0035	0.0060	0.0097	0.015	0.020	0.036
		DBA	[0.0014, 0.0074]	[0.0030, 0.011]	[0.0057, 0.017]	[0.0097, 0.025]	[0.013, 0.033]	[0.022, 0.060]
		PBA	[0.000057, 0.15]	[0.00016, 0.23]	[0.00033, 0.30]	[0.00052, 0.56]	[0.00061, 0.68]	[0.00074, 0.77]
ATV/Dirt and Mountain Biker	Older Child	MCA	0.011	0.017	0.024	0.033	0.040	0.057
		DBA	[0.0059, 0.019]	[0.0092, 0.029]	[0.013, 0.042]	[0.017, 0.059]	[0.020 0.072]	[0.023, 0.10]
		PBA	[0.00042, 0.017]	[0.00081, 0.25]	[0.0014, 0.32]	[0.0020, 0.40]	[0.0023, 0.45]	[0.0027, 0.52]
Angler	Older Child	MCA	0.0023	0.0058	0.014	0.033	0.054	0.18
		DBA	[0.0016, 0.0043]	[0.0046, 0.0095]	[0.012, 0.021]	[0.027, 0.047]	[0.042, 0.085]	[0.093, 0.32]
		PBA	[0.000060, 0.062]	[0.00013, 0.12]	[0.00028, 0.24]	[0.00055, 0.44]	[0.00081, 0.73]	[0.0023, 3.1]
	Adult	MCA	0.0015	0.0037	0.0091	0.021	0.036	0.12
		DBA	[0.0011, 0.0024]	[0.0030, 0.0054]	[0.0076, 0.012]	[0.018, 0.029]	[0.028, 0.051]	[0.064, 0.19]
		PBA	[0.000034, 0.042]	[0.000079, 0.081]	[0.00018, 0.17]	[0.00036, 0.31]	[0.00052, 0.62]	[0.0014, 2.0]
Waterfowl Hunter	Older Child	MCA	0.0013	0.0029	0.0060	0.013	0.019	0.026
		DBA	[0.00059, 0.0026]	[0.0015, 0.0053]	[0.0039, 0.010]	[0.0097, 0.019]	[0.016, 0.026]	[0.022, 0.034]
		PBA	[0.000061, 0.062]	[0.00013, 0.074]	[0.00023, 0.087]	[0.00033, 0.095]	[0.00039, 0.10]	[0.00046, 0.11]
	Adult	MCA	0.00100	0.0021	0.0044	0.0091	0.014	0.019
		DBA	[0.00044, 0.0020]	[0.0011, 0.0041]	[0.0027, 0.0075]	[0.0069, 0.014]	[0.011, 0.019]	[0.015, 0.026]
		PBA	[0.000043, 0.042]	[0.000095, 0.050]	[0.00018 0.058]	[0.00026, 0.068]	[0.00030, 0.076]	[0.00036, 0.083]
Recreational Canoeist/Boater	Older Child	MCA	0.013	0.026	0.053	0.086	0.11	0.17
		DBA	[0.0092, 0.026]	[0.021, 0.041]	[0.046, 0.071]	[0.077, 0.11]	[0.095, 0.14]	[0.13, 0.22]
		PBA	[0.00016, 0.77]	[0.00032, 1.0]	[0.00059, 1.3]	[0.00087, 1.4]	[0.0010, 1.7]	[0.0012, 1.9]
	Adult	MCA	0.0082	0.016	0.034	0.056	0.072	0.12
		DBA	[0.0059, 0.014]	[0.013, 0.023]	[0.030, 0.043]	[0.050, 0.068]	[0.063, 0.086]	[0.091, 0.15]
		PBA	[0.000087, 0.52]	[0.00020, 0.69]	[0.00038 0.87]	[0.00057, 1.2]	[0.00068, 1.4]	[0.00081, 1.6]
Sediment	Older Child	MCA	0.0082	0.017	0.034	0.056	0.071	0.11
		DBA	[0.0061, 0.015]	[0.014, 0.025]	[0.030, 0.044]	[0.050, 0.071]	[0.063, 0.089]	[0.087, 0.14]
		PBA	[0.00010, 0.36]	[0.00018, 0.51]	[0.00030, 0.66]	[0.00042, 0.76]	[0.00048, 0.87]	[0.00056, 0.99]
	Adult	MCA	0.0052	0.011	0.022	0.036	0.047	0.075
		DBA	[0.0040, 0.0084]	[0.0091, 0.015]	[0.020, 0.027]	[0.033, 0.044]	[0.041, 0.056]	[0.058, 0.091]
		PBA	[0.000051, 0.24]	[0.000099, 0.35]	[0.00018, 0.45]	[0.00025, 0.62]	[0.00030, 0.75]	[0.00035, 0.85]

resulted in a cancer risk of 6E-07, the DBA resulted in a cancer risk in the interval [1E-07, 2E-06], and the PBA resulted in a cancer risk in the interval [9E-10, 2E-05]. The DBA indicates the range of possible cancer risks given any of the possible dependencies between variables in the risk model. The PBA indicate the range of possible cancer risk values given both the dependencies allowed for by the dependency bounds analysis and the uncertainty regarding the magnitudes and precise distributional shapes of the various input distributions.

Table ES-3 presents the noncancer hazard indices from the probabilistic risk assessment for selected percentiles. Like Table ES-2, each cell of the table shows the results of the MCA analog analysis (MCA), dependency bounds analysis (DBA, in brackets), and probability bounds analysis (PBA, in brackets). The PBA indicates the range of values that the HIs could take given the uncertainty regarding the magnitudes and precise distributional shapes of the various input distributions.

COMPARISON OF POINT ESTIMATE AND PROBABILISTIC RESULTS

A combination of high-end and average values for exposure parameters was used in the point estimate approach to calculate the RME risk, and average values were used to calculate the CTE risk. In the probabilistic assessments, the RME risk and CTE risk were obtained from the risk distribution. EPA defines the high-end risk, or RME range, as generally between the 90^{th} and 99.9^{th} percentiles, whereas the CTE risk is generally the 50^{th} percentile (EPA, 2001).

Tables ES-4 and ES-5 provide the RME and CTE results from the point estimate and the 95^{th} percentile and 50^{th} percentile (median) of the MCA analog, assuming a tPCB EPC of 1 mg/kg for cancer risks and noncancer hazards, respectively. The 95^{th} percentile is the approximate midpoint of the RME range and is the recommended starting point for risk management decisions (EPA, 2001). Alternative percentiles within the RME range may be selected to account for the level of confidence in the estimated risk distribution.

As indicated in Table ES-4, the point estimate RME cancer risks for the general recreation and ATV/dirt and mountain biker scenarios are approximately 1.8 to 3.5 times higher than the 95^{th} percentile of the risk calculated using the MCA analog. For the remaining scenarios, the RME

Table ES-4
Cancer Risk from Direct Contact:
Point Estimate and Monte Carlo Analog Analysis[a]

		RME Range		Central Tendency Range	
Exposure Scenario	Receptor	RME Point Estimate	95th Percentile Monte Carlo	CTE Point Estimate	50th Percentile Monte Carlo
General Recreation[b]	Young Child	7E-07	2E-07	1E-07	6E-08
	Older Child	3E-07	1E-07	4E-08	3E-08
	Adult	7E-07	4E-07	3E-08	6E-08
ATV/Dirt and Mountain Biker[b]	Older Child	5E-07	2E-07	3E-08	5E-08
Recreational Canoeist/Boater[c]	Older Child	2E-07	5E-07	3E-08	8E-08
	Adult	8E-07	1E-06	8E-08	2E-07
Angler[d]	Older Child	2E-07	2E-07	2E-08	2E-08
	Adult	4E-07	6E-07	1E-08	5E-08
Waterfowl Hunter[e]	Older Child	2E-08	4E-08	4E-09	5E-09
	Adult	2E-07	2E-07	1E-08	3E-08
Sediment Exposure[f]	Older Child	2E-07	3E-07	3E-08	5E-08
	Adult	7E-07	9E-07	4E-08	1E-07

[a] Cancer risk estimates assuming a total PCB concentration of 1 mg/kg in soil or sediment.

[b] Point estimate risks are based on an EF of 90 days/year for the RME and 30 days/year for the CTE.

[c] Point estimate risks are based on an EF of 30 and 60 days/year for the RME older child and adult, respectively, and 15 and 30 days/year for the CTE older child and adult, respectively.

[d] Point estimate risks are based on an EF of 30 days/year for the RME and 10 days/year for the CTE.

[e] Point estimate risks are based on an EF of 14 days/year for the RME and 7 days/year for the CTE.

[f] Point estimate risks are based on an EF of 36 days/year for the RME and 12 days/year for the CTE.

Table ES-5
Noncancer Hazards from Direct Contact:
Point Estimate and Monte Carlo Analog Analysis[a]

		RME Range		Central Tendency Range	
Exposure Scenario	Receptor	RME Point Estimate	95th Percentile Monte Carlo	CTE Point Estimate	50th Percentile Monte Carlo
General Recreation[b]	Young Child	0.22	0.084	0.032	0.033
	Older Child	0.038	0.031	0.0057	0.0094
	Adult	0.026	0.020	0.0043	0.0060
ATV/Dirt and Mountain Biker[b]	Older Child	0.071	0.040	0.010	0.017
Recreational Canoeist/Boater[c]	Older Child	0.024	0.11	0.0084	0.026
	Adult	0.036	0.072	0.014	0.016
Angler[d]	Older Child	0.024	0.054	0.0056	0.0058
	Adult	0.018	0.036	0.0045	0.0037
Waterfowl Hunter[e]	Older Child	0.0050	0.019	0.0025	0.0029
	Adult	0.0090	0.014	0.0019	0.0021
Sediment Exposure[f]	Older Child	0.032	0.071	0.0080	0.017
	Adult	0.025	0.047	0.0066	0.011

[a] Noncancer hazard estimates assuming a tPCB concentration of 1 mg/kg in soil or sediment.

[b] Point estimate risks are based on an EF of 90 days/year for the RME and 30 days/year for the CTE.

[c] Point estimate risks are based on an EF of 30 and 60 days/year for the RME older child and adult, respectively, and 15 and 30 days/year for the CTE older child and adult, respectively.

[d] Point estimate risks are based on an EF of 30 days/year for the RME and 10 days/year for the CTE.

[e] Point estimate risks are based on an EF of 14 days/year for the RME and 7 days/year for the CTE.

[f] Point estimate risks are based on an EF of 36 days/year for the RME and 12 days/year for the CTE.

risks are equal to or less than the 95th percentile risks. In general, the point estimate RME risks fall between the 90th and 95th percentiles. With the exception of the older child angler, the point estimate CTE risks were approximately 1.2 to 5 times less than the 50th percentile risks of the MCA analog, placing these risks between the 25th and 50th percentiles.

Table ES-5 provides a comparison of the point estimate and MCA analog for hazard indices. For the general recreation and ATV/dirt and mountain biker scenarios, the RME point estimate HIs are greater than the 95th percentile HIs calculated using the MCA analog. In general, the remaining RME point estimate HIs fall between the 75th and 90th percentiles. The CTE point estimate HI for the adult angler is 1.3 times greater than the 50th percentile. The point estimate CTE HIs for the young child general recreation, older child angler, and waterfowl hunter (older child and adult) are very close to the 50th percentile HI from the MCA analog. The point estimate HIs for the remaining scenarios fall between the 25th and 50th percentiles.

UNCERTAINTY

EPA guidance and policy (EPA, 1995) recommend that a discussion be provided of the variability and uncertainty surrounding the calculation of risk to inform decisionmakers when considering risk management alternatives. Multiple approaches were used to characterize the variability and uncertainty in the risk assessment:

- Point estimate calculations of both reasonable maximum exposure (RME) and central tendency exposure (CTE).
- Monte Carlo analysis to characterize variability in risks, providing estimates of both a CTE and an RME range (i.e., 90th to 99.9th percentiles).
- Probability bounds analysis to quantify uncertainty in the risk assessment modeling assumptions, including the derivation of point estimates and probability distributions.
- Sensitivity analyses to identify the contribution of individual exposure parameters to variability and uncertainty.
- Qualitative evaluation of sources of uncertainty in the underlying data, the selection of parameter values, and modeling assumptions.
- Evaluation of cancer risk from dioxin TEQ.

MAJOR FINDINGS

The major findings of the Phase 2 Direct Contact Risk Assessment include:

- Point estimate RME cancer risks from soil exposure to tPCBs are within the EPA risk range. All CTE risks for exposure to tPCBs were within or below the EPA risk range, typically less than 1E-05.
- Noncancer hazard indices (HIs) from soil exposure to tPCBs exceeded 1 in some EAs for about half of the RME scenarios. For most of these exceedances, the HIs were below 10. Only two of the scenarios had CTE HIs that exceeded 1.
- Cancer risks from sediment exposure to tPCBs were within the EPA risk range at all eight sediment exposure areas.
- Noncancer HIs for the RME exceeded 2 at four of the eight sediment exposure areas. None of the HIs exceeded 10.
- Noncancer risks for both soil and sediment included only an evaluation of tPCBs. Because no reference dose is available for TEQ, this potential hazard could not be quantified.
- The regression analysis performed for tPCBs and soil exposure to TEQ resulted in an increase in cancer risk for all scenarios but the risks still did not exceed the EPA risk range.

1. INTRODUCTION

1.1 OVERVIEW

The Housatonic River flows from north of Pittsfield, MA, to Long Island Sound and drains an area of approximately 1,950 square miles (500,000 hectares) in Massachusetts, New York, and Connecticut. The Housatonic River, its sediment, and associated floodplain have been contaminated with polychlorinated biphenyls (PCBs) and other hazardous substances released from the General Electric Company (GE) facility located in Pittsfield, MA. The entire site, known as the General Electric/Housatonic River Site, consists of the 254-acre (103-hectare) GE manufacturing facility; the Housatonic River and associated riverbanks and floodplains from Pittsfield, MA, to Long Island Sound; former river oxbows that have been filled; neighboring commercial properties; Allendale School; Silver Lake; and other properties or areas that have become contaminated as a result of GE's facility operations.

Because of its size and complexity, the GE/Housatonic River Site has been divided into several areas for investigation and cleanup. This report provides a comprehensive Human Health Risk Assessment (HHRA) for the portion of the site known as the Rest of River. The Rest of River extends from the confluence of the East and West Branches of the Housatonic River (the confluence) to the Massachusetts border with Connecticut, a distance of approximately 54 miles (87 km), and beyond into Connecticut to Long Island Sound. The total distance from the confluence to Long Island Sound is approximately 139 miles (224 km). In addition to the river proper, the Rest of River includes the associated riverbank and floodplain.

In September 1998, a comprehensive agreement was reached between GE and various governmental entities, including the U.S. Environmental Protection Agency (EPA), the Massachusetts Department of Environmental Protection (MDEP), the U.S. Department of Justice (DOJ), the Connecticut Department of Environmental Protection (CTDEP), and the City of Pittsfield. The agreement provides for the investigation and cleanup of the Housatonic River and associated areas. The agreement has been documented in a Consent Decree between all parties that was entered by the court in October 2000. Under the terms of the Consent Decree, EPA conducted the human health and ecological risk assessments, and is conducting a modeling study of PCB transport and fate for the Housatonic River downstream of the confluence of the East and West Branches (Rest of River) and the surrounding watershed.

The Rest of River is defined in the Consent Decree as follows:

- "Between the confluence of the East and West Branches of the River and Woods Pond Dam, the Rest of the River generally includes the Housatonic River and its sediments, as well as its floodplain (except for Actual/Potential Lawns) extending laterally to the approximate 1 ppm PCB isopleth."
- "Downstream of Woods Pond Dam, the Rest of the River shall include those areas of the River and its sediments and floodplain (except for Actual/Potential Lawns) at which Waste Materials originating at the GE Plant Area have come to be located and which are being investigated and/or remediated pursuant to this Consent Decree."

Between the confluence and Woods Pond Dam, the 1-ppm tPCB isopleth is approximately equivalent to the 10-year floodplain, based on information in the RCRA Facility Investigation (RFI) (BBL, 1996; BBL and QEA, 2003). Downstream of Woods Pond Dam, the Rest of River is approximated by the 100-year floodplain. The 10-year floodplain and 1-ppm tPCB isopleth have not been delineated downstream of Woods Pond Dam.

The Consent Decree also includes specific language that requires the risk assessments and components of the modeling studies to be submitted for formal Peer Review. The Human Health Risk Assessment (HHRA) was submitted for Peer Review in June 2003. The Peer Review was conducted in November 2003, and EPA issued a Responsiveness Summary in March 2004. This final HHRA reflects the comments from the Peer Review Panel.

The HHRA consists of seven volumes. The first volume provides a comprehensive summary of the potential risks to human health associated with contamination in the Rest of River portion of the GE/Housatonic River Site for all exposure pathways, including direct contact with soil and sediment, consumption of fish and waterfowl from the river, and consumption of agricultural products (both plant and animal) grown on the floodplain. The six remaining volumes are appendices that provide the details of the assessment conducted for each exposure pathway.

1.2 SITE HISTORY

The Housatonic River is located in a predominantly rural area of western Massachusetts and Connecticut, where farming was the main occupation from colonial settlement through the late 1800s. As with most rivers, the onset of the industrial revolution in the late 1800s brought manufacturing to the banks of the Housatonic River in Pittsfield, MA. GE began its operations in its present location in 1903. Three manufacturing divisions have operated at the GE facility (Transformer, Ordnance, and Plastics).

The 254-acre GE facility in Pittsfield has historically been the major handler of PCBs in western Massachusetts, and is the only known source of PCBs found in the Housatonic River sediment and floodplain soil in Massachusetts. Although GE performed many functions at the Pittsfield facility throughout the years, the activities of the Transformer Division, including the construction and repair of electrical transformers using dielectric fluids, some of which contained PCBs (primarily Aroclors 1260, and to a lesser extent, 1254), were one likely significant source of PCB contamination. According to GE's reports, from 1932 through 1977, releases of PCBs reached the wastewater and stormwater systems associated with the facility and were subsequently conveyed to the East Branch of the Housatonic River and to Silver Lake, a 25-acre lake adjacent to the GE facility.

During the 1940s, efforts to straighten the Pittsfield reach of the Housatonic River by the City of Pittsfield and the U.S. Army Corps of Engineers (USACE) resulted in 11 former oxbows being isolated from the river channel. The oxbows were filled with material, some of which was later discovered to contain PCBs and other hazardous substances.

The State of Connecticut posted a fish consumption advisory for most of the Connecticut section of the river in 1977 as a result of the PCB contamination in the river sediment and fish tissue. In 1982, the Massachusetts Department of Public Health (MDPH) issued a consumption advisory for fish, frogs, and turtles for the Housatonic River. In addition, in 1999, MDPH issued a waterfowl consumption advisory from Pittsfield to Great Barrington due to PCB concentrations in wood ducks and mallards collected from the river by EPA.

Although a portion of the first 2 miles downstream from the facility was historically channelized, the river's course is relatively unaffected (with the exception of the several dams downstream) in areas south of Pittsfield. The river, from the confluence of the East and West Branches of the Housatonic to Woods Pond Dam in Lenox, is 10.7 miles long. The channel in this area is commonly 60 to 90 ft wide (and is occasionally as narrow as 40 ft or as wide as 125 ft), is bordered by extensive floodplain (up to 3,600 ft wide), and has a meandering pattern with numerous oxbows and backwaters. Woods Pond, the first impoundment downstream of the GE facility, is a shallow 54-acre impoundment that was formed by the construction of a dam in the late 1800s.

The land uses of the floodplain properties in Massachusetts include residential, commercial/industrial, agricultural, recreational (such as canoeing, fishing, and hunting), wildlife management, and parks and a golf course. The Housatonic River floodplain is an attractive area for recreation, including fishing and waterfowl hunting.

Numerous studies conducted since 1988 have documented PCB contamination of soil within the floodplain of the Housatonic River downstream of the GE facility. PCBs originating from the GE facility in Pittsfield have been detected in river sediment in Massachusetts as far downstream as the border with Connecticut (BBL, 1996), and in Connecticut as far as the Derby Dam and beyond into Long Island Sound (other sources have been identified downstream of this dam). PCBs detected in Housatonic River floodplain soil and sediment consist of predominantly Aroclor 1260, with a minor contribution of Aroclor 1254.

Contaminants released from the GE facility entered the Housatonic River and its sediment via surface water runoff, riverbank soil erosion, and contaminated groundwater (primarily as a non-aqueous phase liquid [NAPL] plume). Contaminants were transported downstream to the Rest of River as three distinct phases: freely dissolved, bound to particulates, and bound to dissolved organic carbon (DOC). Floodplain soil in the Rest of River became contaminated during flooding events when contaminated sediment suspended in the floodwaters was deposited onto the floodplain.

As discussed above, the Rest of River encompasses the Housatonic River and its associated floodplain from the confluence of the East and West Branches downstream to Long Island

Sound. To simplify the description of the Rest of River evaluation, reaches of the river were designated. Figures 1-1 through 1-4 present an overview of the Rest of River and the reach designations. (Note: Figures for the Phase 2 Direct Contact Risk Assessment are presented in Volume IIIB.) The 13 reaches are described below:

- ***Reach 5*** **–** From the confluence of the East and West Branches to the Woods Pond headwaters.
- ***Reach 6*** **–** Woods Pond impoundment.
- ***Reach 7*** **–** From Woods Pond Dam to the upstream extent of the Rising Pond impoundment.
- ***Reach 8*** **–** Rising Pond impoundment.
- ***Reach 9*** **–** From Rising Pond Dam to the Massachusetts/Connecticut border.
- ***Reach 10*** **–** From the Massachusetts/Connecticut border to Great Falls Dam.
- ***Reach 11*** **–** From Great Falls Dam to Cornwall Bridge.
- ***Reach 12*** **–** From Cornwall Bridge to Bulls Bridge Dam.
- ***Reach 13*** **–** From Bulls Bridge Dam to Bleachery (New Milford) Dam.
- ***Reach 14*** **–** From Bleachery Dam to Shepaug Dam (Lake Lillinonah).
- ***Reach 15*** **–** From Shepaug Dam to Stevenson Dam (Lake Zoar).
- ***Reach 16*** **–** From Stevenson Dam to Derby Dam (Lake Housatonic).
- ***Reach 17*** **–** From Derby Dam to Long Island Sound.

1.3 RISK ASSESSMENT OVERVIEW

The human health risk assessment (HHRA) represents an important component of EPA's Supplemental Investigation of the Rest of River, along with the Ecological Risk Assessment and Modeling Study. The HHRA provides the following:

- A characterization of the potential human health risks under baseline conditions (i.e., no action) for current and future uses,
- A basis for determining the need for remedial actions, and
- A basis for setting media protection goals for contaminants of concern.

Figure 1-5 presents the conceptual site model (CSM) for the HHRA. The CSM depicts the pathways from the source of contamination through the various environmental media to exposure to individuals categorized by activity and age group.

This report, Phase 2 Direct Contact Risk Assessment, is part of the overall Human Health Risk Assessment, which consists of the HHRA report and four technical appendices (Appendices A through D). These appendices provide detailed evaluations of the risk to individuals who may come in contact with contaminants in the Housatonic River and associated floodplain by direct contact with soil and sediment, and by eating fish and waterfowl, locally raised crops, locally produced animal products, and edible wild plants.

The other technical appendices are:

- ***Appendix A - Phase 1 Direct Contact Screening Risk Assessment (Volumes IIA and IIB)* –** This appendix presents the conservative screening analysis of the potential risks from direct contact (ingestion and dermal contact) exposure to PCB-contaminated soil and sediment throughout the Rest of River. Risk-based screening levels were developed for several different land uses. Land use was determined for tax parcels or groups of tax parcels, where appropriate. Soil and sediment areas that had PCB concentrations below the screening criteria were eliminated from further evaluation. Soil and sediment areas that had PCB concentrations greater than the screening criteria were identified and evaluated more fully in the Phase 2 Direct Contact Risk Assessment.

- ***Appendix C - Consumption of Fish and Waterfowl Risk Assessment (Volume IV)* –** This appendix provides point estimate and probabilistic risk assessments for the consumption of fish and waterfowl. Risks due to fish consumption were evaluated for locations in Massachusetts and Connecticut. Risks from waterfowl consumption were evaluated in Massachusetts. PCBs, polychlorinated dioxins and furans, and several pesticides were included as contaminants of potential concern (COPCs). Although there are consumption advisories in place for fish, ducks, frogs, and turtles on the Housatonic River, the risk assessment was based on consumption rates likely to occur with no advisories in place.

- ***Appendix D - Agricultural Product Consumption Risk Assessment (Volume V)* –** This appendix provides point estimate and probabilistic risk assessments for the consumption of agricultural products, specifically milk, beef, poultry, eggs, and home gardens, based on both commercial and noncommercial (i.e., "backyard") farming practices. It also includes a qualitative assessment of the risks from other food sources that may be contaminated by PCBs in floodplain soil, such as goats, edible wild plants, and deer. The assessment is based on agricultural activities that are occurring now or reasonably may occur in the future in the Massachusetts portion of the site.

1.4 REPORT ORGANIZATION

The report is organized into the following sections:

- ***Section 2 – Hazard Identification –*** Describes data useability, data validation, and the guidelines for data reduction for risk assessment purposes; outlines the data evaluation approach; and identifies the COPCs.

- ***Section 3 – Dose-Response Assessment –*** Presents the approach to evaluating the potential cancer risks and noncancer health effects and presents the toxicity factors that were used for the COPCs identified in Section 2.

- ***Section 4 – Exposure Assessment –*** Describes the exposure setting and local land and water uses. Presents a conceptual site model that outlines sources of contamination, affected media, and current and future exposure scenarios and their associated exposure pathways. Methods for estimating the contaminant exposure point concentrations (EPCs) are also presented.

- ***Section 5 – Point Estimate Risk Characterization –*** Integrates the toxicity assessment and the exposure assessment to characterize both potential cancer and noncancer health effects.

- ***Section 6 – Probabilistic Risk Characterization –*** Presents an analysis of the variability and uncertainty associated with the exposure parameters using probabilistic techniques as supplemental information to the point estimate approach.

- ***Section 7 – Uncertainty Analysis –*** Identifies the important uncertainties in the risk assessment process, including estimates of risk from TEQ due to dioxin-like PCBs and chlorinated dioxins and furans.

- ***Section 8 – Risk Summary –*** Summarizes both the point estimate and probabilistic risk assessment results.

1.5 REFERENCES

BBL (Blasland, Bouck, & Lee, Inc.). 1996. *Supplemental Phase II/RCRA Facility Investigation for Housatonic River and Silver Lake*. Prepared for General Electric Company.

BBL (Blasland, Bouck & Lee, Inc.) and QEA (Quantitative Environmental Analysis, LLC). 2003. *Housatonic River – Rest of River RCRA Facility Investigation Report*. Prepared for General Electric Company.

2. HAZARD IDENTIFICATION

2.1 INTRODUCTION

The purpose of the hazard identification is to present the data available to assess site risks, outline the approach used to summarize data, and identify COPCs. The following sections describe the methods that were used for data reduction, data evaluation, and selection of COPCs for soil and sediment:

- Sampling Strategy and Available Data (Section 2.2)
- Data Useability and Data Validation (Section 2.3)
- Data Reduction (Section 2.4)
- Contaminants of Potential Concern (COPC) Selection Process (Section 2.5)

Typically, hazard identification sections include data tables summarizing all COPCs by individual areas under evaluation. In this assessment, given the large number of EAs, summary data are presented in the Risk Characterization (Section 5) for each EA.

2.2 SAMPLING STRATEGY AND AVAILABLE DATA

PCB concentration data in soil and sediment were available from investigations dating back to the 1970s. The sources of these data were GE and state and federal agencies. Environmental data for the Rest of River collected from the mid-1970s to 2003 were summarized in the RCRA Facility Investigation (RFI) (BBL and QEA, 2003). The report was prepared by GE as required in the Draft Reissued RCRA Permit, which was part of the Consent Decree.

The following sections describe the data collected in support of EPA's Supplemental Investigation (SI) and other available data sources.

2.2.1 Supplemental Investigation (SI) Data

The Consent Decree between GE, EPA, the States, and Trustees required a Supplemental Investigation (SI) of the Lower Housatonic River, or "Rest of River." The Rest of River is that portion of the Housatonic River from the confluence of the East and West Branches of the river to where the river discharges into Long Island Sound and its associated floodplain and riverbank soil. The data collection and evaluation activities were detailed in the Supplemental Investigation Work Plan (SIWP) prepared under contract to the U.S. Army Corps of Engineers (USACE) and EPA (WESTON, 2000). Implementation of the major elements of the SIWP was completed in 2001.

The objectives of the SI were as follows:

- Provide surface water, hydrology, and sediment data to support the development of a site-specific hydrodynamic, sediment transport, and PCB fate model.
- Characterize and sample biological media and ecological communities to support human health and ecological risk assessments and the modeling study.
- Acquire sufficient information to compare soil and sediment concentrations against screening risk-based concentrations.
- Develop site-specific human health and ecological risk assessments for the Rest of River.
- Define the nature and extent of the soil and sediment contamination in the Rest of River and associated floodplain by PCBs and other contaminants, and further delineate pathways of contaminant migration to support the above objectives.

The SIWP presented a detailed work plan rationale. This rationale outlined the data requirements, data quality objectives, and data management procedures and controls. Table 3.1-1 of the SIWP presents the list of Appendix IX compounds that were analyzed in site media (WESTON, 2000). A project-specific Quality Assurance Project Plan (QAPP) was also prepared (WESTON, 1998, revised 2003) and implemented in concert with the SI activities.

The overall strategy used by EPA to sample for PCBs in soil and sediment was presented in the SIWP (WESTON, 2000). The SIWP described the transect sampling approach for soil and sediment as well as the initial strategy for human health-related sampling and other sampling programs. The human health risk assessment used all applicable soil and sediment data from the transect sampling as well as data from locations selected during the course of the Phase 1 and the Phase 2 site investigations. These samples were identified through an iterative process in which additional locations were selected based on the likelihood of exposure, the degree of contamination, and the need to fill data gaps. The results from each round of additional sampling were reviewed and decisions on the need for and location of additional samples were determined.

2.2.2 Evaluation of Other Data Sources

In addition to the data collected in support of EPA's SI, there were two other primary sources of data that were available for use in the risk assessment. The first of these sources was historical data collected by GE and other government agencies. The second source was data more recently collected by GE. These data are summarized in the RFI (BBL and QEA, 2003). The useability of the data from these sources is discussed in Section 2.3.

2.3 DATA USEABILITY AND DATA VALIDATION

Data useability is defined as the process of ensuring that the quality of the data is appropriate for the intended uses and satisfies the data quality objectives (DQOs). Evaluation of data useability involved assessing the analytical methodology, sampling methodology, and field errors that may be inherent in the data. Factors evaluated included the level of validation (data validation tier) and data quality indicators (DQIs) such as completeness, comparability, precision and accuracy, and analytical detection limits. The EPA-collected data used in this direct contact risk assessment met all DQOs, including appropriate validation as described in the Quality Assurance Project Plan (QAPP) (WESTON, 1998, revised 2003). For additional information about the criteria used in evaluating the useability of historical data, see Attachment 8 to the HHRA, Volume I.

In addition to data collected by EPA as part of the SI, data from other sources (see Section 2.2) that met the project data useability criteria of either A or B as presented in Table 2-1 were also used in the risk assessment.

2.4 DATA REDUCTION

Data reduction includes the evaluation of data qualifiers and their potential use in the risk assessment (EPA, 1989) and describes the treatment of duplicate and co-located samples. This step is subsequent to the data useability and validation steps described above. The following guidelines were used in developing the data set to evaluate risk from direct contact with soil and sediment.

- If a contaminant was not positively identified in any sample from a given medium (reported as non-detect or associated QA blank sample was contaminated), it was not considered further for that medium.

- All J-qualified data were assumed to be positive identifications within any medium at the reported concentration. A "J" qualifier indicates that the numerical value is an estimated concentration (e.g., reported below the minimum confident sample quantitation limit, exceeded holding time, positive sample results associated with quality control recoveries below acceptance limits).

- All U-qualified data represent samples for which the analyte was not present or was below the sample quantitation limit (SQL) and reported as a "non-detect." A numerical value of one-half the sample quantitation limit was used for each non-detected sample when calculating the summary statistics.

- When summarizing data for COPC selection, the following guidelines were followed to treat duplicates:

  - If a sample duplicate was collected and analyzed, and the results of both samples (i.e., the primary and duplicate sample) were above the limit of detection, the average of the two reported concentrations was used for subsequent calculations unless there was a relative percent difference (RPD) between the two concentrations greater than or equal to 50%, in which case the higher of the two concentrations was used.

  - If a sample duplicate was collected and analyzed, and the concentration of only one of the samples was above the limit of detection, this reported concentration was used for subsequent calculations.

- When summarizing soil data for use in spatial weighting applications, the results of duplicates and co-located samples were averaged. If one of the duplicate samples was below the detection limit, then one-half the detection limit was used to compute the average. This guideline was followed regardless of whether the samples were co-located (collected at the same location at different times) or duplicates (collected at the same location and time).

2.5 CONTAMINANTS OF POTENTIAL CONCERN (COPCs) SELECTION PROCESS

2.5.1 Introduction

PCBs were retained as the primary COPC, based on the history of release of PCBs from the facility, the results of the Phase 1 screening (which eliminated specific areas of concern only, not contaminants) and the concentration and extent of PCB contamination throughout the Rest of River. Dioxins/furans were also included as a COPC based on contaminant concentrations, sitewide occurrence, and the association of these compounds, particularly furans, with the manufacture and heating of PCBs, which occurred at the facility. Therefore, PCBs and dioxins/furans were considered to be COPCs and were not included in the soil and sediment screening analysis. This soil and sediment COPC screening process focuses on compounds (Appendix IX) other than PCBs and dioxins/furans.

Because of the large number of individual parcels and exposure areas within the study area, an initial contaminant-screening step was conducted to evaluate all of the Appendix IX data available for soil and sediment in Reaches 5 and 6, also referred to as the Primary Study Area (PSA) to determine which to retain for the Phase 2 analysis. Table 3.1-1 of the SIWP presents the list of Appendix IX compounds that were sampled for and included in the screening evaluation (WESTON, 2000). The screening approach included the following:

- A comparison to EPA Region 9 Preliminary Remediation Goals (PRGs).
- A review of the frequency of detection, the frequency of PRG exceedance, and the degree of PRG exceedance.
- A comparison to site-specific background concentrations.
- A comparison to generic background concentrations developed by MDEP (MDEP, 2002).

The comparisons to background were considered when determining if naturally occurring and anthropogenic chemicals would be quantitatively versus qualitatively evaluated for risk (EPA, 2002a). The application of the background comparison is furthered discussed in Section 2.5.2.2.

The following sections present the approach to evaluating site data to identify COPCs. Separate evaluations are presented for soil and sediment. Appendix IX data were collected primarily in Reaches 5 and 6, which comprise the area from the confluence of the East and West Branches of the Housatonic River downstream to and including Woods Pond. These data were used as the basis for the selection of COPCs in soil and sediment.

2.5.2 Soil

Table 2-2 summarizes all of the detected Appendix IX chemicals in samples (0 to 1 ft) collected from Reach 5 and 6 floodplain and riverbank soil. Data from this depth interval were used for COPC selection because of the greater likelihood of human exposure to surficial soil rather than to soil at greater depths. Table 2-2 includes frequency of detection, range of detected concentrations, the EPA Region 9 residential soil PRGs (EPA, 2002b), and the number of detected samples that exceeded the PRG for each chemical. For screening purposes, the PRGs were based on either a 1E-06 target cancer risk (TR) or a 0.1 target hazard quotient (THQ). Because this was an initial screening-level assessment, the use of conservative (i.e., health protective) criteria was appropriate.

2.5.2.1 Frequency of Detection and Frequency and Degree of Exceedance

The initial criteria used in this screening analysis were the frequency of detection, the frequency of exceedance of the PRG, and the degree of exceedance of the PRG. Contaminants that exceeded their PRG at least once are presented in Table 2-3, along with the frequency of detection, the percentage detected, the range of detected concentrations, the arithmetic mean concentration, the PRG, the ratio of the maximum detected concentration to the PRG, and the number of detected samples that exceeded the PRG. Based on the information presented in Table 2-3, an additional 12 contaminants were eliminated from further evaluation in the risk assessment.

The three factors that were used to determine whether additional contaminants could be eliminated without concern that overall risk might be underestimated include:

- Frequency of detection—An indication of how prevalent a contaminant is across the entire study area.

- Frequency of exceedance of the PRG—An indication of how often concentrations of a contaminant exceed the conservative screening criteria.
- Degree of exceedance of the PRG—An indication of how much a contaminant exceeds the conservative screening criteria. A low degree of exceedance indicates that the concentrations, while slightly greater than the PRG, are of little consequence when compared to the degree of exceedance that occurs for PCBs and dioxins and furans.

Table 2-4 presents the chemicals that were eliminated from the risk evaluation along with the justification for the decision.

The chemicals not screened out based on the above criteria were the following five polycyclic aromatic hydrocarbons (PAHs) and three metals:

- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Dibenzo(a,h)anthracene
- Indeno(1,2,3-cd)pyrene
- Arsenic
- Chromium
- Thallium

Although it is likely that most of the chromium detected at the site is present in the less-toxic trivalent form (ATSDR, 2000), the PRG selected for use in this screening was based on the more-toxic hexavalent form. Site concentrations did not exceed the more-appropriate, but less-conservative, trivalent chromium PRG (11,800 mg/kg). In addition, if site-specific exposure parameter values were used in place of the conservative default assumptions (i.e., residential assumptions) to calculate the hexavalent chromium PRG, the resultant site-specific PRG would be similar to site concentrations.

2.5.2.2 Background Comparison

In determining the need for a quantitative risk characterization, background soil concentrations of contaminants were considered. The comparison to background values for soil included both site-specific and MDEP background concentrations. Only contaminants that screened through the initial steps (frequency of detection, and frequency and degree of exceedance, as presented in Section 2.5.2.1) were compared with background concentrations. Potential risks from COPCs present at or below background concentrations are discussed qualitatively in Section 5 (Risk Characterization) (EPA, 2002a).

2.5.2.2.1 Site-Specific Background

Background locations sampled within the floodplain of Reaches 5 and 6 were identified. Samples selected for use as soil background met all of the following criteria:

- PCBs not detected at a sample quantitation limit of less than 0.6 mg/kg, or detected at concentrations less than 0.3 mg/kg.
- Analyzed for Appendix IX compounds.
- Located near the edge of the floodplain, outside the 10-year floodplain, or within a well-defined area within the floodplain that is clearly outside the influence of a 10-year flood event.
- Located at a distance (generally greater than 25 ft), horizontally or vertically, from contaminated locations, as defined by the PCB concentration exceeding the first criterion listed above.

Soil background concentrations from a depth of 0 to 1 ft are summarized in Table 2-5. Only chemicals that were not eliminated based on the initial screening criteria are listed. When comparing background concentrations to the PRGs, the following observations were made:

- Benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene—None of the detected concentrations exceeded the PRG, and one-half the SQL of one non-detected sample exceeded the PRG.
- Benzo(a)pyrene—Two of the detected concentrations and one-half the SQL of all of the non-detected samples exceeded the PRG.
- Dibenzo(a,h)anthracene—Detected in only one sample, and concentration did not exceed the PRG. One-half the SQL of all of the non-detected samples exceeded the PRG.
- Arsenic—All of the concentrations exceeded the PRG.
- Chromium—None of the detected concentrations exceeded the PRG based on hexavalent chromium.
- Thallium—None of the detected concentrations exceeded the PRG, but one-half the SQL of five non-detected samples exceeded the PRG.

The *Guidance for Disposal Site Risk Characterization* (MDEP, 1995) indicates that although distributions of site-background data should be compared to distributions of site-release concentrations, there are circumstances under which a streamlined approach is justified. Because the Housatonic River, Rest of the River investigation is driven largely by PCB releases from the GE facility and other potential contaminants are not likely to contribute notably to overall risk, a streamlined approach to comparison to background concentrations was selected. It was assumed that the arithmetic mean was the appropriate measure of the central tendency of the distribution of concentrations. The arithmetic means of the site-specific contaminant concentrations were compared with the arithmetic means of the site-specific background concentrations (see Table 2-6). These comparisons indicated that the site-to-background ratios were less than 1 for dibenzo(a,h)anthracene, arsenic, and thallium, indicating that the concentrations of these contaminants at the site are consistent with background concentrations. The remaining contaminants had ratios less than 5.

2.5.2.2.2 MDEP Values

MDEP soil background concentrations for "natural soil" listed in *Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil* (MDEP, 2002) were also compared with concentrations detected at the site. The background concentration was the 90th percentile value from the MDEP 1995 data set; however, in the absence of data in the MDEP 1995 data set, a lower percentile value from the CDM 1996 data set (MDEP, 2002) was chosen as representative of background. Specific data sources (MDEP, 2002) from which the background data were determined included the following:

- Data (30 to 140 samples) collected to represent background at Chapter 21E sites located in nonurban areas, gathered from a review of MDEP files.
- Site-specific background samples generated for locations in Worcester (68 samples) and Watertown, Massachusetts (17 samples).
- Data (750 to 1,000 samples) collected by MassHighway Department as part of the Central Artery/Tunnel (CA/T) project and presented in a draft document Background Soil Contaminant Assessment (CDM, April 1996).
- Data (590 natural soil samples from depths of 10 to 70 ft) collected by Haley & Aldrich, Inc., in the Boston area.

- Preliminary data compiled by the Massachusetts Licensed Site Professional Association from background data submitted by its members.
- Published data (62 samples) from ENSR, Inc., from three New England locations.
- Generic background data published by the Agency for Toxic Substances and Disease Registry (ATSDR).

Table 2-7 provides a comparison of site-specific contaminant concentrations to MDEP background concentrations for the five PAHs and three metals that exceeded their respective PRGs. The final two columns of the table list the ratio of the maximum detected concentration and the mean concentration, respectively, with the MDEP background concentration. For arsenic, the maximum detected concentration was less than the MDEP generic background concentration. The maximum detected concentrations for the five PAHs, chromium, and thallium were 2 to 9 times greater than their respective MDEP background concentrations. The arithmetic means of the concentrations for the five PAHs and arsenic were less than MDEP background concentrations. The arithmetic mean of the concentrations for chromium and thallium were approximately twice the MDEP background concentrations.

2.5.2.2.3 Decisions Based on Background Comparisons

In addition to the contaminants eliminated from consideration based on the comparison to PRGs, the following conclusions were reached regarding inorganic contaminants that were retained and for which background comparisons were made for soil:

- Arsenic—Below site-specific and MDEP background values in all three comparisons made.
- Chromium—Slightly exceeded site-specific and MDEP background values in all three comparisons made.
- Thallium—Below site-specific background value.

Based on these comparisons with site-specific background, arsenic, chromium, and thallium in floodplain soil do not appear to be related to a release from the GE facility. On this basis, these inorganic contaminants were eliminated from further quantitative evaluation. Potential risks from these contaminants are discussed qualitatively in Section 5 (Risk Characterization) (EPA, 2002a).

Based on the comparison to MDEP generic background concentrations in Table 2-7, five PAHs have at least one site sample concentration greater than the MDEP background concentrations. The maximum concentration for these five PAHs exceeds the MDEP background concentration by a factor of 2 to 6. Because samples with PAH concentrations above background are not widespread, as they are for PCBs, PAHs do not appear to be attributable to releases from the GE Facility. Potential risks are evaluated qualitatively in Section 5 (Risk Characterization).

The MDEP background concentrations for aluminum and manganese (both were eliminated as COPCs in the initial step) are 10,000 mg/kg and 300 mg/kg, respectively. In both cases the PRGs (with an HI = 0.1) are below what is considered background in Massachusetts.

2.5.2.3 Selected COPCs in Soil

PCBs and dioxins/furans were retained for quantitative evaluation as COPCs in soil.

2.5.3 Sediment

Table 2-8 summarizes all of the detected Appendix IX contaminants in sediment (0 to 6 inches) collected from Reaches 5 and 6. Sediment data from this depth range were used for COPC selection because of the greater likelihood of human exposure to surficial sediment rather than to sediment at greater depths. The data summary includes only EPA data because there were no Appendix IX data available from GE or other sources. Table 2-8 includes frequency of detection, range of detected concentrations, the EPA Region 9 residential soil PRGs (EPA, 2002b), and the number of detected samples that exceeded the PRG for each contaminant. The soil PRG was used to evaluate sediment exposure because sediment PRGs were not available. The use of the residential soil PRG was assumed to be a conservative surrogate for the sediment PRG considering the similarities in the media and the differences in frequency of contact (i.e., contact is likely to be more frequent for soil). For screening purposes, the PRGs were based on either a 1E-06 target cancer risk (TR) or a 0.1 target hazard quotient (THQ).

2.5.3.1 Frequency of Detection and Frequency and Degree of Exceedance

The initial criteria used in this screening analysis were the frequency of detection, the frequency of exceedance of the PRG, and the degree of exceedance of the PRG. The contaminants that exceeded the PRG at least once are presented in Table 2-9, along with the frequency of detection, the percentage detected, the range of detected concentrations, the arithmetic mean concentration, the PRG, the ratio of the maximum detected concentration to the PRG, and the number of detected samples that exceeded the PRG. Based on the information presented in Table 2-9, five additional contaminants were eliminated from further evaluation in the risk assessment.

The following three factors were used to determine whether additional contaminants could be eliminated without concern that overall risk might be underestimated:

- Frequency of detection—An indication of how prevalent a contaminant is across the entire study area.
- Frequency of exceedance of the PRG—An indication of how often concentrations of a contaminant exceed the conservative screening criteria.
- Degree of exceedance of the PRG—An indication of how much a contaminant exceeds the conservative screening criteria. A low degree of exceedance indicates that the concentrations, while slightly greater than the PRG, are of little consequence when compared to the degree of exceedance that occurs for PCBs and dioxins and furans.

Table 2-10 presents the compounds that were eliminated from the risk evaluation along with the justification for the decision.

The following contaminants were retained based on the above criteria:

- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Dibenzo(a,h)anthracene
- Indeno(1,2,3-cd)pyrene
- Phenanthrene
- Arsenic
- Cadmium
- Chromium
- Thallium

Although it is likely that most of the chromium detected at the site is present in the less toxic trivalent form (ATSDR, 2000), the PRG selected for use in this screening was based on the more toxic hexavalent form. Site concentrations did not exceed the more appropriate, but less conservative, trivalent chromium PRG (11,800 mg/kg). In addition, if site-specific exposure parameter values were used in the place of the conservative default assumptions (i.e., residential assumptions) to calculate the hexavalent chromium PRG, the resultant site-specific PRG would be similar to site concentrations.

2.5.3.2 Background Comparison

In determining the need for a quantitative risk characterization, background sediment concentrations were considered. As previously stated, a comparison to background was not a criterion for selecting organic COPCs. As with the soil comparison, the comparison to background values for sediment included both site-specific and MDEP background concentrations. Only contaminants that were retained in the initial step were evaluated.

2.5.3.2.1 Site-Specific Background

Samples upstream of Unkamet Brook and the Pittsfield landfill, and in other waterbodies within the Housatonic River watershed, were selected as sediment background locations. The locations of the 23 sediment background samples (0 to 6 inches) were as follows:

Location	Number of Samples
Housatonic River upstream of facility influence	11
Muddy Pond	2
Threemile Pond	3
Washington Mountain Lake (WML)	1
WML-1*	2
WML-2*	2
WML-3*	2

* Unnamed ponds separate from but in the vicinity of Washington Mountain Lake.

Sediment background concentrations are summarized in Table 2-11. When comparing background concentrations to the PRGs, the following observations were made:

- Benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene—None of the detected concentrations exceeded the PRG, and one-half the SQL for five non-detects exceeded the PRG.
- Benzo(a)pyrene—Ten of the detected concentrations and one-half the SQL for all of the non-detects exceeded the PRG.
- Dibenzo(a,h)anthracene—Only one detected concentration exceeded the PRG. One-half the SQL for all of the non-detects exceeded the PRG.
- Phenanthrene—None of the concentrations exceeded the PRG.
- Arsenic—All of the concentrations exceeded the PRG.
- Cadmium—None of the concentrations exceeded the PRG.
- Chromium—Two of the detected concentrations exceeded the PRG.
- Thallium—Ten of the detected concentrations exceeded the PRG and one-half the SQL for two-thirds of the non-detects exceeded the PRG.

Site concentrations were compared with site-specific background concentrations by directly comparing arithmetic means as shown in Table 2-12. This comparison shows site means for all of the contaminants exceeding PRGs as slightly greater than site-specific background.

2.5.3.2.2 MDEP Background Concentrations

Table 2-13 illustrates the comparison of site-specific sediment contaminant concentrations to the MDEP background concentrations for soil (MDEP, 2002). As shown in Table 2-13, the site-specific maximum and average concentrations were less than the MDEP generic background concentrations for arsenic (ratios of 0.7 and 0.2, respectively). The maximum values for all of the other chemicals were higher than the MDEP generic background concentrations. The arithmetic mean concentrations for all of the other chemicals except chromium and thallium were less than the MDEP background concentrations. The arithmetic mean concentration for chromium and thallium exceeded the MDEP background concentration by approximately 2.5 and 2 times, respectively.

2.5.3.2.3 Decisions Based on Background Comparisons

In addition to the contaminants eliminated as COPCs based on the comparison to PRGs, the following conclusions were reached regarding contaminants that were retained and for which background comparisons were made for sediment:

- Arsenic—Site-specific arithmetic mean concentration to site background ratio of 1.7; and maximum and arithmetic mean below MDEP generic background concentrations for soil.
- Cadmium—Site-specific arithmetic mean concentration to site background ratio of 2.9; and arithmetic mean less than the MDEP generic background concentration for soil.
- Chromium—Site-specific arithmetic mean concentration to site background ratio of 4.1; and arithmetic mean approximately 2.5 times greater than the MDEP generic background for soil.
- Thallium—Site-specific arithmetic mean concentration to site background ratio of 1.2; and arithmetic mean approximately two times greater than the MDEP generic background for soil.

Based on these comparisons with site-specific background, arsenic, cadmium, chromium, and thallium do not appear to be related to a release from the GE Facility. On this basis, these contaminants were eliminated from further quantitative evaluation. Potential risks from these contaminants were discussed qualitatively in Section 5 (Risk Characterization) (EPA, 2002a).

Based on the comparison to MDEP generic background concentrations in Table 2-13, the six PAHs that had site maximum concentrations greater than the MDEP background concentrations were evaluated qualitatively in Section 5 (Risk Characterization).

2.5.3.3 Selected COPCs in Sediment

PCBs and dioxins/furans were retained for quantitative evaluation as COPCs in sediment.

2.6 REFERENCES

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SECTION 2

TABLES

Table 2-1

Criteria for Ranking Data Useability of Historical Data

Criterion	Level A - Acceptable, Unrestricted Use	Level B - Acceptable, Some Use Restrictions May Apply	Level C - Conditionally Acceptable for Limited Uses	Level D - Conditionally Acceptable, Use with Caution
Criterion 1: Overall quality of and level of detail in report(s)	Accompanying report provides complete description of study design and sample location(s) with justification and rationale.	Report is generally complete and well written but lacks sufficient detail in a few areas. Sampling locations specified, but not located with GPS or equivalent.	Accompanying report is incomplete but does provide sufficient information for one or more parameters of interest. Sampling locations may not be well specified.	No information available on background and conduct of study. Significant questions regarding sampling locations.
Criterion 2: Formal documentation of procedures	Work Plan, Quality Assurance Plan, chain-of-custody records, SOPs, and similar field and laboratory documentation exist and are available for review.	Documentation exists for most areas but is insufficient or lacking in a few areas considered noncritical.	Documentation generally not available but sufficient information is known or available via other sources to establish validity of field and analytical procedures.	Documentation non-existent, not available for review, or status unknown.
Criterion 3: Analytical methods used and detection limits achieved	Analytical procedures follow documented standard methods such as EPA or ASTM.	Analytical procedures nonstandard but sufficiently documented to establish validity of and ensure confidence in data.	Analytical procedures nonstandard and not well documented, but data are believed to be valid due to other information provided.	Insufficient information provided or available via other sources to establish validity of data.
Criterion 4: Data review, validation, and quality assurance	Study incorporated all or most of the full range of QA/QC procedures, e.g., blanks, spikes, duplicates, data review, and data validation.	Study generally employed and documented established QA/QC procedures but did not conduct data validation.	Nonstandard or incomplete QA/QC procedures were followed.	No QA/QC procedures employed or documented.
Criterion 5: Assessment of data quality indicators	Study had established DQIs and data substantially meet all acceptability criteria for completeness, comparability, representativeness, precision, and accuracy.	DQIs not established, but data appear to meet minimum standards for DQIs.	DQIs not established; data appear to not satisfy minimum standards for one or more noncritical DQIs.	Data fail to meet minimum standards for one or more critical DQIs, or not possible to evaluate DQIs.
Criterion 6: Data history and overall apparent data quality	Data are recent (i.e., within past 5 years), reported in standard units, and are reasonable and internally consistent. Methods followed meet current standards for scientific investigation and were followed consistently.	Data appear to be of acceptable quality but derive from a study conducted prior to 1995. Methods may not meet current standards but are judged to have produced data equivalent to current methodologies.	Portions of the data appear to be of questionable quality due to age, changes in methods, and/or failure to follow current standards for scientific investigation.	The overall data quality is questionable due to outmoded methodologies, poor performance, and/or apparent lack of consistency with current standards.

Table 2-2

Summary of Appendix IX Compounds Detected in Reaches 5 and 6 Soil (0 to 1 ft)

Chemical	Frequency of Detection[a]	Range of Detected Concentrations (mg/kg)	EPA Region 9 Residential Soil PRG (mg/kg)		EPA Region 9 Residential Soil PRG Exceedance Count
SEMIVOLATILES					
1,2,3,4-TETRACHLOROBENZENE	7 / 7	0.00060 - 0.030	NA		---
1,2,4,5-TETRACHLOROBENZENE	7 / 105	0.0013 - 0.039	1.8	nc	0
1,2,4-TRICHLOROBENZENE	29 / 98	0.019 - 0.16	65	nc	0
1,3-DICHLOROBENZENE	1 / 98	0.028 - 0.028	1.6	nc	0
1,4-DICHLOROBENZENE	47 / 98	0.028 - 0.18	3.4	ca	0
4-METHYLPHENOL	17 / 97	0.023 - 5.1	31	nc	0
4-NITROPHENOL	1 / 97	1.5 - 1.5	NA		---
ACETOPHENONE	6 / 98	0.033 - 0.37	0.049	nc	4
BIPHENYL (DIPHENYL)	7 / 7	0.0051 - 0.074	301	nc	0
BIS(2-ETHYLHEXYL) PHTHALATE	35 / 98	0.026 - 1.2	35	ca*	0
BUTYLBENZYLPHTHALATE	7 / 98	0.026 - 0.075	1222	nc	0
DIBENZOFURAN	34 / 98	0.021 - 0.89	29	nc	0
DIETHYL PHTHALATE	5 / 99	0.033 - 0.12	4888	nc	0
DIMETHYL PHTHALATE	1 / 98	0.48 - 0.48	61104	nc	0
DI-N-BUTYL PHTHALATE	11 / 98	0.021 - 0.067	611	nc	0
HEXACHLOROBENZENE	7 / 105	0.00030 - 0.0035	0.30	ca	0
N-NITROSO-DI-N-BUTYLAMINE	1 / 98	0.044 - 0.044	0.024	ca	1
PENTACHLOROANISOLE	7 / 7	0.00040 - 0.00090	NA		---
PENTACHLOROBENZENE	12 / 105	0.00050 - 0.053	4.9	nc	0
PHENOL	3 / 98	0.038 - 2.2	3666	nc	0
P-PHENYLENEDIAMINE	1 / 83	0.61 - 0.61	1161	nc	0
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)					
1,6,7-TRIMETHYLNAPHTHALENE	7 / 7	0.0031 - 0.069	NA		---
1-METHYLNAPHTHALENE	7 / 7	0.0061 - 0.54	NA		---
1-METHYLPHENANTHRENE	7 / 7	0.011 - 0.45	NA		---
2,6 DIMETHYLNAPHTHALENE	7 / 7	0.0049 - 0.10	NA		---
ACENAPHTHENE	39 / 105	0.0043 - 0.91	368	nc	0
ACENAPTHYLENE	66 / 105	0.023 - 2.1	5.6	nc [b]	0
ANTHRACENE	70 / 105	0.023 - 5.3	2190	nc	0
BENZO(A)ANTHRACENE	96 / 106	0.032 - 12	0.62	ca	25
BENZO(A)PYRENE	93 / 106	0.027 - 11	0.062	ca	84
BENZO(B)FLUORANTHENE	97 / 106	0.032 - 11	0.62	ca	29
BENZO(E)PYRENE	7 / 7	0.038 - 3.2	NA		---
BENZO(GHI)PERYLENE	92 / 106	0.031 - 3.1	5.6	nc [b]	0
BENZO(K)FLUORANTHENE	96 / 106	0.031 - 14	6.2	ca	1
CHRYSENE	100 / 106	0.028 - 13	62	ca	0
DIBENZO(A,H)ANTHRACENE	69 / 105	0.0076 - 0.94	0.062	ca	48
DIBENZOTHIOPHENE	7 / 7	0.0032 - 0.092	NA		---
FLUORANTHENE	101 / 105	0.020 - 20	229	nc	0
FLUORENE	53 / 105	0.011 - 2.0	275	nc	0
INDENO(1,2,3-C,D)PYRENE	94 / 106	0.029 - 3.8	0.62	ca	9
2-METHYLNAPHTHALENE	61 / 105	0.011 - 1.1	15	nc	0
NAPHTHALENE	85 / 106	0.016 - 1.7	5.6	nc	0
PERYLENE	7 / 7	0.015 - 0.50	NA		---
PHENANTHRENE	99 / 106	0.018 - 12	5.6	nc [b]	2
PYRENE	101 / 105	0.024 - 15	231	nc	0
PYRIDINE	1 / 98	0.48 - 0.48	6.1	nc	0
PESTICIDES/HERBICIDES					
4,4'-DDD	10 / 108	0.0015 - 0.48	2.4	ca	0
4,4'-DDE	12 / 110	0.012 - 2.0	1.7	ca	2
4,4'-DDT	10 / 85	0.0048 - 2.8	1.7	ca*	2
ALDRIN	3 / 109	0.00020 - 0.0013	0.029	ca*	0
ALPHA-BHC	5 / 109	0.00010 - 0.0076	0.090	ca	0
ALPHA-CHLORDANE	5 / 7	0.00070 - 0.0032	1.6	ca* [c]	0
BETA-BHC	2 / 109	0.00050 - 0.016	0.32	ca	0
CHLORPYRIFOS	5 / 7	0.00040 - 0.0028	18	nc	0
CIS-NONACHLOR	7 / 7	0.0013 - 0.18	NA		---
DELTA-BHC	3 / 95	0.00010 - 0.00030	0.32	ca	0
DIELDRIN	7 / 102	0.00050 - 0.0037	0.030	ca	0

Table 2-2

Summary of Appendix IX Compounds Detected in Reaches 5 and 6 Soil (0 to 1 ft)

Chemical	Frequency of Detection[a]	Range of Detected Concentrations (mg/kg)	EPA Region 9 Residential Soil PRG (mg/kg)	EPA Region 9 Residential Soil PRG Exceedance Count
ENDOSULFAN II	7 / 109	0.00080 - 0.047	37 nc	0
ENDOSULFAN SULFATE	1 / 102	0.052 - 0.052	37 nc [d]	0
ENDRIN	5 / 109	0.00040 - 0.0032	1.8 nc	0
ENDRIN ALDEHYDE	1 / 101	0.69 - 0.69	1.8 nc [e]	0
GAMMA-BHC (LINDANE)	5 / 109	0.00030 - 0.0012	0.44 ca*	0
GAMMA-CHLORDANE	2 / 7	0.00020 - 0.00060	1.6 ca* [c]	0
HEPTACHLOR	4 / 109	0.00040 - 0.010	0.11 ca	0
HEPTACHLOR EPOXIDE	1 / 109	0.0019 - 0.0019	0.053 ca*	0
MIREX	3 / 7	0.00030 - 0.0037	0.27 ca*	0
O,P'-DDD	7 / 7	0.0028 - 0.19	2.4 ca [f]	0
O,P'-DDE	5 / 7	0.0015 - 0.020	1.7 ca [f]	0
O,P'-DDT	7 / 7	0.0035 - 0.22	1.7 ca* [f]	0
OXYCHLORDANE	4 / 7	0.00030 - 0.0046	NA	---
TRANS-NONACHLOR	6 / 7	0.00083 - 0.0020	NA	---
2,4,5-T	1 / 20	0.024 - 0.024	61 nc	0
METALS				
ALUMINUM	7 / 7	4619 - 16667	7614 nc	6
ANTIMONY	58 / 98	0.28 - 3.3	3.1 nc	1
ARSENIC	99 / 106	1.0 - 13	0.39 ca*	99
BARIUM	106 / 106	15 - 148	537 nc	0
BERYLLIUM	104 / 106	0.090 - 1.9	15 nc	0
CADMIUM	58 / 105	0.050 - 7.2	3.7 nc	2
CHROMIUM	106 / 106	5.3 - 190	22 nc	73
COBALT	99 / 99	3.8 - 19	138 nc	0
COPPER	106 / 106	7.6 - 178	313 nc	0
IRON	7 / 7	9667 - 29145	NA [g]	---
MAGNESIUM	7 / 7	1520 - 6382	NA	---
MANGANESE	7 / 7	69 - 538	176 nc	6
LEAD	106 / 106	7.8 - 241	400 [h]	0
MERCURY	100 / 106	0.030 - 4.6	2.3 nc	1
NICKEL	106 / 106	3.7 - 40	156 nc	0
SELENIUM	23 / 105	0.37 - 2.4	39 nc	0
SILVER	60 / 99	0.20 - 6.3	39 nc	0
THALLIUM	54 / 99	0.39 - 5.2	0.52 nc	50
TIN	49 / 98	0.60 - 21	4692 nc	0
VANADIUM	106 / 106	7.0 - 33	55 nc	0
ZINC	106 / 106	30 - 383	2346 nc	0
INORGANICS				
CYANIDE	3 / 98	0.67 - 3.6	1.1 nc	1
SULFIDE	6 / 89	7.1 - 99	NA	---

[a] Number of sampling locations at which chemical was detected compared with total number of sampling locations; duplicates at a location were averaged and considered one sample.

[b] Per EPA Region 1 guidance, the PRG for naphthalene was used as a surrogate (EPA, 1999).

[c] Chlordane PRG was used as a surrogate.

[d] Endosulfan PRG was used as a surrogate.

[e] Endrin PRG was used as a surrogate.

[f] 4,4'-DD* PRG was used as a surrogate.

[g] Region 1 does not quantitatively evaluate iron. See *U.S. EPA Region I Waste Management Division Risk Update, No. 4.*

[h] EPA Region 1 value. See *U.S. EPA Region I Waste Management Division Risk Update, No. 5.*

ca = Cancer-based PRG, target risk is 1.0E-06.
mg/kg = milligrams per kilogram
NA = Not available
nc = Noncancer-based PRG, target hazard quotient is 0.1.
*Indicates that the noncancer PRG < = 100X the cancer PRG

Table 2-3

Summary of Detected Appendix IX Compounds in Soil (0 to 1 ft) that Exceeded PRGs in Reaches 5 and 6

Chemical	Frequency of Detection[a]	Detection Frequency (%)	Range of Detected Concentrations (mg/kg)	Arithmetic Mean Concentration[b] (mg/kg)	EPA Region 9 Residential Soil PRG (mg/kg)		Ratio of Maximum Detected Concentration to PRG	EPA Region 9 Residential Soil PRG Exceedance Count
SEMIVOLATILES								
ACETOPHENONE	6 / 98	6.1	0.033 - 0.37	0.30	0.049	nc	7.5	4
N-NITROSO-DI-N-BUTYLAMINE	1 / 98	1.0	0.044 - 0.044	0.32 [c]	0.024	ca	1.8	1
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)								
BENZO(A)ANTHRACENE	96 / 106	90.6	0.032 - 12	0.69	0.62	ca	19.3	25
BENZO(A)PYRENE	93 / 106	87.7	0.027 - 11	0.72	0.062	ca	177.0	84
BENZO(B)FLUORANTHENE	97 / 106	91.5	0.032 - 11	0.79	0.62	ca	17.7	29
BENZO(K)FLUORANTHENE	96 / 106	90.6	0.031 - 14	0.71	6.2	ca	2.3	1
DIBENZO(A,H)ANTHRACENE	69 / 105	65.7	0.0076 - 0.94	0.23	0.062	ca	15.1	48
INDENO(1,2,3-C,D)PYRENE	94 / 106	88.7	0.029 - 3.8	0.38	0.62	ca	6.2	9
PHENANTHRENE	99 / 106	93.4	0.018 - 12	0.68	5.6	nc [d]	2.1	2
PESTICIDES/HERBICIDES								
4,4'-DDE	12 / 110	10.9	0.012 - 2.0	0.28	1.7	ca	1.2	2
4,4'-DDT	10 / 85	11.8	0.0048 - 2.8	0.27	1.7	ca*	1.6	2
METALS								
ALUMINUM	7 / 7	100.0	4619 - 16667	11168	7614	nc	2.2	6
ANTIMONY	58 / 98	59.2	0.28 - 3.3	0.92	3.1	nc	1.1	1
ARSENIC	99 / 106	93.4	1.0 - 13	4.5	0.39	ca*	33.6	99
CADMIUM	58 / 105	55.2	0.050 - 7.2	0.70	3.7	nc	1.9	2
CHROMIUM	106 / 106	100.0	5.3 - 190	45	22	nc	8.5	73
MANGANESE	7 / 7	100.0	69 - 538	319	176	nc	3.1	6
MERCURY	100 / 106	94.3	0.030 - 4.6	0.42	2.3	nc	2.0	1
THALLIUM	54 / 99	54.5	0.39 - 5.2	1.2	0.52	nc	10.1	50
INORGANICS								
CYANIDE	3 / 98	3.1	0.67 - 3.6	0.56	1.1	nc	3.3	1

[a] Number of sampling locations at which chemical was detected compared with total number of sampling locations; duplicates at a location were averaged and considered one sample.

[b] Non-detects were included at one-half the sample quantitation limit.

[c] Arithmetic mean greater than max due to substitution of one-half the SQL for non-detects.

[d] Naphthalene PRG was used as a surrogate.

ca = Cancer based PRG, target risk is 1.0E-06.
mg/kg = Milligrams per kilogram
NA = Not available
nc = Noncancer-based PRG, target hazard quotient is 0.1.
*Indicates that the noncancer PRG < = 100X the cancer PRG

Table 2-4

Additional Chemicals Eliminated from the Appendix IX Soil Screening Evaluation

Chemical	Endpoint	Reason for Elimination
Acetophenone	Noncancer	Frequency of detection (6%).*
n-Nitroso-di-n-butylamine	Cancer	Frequency of detection (approximately 1%).*
Benzo(k)fluoranthene	Cancer	Frequency of PRG exceedance (less than 1%) and degree of exceedance (maximum detected concentration to PRG ratio of 2.3).
Phenanthrene	Noncancer	Frequency of PRG exceedance (less than 2%) and degree of exceedance (maximum detected concentration to PRG ratio of 2.1).
4,4'-DDE	Cancer	Frequency of detection (approximately 11%); frequency of PRG exceedance (less than 2%); and degree of exceedance (maximum detected concentration to PRG ratio of 1.2).
4,4'-DDT	Cancer	Frequency of detection (12%); frequency of PRG exceedance (approximately 2.4%); and degree of exceedance (maximum detected concentration to PRG ratio of 1.6).
Aluminum	Noncancer	Degree of exceedance (maximum detected concentration to PRG ratio of 2.2).
Antimony	Noncancer	Frequency of PRG exceedance (approximately 1%) and degree of exceedance (maximum detected concentration to PRG ratio of 1.1).
Cadmium	Noncancer	Frequency of PRG exceedance (approximately 2%) and degree of exceedance (maximum detected concentration to PRG ratio of 1.9).
Manganese	Noncancer	Degree of exceedance (maximum detected concentration to PRG ratio of 3.1).
Mercury	Noncancer	Frequency of PRG exceedance (less than 1%) and degree of exceedance (maximum detected concentration to PRG ratio of 2.0).
Cyanide	Noncancer	Frequency of detection (approximately 3%) and degree of exceedance (maximum detected concentration to PRG ratio of 3.3).

* Acetophenone and n-nitroso-di-n-butylamine were reported as non-detect in a large number of samples for which one-half the sample quantitation limit (SQL) is greater than the PRG.

Table 2-5

Summary of the Appendix IX Compounds Detected in Background Soil (0 to 1 ft)

Chemical	Frequency of Detection[a]	Range of Detected Concentrations (mg/kg)	EPA Region 9 Residential Soil PRG (mg/kg)		EPA Region 9 Residential Soil PRG Exceedance Count
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)					
BENZO(A)ANTHRACENE	10 / 19	0.022 - 0.14	0.62	ca	0
BENZO(A)PYRENE	8 / 19	0.029 - 0.14	0.062	ca	2
BENZO(B)FLUORANTHENE	10 / 19	0.033 - 0.18	0.62	ca	0
DIBENZO(A,H)ANTHRACENE	1 / 19	0.024 - 0.024	0.062	ca	0
INDENO(1,2,3-C,D)PYRENE	9 / 19	0.020 - 0.072	0.62	ca	0
METALS					
ARSENIC	18 / 19	1.5 - 7.5	0.39	ca*	18
CHROMIUM	19 / 19	2.5 - 22	22	nc	0
THALLIUM	11 / 19	0.61 - 2.4	0.52	nc	0

[a] Number of sampling locations at which chemical was detected compared with total number of sampling locations; duplicates at a location were averaged and considered one sample.

ca = Cancer-based PRG, target risk is 1.0E-06.

mg/kg = Milligrams per kilogram

NA = Not available

nc = Noncancer-based PRG, target hazard quotient is 0.1.

*Indicates that the noncancer PRG < = 100X the cancer PRG

Table 2-6

Comparison of Appendix IX Compounds in Reaches 5 and 6 Soil (0 to 1 ft) with Site-Specific Background Concentrations

Chemical	Arithmetic Mean[a] (mg/kg)		Ratio of Site to Background
	Reaches 5 and 6	Site-Specific Background	
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)			
BENZO(A)ANTHRACENE	0.69	0.18 [b]	3.91
BENZO(A)PYRENE	0.72	0.20 [b]	3.66
BENZO(B)FLUORANTHENE	0.79	0.19 [b]	4.24
DIBENZO(A,H)ANTHRACENE	0.23	0.26 [b]	0.90
INDENO(1,2,3-C,D)PYRENE	0.38	0.18 [b]	2.13
METALS			
ARSENIC	4.5	4.9	0.94
CHROMIUM	45	11	4.0
THALLIUM	1.2	1.3	0.91

[a] Non-detects were included at half the sample quantitation limit. Duplicates were averaged and considered one sample.
[b] Arithmetic mean greater than max due to substitution of one-half the SQL for non-detects.
mg/kg = Milligrams per kilogram
NA = Not available

Table 2-7

Comparison of Appendix IX Compounds in Reaches 5 and 6 Soil (0 to 1 ft) with MDEP Generic Background Concentrations

Chemical	Frequency of Detection[a]	Range of Detected Concentrations (mg/kg)	Arithmetic Mean[b] (mg/kg)	MDEP Soil Background[c] (mg/kg)	Ratio of Maximum Concentration to MDEP Soil Background Concentration	Ratio of Arithmetic Mean Concentration to MDEP Soil Background Concentration
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)						
BENZO(A)ANTHRACENE	96 / 106	0.032 - 12	0.69	2	6	0.35
BENZO(A)PYRENE	93 / 106	0.027 - 11	0.72	2	5.5	0.36
BENZO(B)FLUORANTHENE	97 / 106	0.032 - 11	0.79	2	5.5	0.39
DIBENZO(A,H)ANTHRACENE	69 / 105	0.0076 - 0.94	0.23	0.5	2	0.47
INDENO(1,2,3-C,D)PYRENE	94 / 106	0.029 - 3.8	0.38	1	3.84	0.38
METALS						
ARSENIC	99 / 106	1.0 - 13	4.5	20	0.66	0.23
CHROMIUM	106 / 106	5.3 - 190	45	30	6.3	1.5
THALLIUM	54 / 99	0.39 - 5.2	1.2	0.6	8.67	2.0

[a] Number of sampling locations at which chemical was detected compared with total number of sampling locations; duplicates at a location were averaged and considered one sample.

[b] Non-detects were included at one-half the sample quantitation limit.

[c] Values from *Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil* (MDEP, 2002).

mg/kg = Milligrams per kilogram

Table 2-8

Summary of Appendix IX Compounds Detected in Reaches 5 and 6 Sediment (0 to 6 inches)

Chemical	Frequency of Detection[a]	Range of Detected Concentrations (mg/kg)	EPA Region 9 Residential Soil PRG (mg/kg)		EPA Region 9 Residential Soil PRG Exceedance Count
SEMIVOLATILES					
1,2,4,5-TETRACHLOROBENZENE	3 / 58	0.022 - 0.083	1.8	nc	0
1,2,4-TRICHLOROBENZENE	18 / 58	0.021 - 0.20	65	nc	0
1,2-DICHLOROBENZENE	1 / 57	0.68 - 0.68	110	nc	0
1,3-DICHLOROBENZENE	6 / 57	0.038 - 0.21	1.6	nc	0
1,4-DICHLOROBENZENE	39 / 59	0.026 - 0.83	3.4	ca	0
4-METHYLPHENOL	11 / 58	0.029 - 0.88	31	nc	0
BIS(2-ETHYLHEXYL) PHTHALATE	36 / 58	0.024 - 8.6	35	ca*	0
BUTYLBENZYLPHTHALATE	1 / 57	0.047 - 0.047	1222	nc	0
DIBENZOFURAN	20 / 57	0.030 - 5.0	29	nc	0
DIETHYL PHTHALATE	2 / 58	0.050 - 0.13	4888	nc	0
DI-N-BUTYL PHTHALATE	3 / 57	0.026 - 0.16	611	nc	0
METHAPYRILENE	1 / 57	0.82 - 0.82	NA		---
N-NITROSO-DI-N-BUTYLAMINE	1 / 57	0.056 - 0.056	0.024	ca	1
PENTACHLOROBENZENE	8 / 57	0.021 - 0.070	4.9	nc	0
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)					
ACENAPHTHENE	20 / 58	0.028 - 3.9	368	nc	0
ACENAPTHYLENE	32 / 58	0.020 - 4.3	5.6	nc [b]	0
ANTHRACENE	35 / 57	0.023 - 14	2190	nc	0
BENZO(A)ANTHRACENE	52 / 58	0.025 - 20	0.62	ca	11
BENZO(A)PYRENE	48 / 57	0.027 - 15	0.062	ca	45
BENZO(B)FLUORANTHENE	51 / 58	0.024 - 14	0.62	ca	17
BENZO(GHI)PERYLENE	51 / 58	0.022 - 4.9	5.6	nc [b]	0
BENZO(K)FLUORANTHENE	51 / 58	0.028 - 12	6.2	ca	2
CHRYSENE	53 / 59	0.034 - 14	62	ca	0
DIBENZO(A,H)ANTHRACENE	36 / 56	0.020 - 2.3	0.062	ca	21
FLUORANTHENE	54 / 58	0.027 - 40	229	nc	0
FLUORENE	28 / 57	0.031 - 10	275	nc	0
INDENO(1,2,3-C,D)PYRENE	51 / 58	0.021 - 5.0	0.62	ca	6
2-METHYLNAPHTHALENE	30 / 58	0.025 - 2.2	15	nc	0
NAPHTHALENE	44 / 59	0.030 - 6.0	5.6	nc	1
PHENANTHRENE	51 / 58	0.034 - 54	5.6	nc [b]	4
PYRENE	57 / 60	0.029 - 36	231	nc	0
PESTICIDES/HERBICIDES					
4,4'-DDD	2 / 57	0.023 - 0.080	2.4	ca	0
4,4'-DDE	1 / 56	0.17 - 0.17	1.7	ca	0
ENDRIN ALDEHYDE	2 / 56	0.39 - 0.90	1.8	nc [c]	0
2,4,5-T	1 / 17	0.052 - 0.052	61	nc	0
METALS					
ANTIMONY	33 / 57	0.38 - 4.5	3.1	nc	3
ARSENIC	54 / 59	0.97 - 14	0.39	ca*	54
BARIUM	60 / 60	8.70 - 215	537	nc	0
BERYLLIUM	51 / 60	0.15 - 1.6	15	nc	0
CADMIUM	26 / 58	0.050 - 8.8	3.7	nc	9
CHROMIUM	60 / 60	5.3 - 382	22	nc	32
COBALT	60 / 60	3.2 - 23	138	nc	0
COPPER	60 / 60	6.2 - 250	313	nc	0
LEAD	60 / 60	4.0 - 303	NA	[d]	---

Table 2-8

Summary of Appendix IX Compounds Detected in Reaches 5 and 6 Sediment (0 to 6 inches)

Chemical	Frequency of Detection[a]	Range of Detected Concentrations (mg/kg)	EPA Region 9 Residential Soil PRG (mg/kg)		EPA Region 9 Residential Soil PRG Exceedance Count
MERCURY	51 / 58	0.030 - 1.9	2.3	nc	0
NICKEL	58 / 60	4.6 - 50	156	nc	0
SELENIUM	10 / 58	0.55 - 2.5	39	nc	0
SILVER	28 / 58	0.11 - 10	39	nc	0
THALLIUM	32 / 58	0.45 - 7.9	0.52	nc	29
TIN	32 / 58	1.7 - 30	4692	nc	0
VANADIUM	60 / 60	4.9 - 41	55	nc	0
ZINC	60 / 60	24 - 601	2346	nc	0
INORGANICS					
CYANIDE	1 / 53	1.4 - 1.4	1.1	nc	1
SULFIDE	22 / 50	6.4 - 447	NA		---

[a] Number of sampling locations at which chemical was detected compared with total number of sampling locations; duplicates at a location were averaged and considered one sample.

[b] Per EPA Region 1 guidance, the PRG for naphthalene was used as a surrogate (EPA, 1999).

[c] Endrin PRG was used as a surrogate.

[d] EPA Region 1 value. See *U.S. EPA Region I Waste Management Division Risk Update, No. 5.*

ca = Cancer-based PRG, target risk is 1.0E-06.
mg/kg = Milligrams per kilogram
NA = Not available
nc = Noncancer-based PRG, target hazard quotient is 0.1.
sat = Soil saturation concentration
*Indicates that the noncancer PRG < = 100X the cancer PRG

Table 2-9

Summary of Detected Appendix IX Compounds in Sediment (0 to 6 inches) that Exceeded PRGs in Reaches 5 and 6

Chemical	Frequency of Detection[a]	Detection Frequency (%)	Range of Detected Concentrations (mg/kg)	Arithmetic Mean Concentration[b] (mg/kg)	EPA Region 9 Residential Soil PRG (mg/kg)		Ratio of Maximum Detected Concentration to PRG	EPA Region 9 Residential Soil PRG Exceedance Count
SEMIVOLATILES								
N-NITROSO-DI-N-BUTYLAMINE	1 / 57	2	0.056 - 0.056	0.39 [c]	0.024	ca	2.3	1
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)								
BENZO(A)ANTHRACENE	52 / 58	90	0.025 - 20	1.2	0.62	ca	32.2	11
BENZO(A)PYRENE	48 / 57	84	0.027 - 15	1.0	0.062	ca	241.4	45
BENZO(B)FLUORANTHENE	51 / 58	88	0.024 - 14	0.93	0.62	ca	22.5	17
BENZO(K)FLUORANTHENE	51 / 58	88	0.028 - 12	0.95	6.2	ca	1.9	2
DIBENZO(A,H)ANTHRACENE	36 / 56	64	0.020 - 2.3	0.36	0.062	ca	37.0	21
INDENO(1,2,3-C,D)PYRENE	51 / 58	88	0.021 - 5.0	0.49	0.62	ca	8.0	6
NAPHTHALENE	44 / 59	75	0.030 - 6.0	0.41	5.6	nc	1.1	1
PHENANTHRENE	51 / 58	88	0.034 - 54	2.2	5.6	nc	9.7	4
METALS								
ANTIMONY	33 / 57	58	0.38 - 4.5	1.2	3.1	nc	1.4	3
ARSENIC	54 / 59	92	0.97 - 14	4.5	0.39	ca*	37.0	54
CADMIUM	26 / 58	45	0.050 - 8.8	1.4	3.7	nc	2.4	9
CHROMIUM	60 / 60	100	5.3 - 382	75	22	nc	17.1	32
THALLIUM	32 / 58	55	0.45 - 7.9	1.3	0.52	nc	15.3	29
INORGANICS								
CYANIDE	1 / 53	2	1.4 - 1.4	0.65	1.1	nc	1.3	1

[a] Number of sampling locations at which chemical was detected compared with total number of sampling locations; duplicates at a location were averaged and considered one sample.

[b] Non-detects were included at half the sample quantitation limit.

[c] Arithmetic mean greater than max due to substitution of one-half the SQL for non-detects.

ca = Cancer-based PRG, target risk is 1.0E-05.
mg/kg = Milligrams per kilogram
NA = Not available
nc = Noncancer-based PRG, target hazard quotient is 1.
*Indicates that the noncancer PRG < = 100X the cancer PRG

Table 2-10

Additional Chemicals Eliminated from the Appendix IX Sediment Screening Evaluation

Chemical	Endpoint	Reason for Elimination
n-Nitroso-di-n-butylamine	Cancer	Frequency of detection (2%) and degree of exceedance (maximum detected concentration to PRG ratio of 2.3).*
Benzo(k)fluoranthene	Cancer	Frequency of PRG exceedance (less than 4%) and degree of exceedance (maximum detected concentration to PRG ratio of 1.9).
Naphthalene	Noncancer	Frequency of PRG exceedance (less than 2%) and degree of exceedance (maximum detected concentration to PRG ratio of 1.1).
Antimony	Noncancer	Frequency of PRG exceedance (5%) and degree of exceedance (maximum detected concentration to PRG ratio of 1.4).
Cyanide	Noncancer	Frequency of detection (less than 2%) and degree of exceedance (maximum detected concentration to PRG ratio of 1.3).

* n-Nitroso-di-n-butylamine has a large number of samples in which one-half the SQL is greater than the PRG.

Table 2-11

Summary of the Appendix IX Compounds Detected in Background Sediment (0 to 6 inches)

Chemical	Frequency of Detection[a]	Range of Detected Concentrations (mg/kg)	EPA Region 9 Residential Soil PRG (mg/kg)		EPA Region 9 Residential Soil PRG Exceedance Count
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)					
BENZO(A)ANTHRACENE	14 / 23	0.026 - 0.44	0.62	ca	0
BENZO(A)PYRENE	14 / 23	0.030 - 0.46	0.062	ca	10
BENZO(B)FLUORANTHENE	14 / 23	0.032 - 0.43	0.62	ca	0
DIBENZO(A,H)ANTHRACENE	11 / 23	0.0024 - 0.083	0.062	ca	1
INDENO(1,2,3-C,D)PYRENE	14 / 23	0.00050 - 0.23	0.62	ca	0
PHENANTHRENE	16 / 23	0.022 - 0.75	5.6	nc	0
METALS					
ARSENIC	18 / 23	1.5 - 5.8	0.39	ca*	18
CADMIUM	9 / 23	0.18 - 2.5	3.7	nc	0
CHROMIUM	23 / 23	5.3 - 139	22	nc	2
THALLIUM	11 / 20	0.37 - 3.4	0.52	nc	10

[a] Number of sampling locations at which chemical was detected compared with total number of sampling locations; duplicates at a location were averaged and considered one sample.
ca = Cancer-based PRG, target risk is 1.0E-06.
mg/kg = Milligrams per kilogram
NA = Not available
nc = Noncancer-based PRG, target hazard quotient is 0.1.
sat = Soil saturation concentration
*Indicates that the noncancer PRG < = 100X the cancer PRG

Table 2-12

Comparison of Appendix IX Compounds in Reaches 5 and 6 Sediment (0 to 6 inches) with Site-Specific Background Concentrations

Chemical	Arithmetic Mean[a] (mg/kg)		Ratio of Site to Background
	Reaches 5 and 6	Site-Specific Background	
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)			
BENZO(A)ANTHRACENE	1.2	0.40	3.01
BENZO(A)PYRENE	1.0	0.38	2.66
BENZO(B)FLUORANTHENE	0.93	0.39	2.36
DIBENZO(A,H)ANTHRACENE	0.36	0.34 [b]	1.05
INDENO(1,2,3-C,D)PYRENE	0.49	0.34 [b]	1.42
PHENANTHRENE	2.2	0.39	5.62
METALS			
ARSENIC	4.5	2.7	1.67
CADMIUM	1.4	0.48	2.91
CHROMIUM	75	18	4.12
THALLIUM	1.3	1.1	1.23

[a] Non-detects were included at one-half the sample quantitation limit. Duplicates were averaged and considered one sample.
[b] Arithmetic mean greater than max due to substitution of one-half the SQL for non-detects.
mg/kg = Milligrams per kilogram

Table 2-13

Comparison of Appendix IX Compounds in Reaches 5 and 6 Sediment (0 to 6 inches) with MDEP Generic Background Concentrations

Chemical	Frequency of Detection[a]	Range of Detected Concentrations (mg/kg)	Arithmetic Mean[b] (mg/kg)	MDEP Background Concentration[c] (mg/kg)	Ratio of Maximum Concentration to MDEP Soil Background Concentration	Ratio of Arithmetic Mean Concentration to MDEP Soil Background Concentration
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)						
BENZO(A)ANTHRACENE	52 / 58	0.025 - 20	1.2	2	10.0	0.6
BENZO(A)PYRENE	48 / 57	0.027 - 15	1.0	2	7.5	0.51
BENZO(B)FLUORANTHENE	51 / 58	0.024 - 14	0.93	2	7.0	0.47
DIBENZO(A,H)ANTHRACENE	36 / 56	0.020 - 2.3	0.36	0.5	4.6	0.72
INDENO(1,2,3-C,D)PYRENE	51 / 58	0.021 - 5.0	0.49	1	5.0	0.49
PHENANTHRENE	51 / 58	0.034 - 54	2.2	3	18.0	0.74
METALS						
ARSENIC	54 / 59	0.97 - 14	4.5	20	0.7	0.22
CADMIUM	26 / 58	0.050 - 8.8	1.4	2	4.4	0.70
CHROMIUM	60 / 60	5.3 - 382	75	30	12.7	2.49
THALLIUM	32 / 58	0.45 - 7.9	1.3	0.6	13.2	2.2

[a] Number of sampling locations at which chemical was detected compared with total number of sampling locations; duplicates at a location were averaged and considered one sample.

[b] Non-detects were included at one-half the sample quantitation limit.

[c] Values from *Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil* (MDEP, 2002).

mg/kg = Milligrams per kilogram

NA = Not available

3. DOSE-RESPONSE ASSESSMENT

3.1 INTRODUCTION

The primary purpose of the dose-response assessment is to identify the toxicity values to use in the evaluation of potential human cancer risks and noncancer health effects. These toxicity values are combined with the average daily doses of COPCs to calculate potential cancer risks and noncancer health hazards in the risk characterization step.

EPA has developed toxicity values for cancer and noncancer effects. The toxicity values for cancer are known as cancer slope factors (CSFs), whereas toxicity values for noncancer effects associated with oral exposures are known as reference doses (RfDs).

CSFs are plausible upper-bound estimates of carcinogenic potency used to calculate cancer risk from exposure to carcinogens by relating estimates of lifetime average chemical intake to the incremental probability of an individual developing cancer over a lifetime (EPA, 1986a, 1999). Because the CSFs developed by EPA are plausible upper-bound estimates, EPA is reasonably confident that the actual cancer risks are likely to be less than the risks estimated with the upper-bound slope factor. It is not possible to estimate how much less, but risks to some individuals could be zero.

The chronic RfD represents an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime (EPA, 1989).

Historically, an important distinction between the cancer and noncancer toxicity values has been that CSFs were developed assuming a linear dose-response relationship at the low doses associated with environmental exposures in humans (EPA, 1986a), whereas noncancer reference doses were developed assuming that there was a threshold to the adverse effect. In other words, for a carcinogen, it was assumed that there is a finite risk of a carcinogenic response associated with all exposures, no matter how low. For a noncancer, threshold effect, it was assumed that there is a dose below which no adverse effects would be expected.

The different shapes of the cancer and noncancer dose-response relationships were based on data and inferences regarding toxic processes. As scientific knowledge of the carcinogenic process has increased, several different "modes of action" of cancer have been recognized. Although for many modes of action, such as those that include a reaction with DNA, linear extrapolations to low dose are appropriate, there may be some modes of action that are appropriately modeled using a threshold approach. EPA has recently published drafts of revised cancer risk assessment guidelines (EPA, 2003; 1999; 1996a) that reflect the mode of action differences. The carcinogens evaluated in this report have CSFs derived using linear extrapolations to low doses. The CSFs for PCBs and dioxin-like compounds used in this report have been evaluated and reviewed by EPA in the context of the revised cancer risk assessment guidelines and are consistent with these guidelines.

Cancer and noncancer toxicity values published in EPA databases and reports were used in the risk assessment. Toxicity values obtained from the Integrated Risk Information System (IRIS), EPA's consensus toxicity values (EPA, 2004), were used preferentially because these values have undergone extensive scientific peer review. For COPCs for which toxicity values are not published in IRIS, provisional values were obtained from the Health Effects Assessment Summary Tables (HEAST) (EPA, 1997).

The following sections describe the approach to calculating toxicity values and identify the toxicity values selected for use in this assessment. Section 3.2 describes the approach to evaluating cancer effects, and Section 3.3 describes the approach to evaluating noncancer health effects.

3.2 CARCINOGENIC EFFECTS

3.2.1 Cancer Potency

The CSF is used with exposure information to provide a conservative estimate of the likelihood that an individual will develop cancer as a result of lifetime exposure to a chemical. It is a plausible upper-bound estimate of carcinogenic potency used to calculate cancer risk from exposure to carcinogens by relating lifetime average contaminant intake to the incremental probability of an individual developing cancer over a lifetime. The oral CSFs used in this risk assessment are expressed as risk per unit dose, in units of incremental cancer risk per milligram of contaminant per kilogram of body weight per day $(mg/kg\text{-}d)^{-1}$. Cancer potency is directly proportional to the CSF value; the larger the CSF, the greater the cancer potency of the compound.

Two carcinogenic COPCs are considered in this assessment: tPCBs and 2,3,7,8-TCDD TEQ. The following two sections provide a discussion of some of the important toxicological issues associated with these COPCs. A more detailed discussion is provided in Section 4 of HHRA Volume I.

3.2.2 PCBs

PCBs are synthetic organic chemicals including 209 individual chlorinated biphenyl compounds, known as congeners. The manufacturing process of commercial PCB mixtures (e.g., Aroclors) produced approximately 175 of the possible 209 PCB congeners. During Aroclor production, small amounts of furans are also formed and are present in the commercial product at parts per million (ppm) concentrations (ATSDR, 2000; Erickson, 2001). Heating PCBs, either at high temperatures, or at lower temperatures for longer periods of time, also results in the formation of furans (Erickson, 2001).

Aroclor 1260 is the predominant Aroclor pattern detected in the Rest of River; a PCB pattern resembling Aroclor 1254 has also been detected, but at lower concentrations (WESTON, 2002). Aroclor 1260 is one of the most highly chlorinated of the commercial Aroclors, with an average chlorine content by weight of 60%; Aroclor 1254 has an average chlorine content by weight of 54%. There is considerable overlap in the individual congeners associated with these two Aroclors (Erickson, 2001). Toxicity data for multiple adverse effects, including cancer, are available for commercial mixtures of Aroclor 1260 and Aroclor 1254 (ATSDR, 2000; Cogliano, 1998; EPA, 2004). Individual PCB congeners also vary in their toxicity, both in their potency and their mechanism of action. Twelve congeners have dioxin-like activity in humans, as discussed in Section 3.2.3.

Following the release of commercial PCB mixtures into the environment, the original mixture may be altered as a result of environmental fate and transport processes such as partitioning, transformation, and bioaccumulation through the food chain. For example, environmental transport processes such as vaporization and dissolution do not act on all congeners equally, resulting in environmental concentrations of individual PCB congeners that may differ substantially from those present in the original commercial mixture. This process is known as weathering (Erickson, 2001; EPA, 1996b). Bioaccumulation and biomagnification through the foodchain can result in altered patterns of the original congeners, as well as metabolic by-products of congeners, notably hydroxyl or methylsulfonyl-PCB metabolites (James, 2001). These alterations in composition may alter the toxicity of the mixture, making it more or less toxic than the commercial product.

EPA has classified PCBs as a B2 or probable human carcinogen based on liver tumors found in rats exposed to a range of commercial PCB mixtures, and on suggestive evidence from human studies, referred to as epidemiological studies (EPA, 1996a; 2004; and Safe, 1994). Although the IRIS profile has not yet been updated to provide a descriptor under draft revised cancer guidelines (EPA, 1999), EPA in 1996 (EPA, 1996b) reaffirmed the classification of PCBs as a probable human carcinogen. The 1996 PCB cancer reassessment was consistent with the 1996 proposed cancer guidelines (EPA, 1996b) and remains consistent with the 1999 Revised Carcinogen Guidelines (EPA, 1999). The 1999 Guidelines currently serve as EPA's interim guidance to EPA risk assessors preparing cancer risk assessments (EPA, 2001).

To evaluate environmental mixtures, EPA recommends an approach to assess cancer risk associated with exposure to PCBs that accounts for different PCB mixtures typically found in environmental media (EPA, 2004). Studies to date suggest that more highly chlorinated, less-volatile congeners are associated with greater cancer risk. These congeners tend to persist in the environment in soil and sediment and to bioaccumulate and biomagnify in biota. More volatile, less-chlorinated congeners are more likely to be metabolized and eliminated than highly chlorinated congeners. If congener data are not available, the exposure pathway can be used to indicate how the potency of a mixture might have changed following release to the environment. EPA's recommendations are summarized in Table 3-1 and described below.

To estimate risk from exposure to highly chlorinated congeners or exposure via pathways that include highly chlorinated congeners, EPA recommends using an upper-bound CSF of 2.0 per mg/kg-d and a central estimate CSF of 1.0 per mg/kg-d. These CSFs are used for (1) food chain exposure; (2) sediment or soil ingestion; (3) dust or aerosol inhalation; (4) dermal exposure, if an absorption factor has been applied; (5) presence of dioxin-like, tumor-promoting, or persistent congeners; and (6) early life exposure (all pathways and mixtures).

To estimate risk from exposure to more volatile PCB congener mixtures that are less persistent in the environment, EPA recommends using an upper-bound CSF of 0.4 per mg/kg-d and a central estimate CSF of 0.3 per mg/kg-d. These CSFs are used for (1) ingestion of water-soluble congeners; (2) inhalation of evaporated congeners; and (3) dermal exposure, if no absorption factor has been applied.

If congener or isomer analyses verify that congeners with more than four chlorines comprise less than 0.5% of tPCBs, EPA (EPA, 2002) recommends use of an upper-bound CSF of 0.07 per mg/kg-d and a central estimate CSF of 0.04 per mg/kg-d.

The exposure pathways evaluated in this risk assessment meet the criteria for evaluating the exposure as a mixture of highly chlorinated PCBs. Thus, the high risk and persistence upper-bound CSF of 2.0 $(mg/kg\text{-}d)^{-1}$ and the central estimate CSF of 1.0 $(mg/kg\text{-}d)^{-1}$ were incorporated into the reasonable maximum exposure (RME) and the central tendency exposure (CTE) risk estimates, respectively.

3.2.3 Dioxins and Furans and Dioxin-Like PCBs

Like PCBs, PCDDs and PCDFs are commonly found as complex mixtures in environmental media and biological tissues. PCDDs include 75 compounds, and PCDFs include 135 compounds. All of these compounds are referred to as congeners. Humans are exposed to these contaminants as complex mixtures, which vary by source and medium of exposure, rather than as individual congeners.

The most frequently studied of the PCDD congeners is 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD), which is often simply referred to as dioxin. Seven PCDD, 10 PCDF, and 12 PCB congeners exhibit human toxicity similar to 2,3,7,8-TCDD. PCB congeners may exert toxic effects through the same mechanism of action as 2,3,7,8-TCDD, namely, binding to the aryl hydrocarbon receptor (AhR), a cellular protein, as an initial step. A toxic equivalence (TEQ) approach has been developed to estimate risk associated with 2,3,7,8-TCDD and other dioxin-like congeners (Van den Berg et al., 1998), which is described in Section 3.2.4.

Cancer risks associated with TEQ from 2,3,7,8-TCDD and other dioxin-like congeners were calculated using EPA's CSF for oral carcinogenicity of 2,3,7,8-TCDD of 1.5E+05 $(mg/kg\text{-}d)^{-1}$ (EPA, 1997). The CSF was derived from linearized multistage modeling of female liver cancer results from a 2-year feeding study of Sprague Dawley rats (EPA, 1985). EPA's Dioxin Reassessment provides a CSF for oral carcinogenicity of 2,3,7,8-TCDD of 1E+06 $(mg/kg\text{-}d)^{-1}$ (EPA, 2001). However, the Dioxin Reassessment has not been formally released, and it is being reviewed by the National Academy of Sciences (NAS). The Dioxin Reassessment, the NAS review, and the uncertainties associated with each of these CSFs are discussed in Section 4 of HHRA Volume I.

All TEQ cancer risk estimates are presented as part of the Uncertainty Analysis (Section 7) instead of the Risk Characterization (Section 5) of this report because of uncertainties associated with predicting floodplain soil concentrations of congeners.

3.2.4 TEQ Approach in Cancer Risk Assessment

A TEQ approach was developed to estimate risk associated with 2,3,7,8-TCDD and other dioxin-like PCDD, PCDF, and PCB congeners (Van den Berg et al., 1998) and has been adopted for use at Superfund and RCRA sites (EPA, 1998). The approach applies only to aryl hydrocarbon receptor (AhR)-mediated effects, assuming a model of dose additivity among congeners. Congeners included in the TEQ approach satisfy the following criteria:

- They are structurally similar to PCDDs and PCDFs.
- They bind to the AhR.
- They elicit AhR-mediated biochemical and toxic responses.
- They are persistent and accumulate in the food chain (Van den Berg et al., 1998).

Binding to the AhR is an important criterion because most (if not all) biological effects of these congeners appear to be mediated by the AhR (Van den Berg et al., 1998).

3.2.4.1 Calculating TEQ

Each dioxin-like congener was assigned a toxic equivalency factor (TEF) to represent the fractional toxicity of the congener relative to 2,3,7,8-TCDD. Table 3-2 summarizes these TEFs, which were developed based on contaminant structure, persistence, resistance to metabolism, and toxicological action (Van den Berg et al., 1998). The uncertainty associated with TEFs is discussed in the HHRA, Volume I, Section 4.2.2.3. TEFs indicate an order-of-magnitude estimate of a congener's toxicity relative to 2,3,7,8-TCDD, and they are used to transform concentrations of individual dioxin-like PCDD, PCDF, and PCB congeners into equivalent concentrations of 2,3,7,8-TCDD.

The TEF of each congener present in the mixture is multiplied by the respective congener concentration. The products are then summed to represent the 2,3,7,8-TCDD TEQ of the mixture, as determined by the equation:

$$TEQ = \sum_{n1}(PCDD_i \, x TEF_i) + \sum_{n2}(PCDF_i \, x TEF_i) + \sum_{n3}(PCB_i x TEF_i)$$

where:

TEQ	=	Toxic equivalence concentration
PCDD	=	Polychlorinated dibenzo-*p*-dioxin concentration
PCDF	=	Polychlorinated dibenzofuran concentration
PCB	=	Dioxin-like polychlorinated biphenyl concentration
TEF	=	Toxic equivalency factor

3.2.4.2 Estimating Total Cancer Risk from PCBs and TEQ

PCB cancer risk was quantified by multiplying tPCB doses by the PCB CSF; and TEQ cancer risk was quantified by multiplying TEQ doses from PCDD, PCDF, and dioxin-like PCB congeners by the CSF for 2,3,7,8-TCDD. Estimating total cancer risk from tPCBs and TEQ is not straightforward for several reasons:

- PCBs were released into the environment from the GE facility as Aroclor 1260 and, to a lesser extent, Aroclor 1254, as a result of construction and repair of electrical transformers.

- Aroclors are complex commercial mixtures that contain many individual PCB congeners, as well as a small component of chlorinated furans (Cogliano, 1998).

- Aroclors that have been subjected to fires or used in transformers, such as those released from the GE facility, are often enriched in chlorinated furans that are formed upon heating PCBs.

- The fate and transport properties of individual congeners differ, and PCB mixtures in the environment can differ significantly from the original commercial products.

- The cancer bioassays used to derive the PCB CSF were conducted using commercial Aroclors as test materials rather than the environmental PCB mixtures to which people are exposed.

Because of the potential differences between the commercial Aroclor mixtures that were tested and the PCB mixture in the environment, there is uncertainty associated with applying the PCB CSF to environmental mixtures. For example, if the relative proportion of carcinogenic PCB congeners is higher in the environmental mixture than in the Aroclor test material used in the cancer bioassays that form the basis of the PCB CSF, use of the PCB CSF alone might underestimate cancer risk from tPCBs.

It is possible that one or more of the 12 dioxin-like PCB congeners (and the furans that composed a small fraction of the Aroclor mixture) might be present in environmental mixtures in higher proportions than in the commercial Aroclors. These PCB congeners can be evaluated as TEQ using the toxic equivalence approach developed for chlorinated dioxins and furans. Although the carcinogenic potency of these PCB congeners (and the furans) is already accounted for in the PCB CSF to the extent that they were present in the Aroclor mixture tested in the animal bioassay(s), assessing risks for tPCBs may not capture the full extent of risks from dioxin-like PCBs. Environmental mixtures, particularly those found in the food chain (fish, for example), may have enhanced concentrations of these and other highly persistent congeners.

Although PCB cancer risk can be quantified as TEQ, this approach alone also may not fully account for PCB carcinogenicity because PCBs have been associated with carcinogenic mechanisms other than through dioxin-like effects. For example, the EPA Science Advisory

Board (SAB) cited the van der Plas et al. (2000) study of rats exposed to Aroclor 1260, which suggests that most of the tumor promotion potential of PCB mixtures is attributable to the nondioxin-like fraction (EPA SAB, 2001). Because this fraction is not included in the TEQ calculation, van der Plas et al. (2000) concluded that the tumor promotion potential of PCBs might be underestimated by the TEQ approach alone.

To address the concern that dioxin-like PCBs in environmental mixtures may pose a health risk that is not predicted by the PCB CSF alone or as TEQ alone, the following approaches were considered for expressing total cancer risk.

Approach 1: Sum cancer risk from tPCBs and from TEQ, and describe the potential overestimate of total cancer risk that results. This approach has the advantage of comparability with the standard EPA approach of summing risks from different contaminants (EPA, 1986b). However, this approach may overestimate cancer risk to the extent that the commercial Aroclor test material contained TEQ from dioxin-like PCB congeners and chlorinated furans. This might be considered "double-counting" TEQ.

Approach 2: Sum tPCB cancer risk and TEQ cancer risk from all congeners after subtracting the amount of TEQ accounted for by the PCB CSF for commercial Aroclors. This approach has the advantage of correcting for the potential overestimate of cancer potency that is associated with "double-counting" TEQ. However, there is uncertainty associated with this approach because it requires characterizing the environmental mixture as a commercial Aroclor, and is further complicated because more than one Aroclor was released. Thus, this option has the disadvantage that there is uncertainty associated with quantifying the amount of TEQ that should be subtracted from the estimate of TEQ from dioxin-like PCB congeners.

Approach 3: Present cancer risk from tPCBs and TEQ separately, and describe the potential underestimate of total cancer risk that results from considering them individually. This approach has the advantage of fully presenting cancer risks from two toxicological evaluations, and avoids potential "double-counting" that may result from summing the two risk values. However, either individual risk estimate alone may not fully quantify the carcinogenic risk of the PCB, dioxin, and furan mixture at the site.

Although the best approach to evaluating total cancer risk would be to appropriately account for the potential enrichment of dioxin-like congeners in the environmental mixture, this approach has too much uncertainty to be adopted at this time.

Approach 3 is used in this risk assessment. Cancer risks from both tPCBs and TEQ are presented separately, and represent two toxicological evaluations of cancer risks from the environmental mixture. The cancer risks from these separate evaluations are not summed, and the potential underestimate of tPCB cancer risk as a result of the potential enrichment of persistent congeners, including dioxin-like PCB congeners, is discussed in the uncertainty analysis (Section 7) of this volume and in more detail in Section 4 of HHRA Volume I.

3.3 NONCANCER HEALTH EFFECTS

3.3.1 Evaluation of Noncancer Health Effects Using RfDs

RfDs are used to characterize noncancer health effects. EPA defines RfDs as:

> The chronic RfD represents an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime (EPA, 1989).

RfDs can be based on adverse effects, such as gross or microscopic organ damage, and physiological effects (reproductive dysfunction, immunotoxicity, or biochemical effects, e.g., altered enzyme system).

Adverse effects are not likely at doses below these toxicity values. The level of concern for a particular contaminant does not increase linearly as the RfD is approached or exceeded because these values are derived as benchmarks. Therefore, comparing these values with exposure estimates at the site provides an index of concern rather than a probability of an adverse effect occurring. RfDs are expressed as a dose in units of milligrams of contaminant per kilogram of body weight per day (mg/kg-d), and are inversely proportional to the toxic potency of the contaminant.

3.3.2 Noncancer Effects of PCBs

EPA's IRIS database (EPA, 2004) provides oral RfDs for two commercial PCB mixtures, Aroclor 1016 and Aroclor 1254:

- RfD for Aroclor 1254: 2E-05 mg/kg-d.
- RfD for Aroclor 1016: 7E-05 mg/kg-d.

The environmental mixture of PCBs at the site most closely resembles the commercial mixture Aroclor 1260 with minor contributions from Aroclor 1254 (WESTON, 2002). However, no RfD is available for Aroclor 1260 or environmental mixtures. With respect to chlorine content and environmental persistence, the environmental PCB mixture at the site more closely resembles Aroclor 1254 than Aroclor 1016. Therefore, the RfD of 0.00002 mg/kg-d (2E-05) was used in the assessment of noncancer health effects. The RfD for Aroclor 1254 is based on the lowest observed adverse effect level (LOAEL) for impaired immune function, distorted growth of fingernails and toenails, and inflamed Meibomian (eyelid) glands in studies conducted on rhesus monkeys.

In addition to the skin, eye, and immune system effects that form the basis of the RfD for Aroclor 1254, experimental animal studies have shown reproductive and developmental effects and toxic effects to the liver, gastrointestinal system, blood, and endocrine system. In epidemiological studies, PCB exposure has been associated with (1) disruption of reproductive function, (2) neurobehavioral and developmental deficits in newborns (with in utero exposure) that continue at least through school age, (3) systemic effects such as (self-reported) liver disease and diabetes, and (4) effects on the thyroid and thyroid hormone status, and (5) impaired immune function (ATSDR/EPA, 1999). These effects are discussed in Section 4 of HHRA Volume I , as are the uncertainties associated with the use of current reference doses for PCBs.

In updating the evaluation of PCB noncancer toxicity, EPA is considering recent studies, including those associated with adverse effects from in utero exposures (EPA, 2004). However, these studies are not yet incorporated into the RfD, and are not assessed quantitatively in this risk assessment.

3.3.3 Noncancer Effects of 2,3,7,8-TCDD TEQ

PCDDs, PCDFs, and other dioxin-like compounds have been shown in multiple animal species to be developmental, reproductive, immunological, and endocrinological hazards. There is no reason to expect, in general, that humans would not be similarly affected at some dose, and there is a growing body of data supporting this assumption. Occupational and industrial accident cohorts exposed at higher concentrations show correlations with exposure and a number of noncancer effects consistent with those seen in the animal studies (EPA, 2000).

An RfD for dioxin-like compounds has not been developed. Further, EPA (2000) concluded that a reference dose for dioxin calculated in the manner typical of the way EPA determines RfDs would result in a dose that is significantly lower than current average background doses. RfDs are used primarily to evaluate increments of exposure from specific sources when background exposures are low and insignificant, and background exposures for dioxin-like compounds are not insignificant.

This assessment quantifies noncancer effects using RfDs to calculate hazard quotients and hazard indices. Because an RfD has not been developed for PCDD/PCDFs, the potential for noncancer effects from exposure to dioxin-like compounds is not quantitatively evaluated in this assessment. The science associated with noncancer effects of dioxin is under review by the NAS. Section 4 of HHRA Volume I includes a discussion of the noncancer adverse health effects associated with dioxin and dioxin-like congeners. In addition, it provides perspective on the potential underestimation of noncancer health effects and a comparison of estimated site-related intake of TEQ to estimated background dietary intake.

3.4 REFERENCES

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SECTION 3

TABLES

Table 3-1

Tiers of CSF Estimates for Environmental Mixtures of Polychlorinated Biphenyls (PCBs)

Central Slope $(mg/kg\text{-}d)^{-1}$	Upper-Bound Slope $(mg/kg\text{-}d)^{-1}$	Criteria for Use
High Risk and Persistence		
1.0	2.0	Food chain exposure
		Sediment or soil ingestion
		Dust or aerosol inhalation
		Dermal exposure, if an absorption factor has been applied to reduce the external dose
		Presence of dioxin-like, tumor-promoting, or persistent congeners in other media
		Early life exposure (all pathways and mixtures)
Low Risk and Persistence		
0.3	0.4	Ingestion of water-soluble congeners
		Inhalation of volatilized congeners
		Dermal exposure, if no absorption factor has been applied to reduce the external dose
Lowest Risk and Persistence		
0.04	0.07	Congener or isomer analyses verify that congeners with more than four chlorines comprise less than 0.5% of tPCBs

Source: EPA, 1996b.

Table 3-2

Toxicity Equivalency Factors (TEFs) for Dioxins and Furans and Dioxin-like PCBs

Compound	TEF
Chlorodibenzo-p-dioxins (CDDs)	
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDD 1,2,3,6,7,8-HxCDD 1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDD	0.01
OCDD	0.0001
Chlorodibenzofurans (CDFs)	
2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDF 2,3,4,7,8-PeCDF	0.05 0.5
1,2,3,4,7,8-HxCDF 1,2,3,6,7,8-HxCDF 1,2,3,7,8,9-HxCDF 2,3,4,6,7,8-HxCDF	0.1
1,2,3,4,6,7,8-HpCDF 1,2,3,4,7,8,9-HpCDF	0.01
OCDF	0.0001
Dioxin-like PCBs	
PCB-77: 3,4,3’,4’-TeCB	0.0001
PCB-81: 3,4,4’5-TeCB	0.0001
PCB-105: 2,3,4,3’,4’-PeCB	0.0001
PCB-114: 2,3,4,5,4’-PeCB	0.0005
PCB-118: 2,4,5,3’,4’-PeCB	0.0001
PCB-123: 3,4,5,2’,4’-PeCB	0.0001
PCB-126: 3,4,5,3’,4’-PeCB	0.1
PCB-156: 2,3,4,5,3’,4’-HxCB	0.0005
PCB-157: 2,3,4,3’,4’,5’-HxCB	0.0005
PCB-167: 2,4,5,3’,4’,5’-HxCB	0.00001
PCB-169: 3,4,5,3’,4’,5’-HxCB	0.01
PCB-189: 2,3,4,5,3’,4’,5’-HpCB	0.0001

Source: Van den Berg et al., 1998.

4. EXPOSURE ASSESSMENT

4.1 INTRODUCTION

The objective of the direct contact exposure assessment is to estimate the nature, extent, and magnitude of potential exposure of humans to COPCs in soil and sediment associated with the Rest of River, considering both current and future uses. Direct contact exposure to air and surface water was eliminated from further quantitative assessment based on screening level risk assessments (see HHRA Volume I, Section 5). The exposure assessment involved several steps, which are listed below:

- Evaluating the exposure setting (Section 4.2), including describing current and future land and water uses and identifying potentially exposed human populations.
- Developing the conceptual site model (Section 4.3), including sources, release mechanisms, transport and receiving media, exposure media, exposure scenarios, exposure routes, and potentially exposed populations.
- Calculating contaminant exposure point concentrations (EPCs) (Section 4.4) for each of the exposure scenarios and routes.
- Identifying the exposure scenarios, models, and parameters (Section 4.5) with which to calculate the exposure doses.

To provide a range of point estimates for exposure, the reasonable maximum exposure (RME) and the central tendency exposure (CTE) scenarios were evaluated (EPA, 1992a). The RME is a high-end description of risk defined by EPA guidance (1992a) as

> "… a plausible estimate of the individual risk for those persons at the upper end of the risk distribution. The intent of this description is to convey an estimate of risk in the upper range of the distribution, but to avoid estimates which are beyond the true distribution."

The CTE is the central tendency (i.e., average) exposure, which uses average exposure parameters to calculate an average risk to an individual. Both the RME and CTE were evaluated for each exposure scenario. A probabilistic exposure assessment (Section 6) was also conducted to provide a further evaluation of the variability and uncertainty associated with the exposure scenarios.

4.2 EXPOSURE SETTING

4.2.1 Current and Future Land Uses

The HHRA evaluated potential risks associated with the current and reasonably anticipated future uses of the Housatonic River and its floodplain. For pathways involving direct and indirect exposure to floodplain soil and sediment, current land and river uses formed the basis for the evaluation of existing (i.e., baseline) conditions. Future land and river uses formed the basis for the evaluation of risks associated with future use of the site. Information about land use trends is important to formulate realistic assumptions regarding reasonably anticipated future land use, to clarify how these assumptions apply to the baseline risk assessment, and to develop alternatives in the remedy selection process ("Land Use in the CERCLA Remedy Selection Process", EPA OSWER Directive No. 9355.7-04, 1995).

4.2.2 Site Description and Current Uses

The Rest of River encompasses the Housatonic River and its associated floodplain from the confluence of the East and West Branches downstream to Long Island Sound. To simplify the description of the Rest of River evaluation, reaches of the river were designated. The following five reaches are discussed in this section:

- ***Reach 5*** **–** From the confluence of the East and West Branches to the Woods Pond headwaters.
- ***Reach 6*** **–** Woods Pond impoundment.
- ***Reach 7*** **–** From Woods Pond Dam to the upstream extent of the Rising Pond impoundment.
- ***Reach 8*** **–** Rising Pond impoundment.
- ***Reach 9*** **–** From Rising Pond Dam to the Massachusetts/Connecticut border.

Figures 1-1 and 1-2 show the river and floodplain areas in these reaches. Maps of individual parcels or exposure areas are presented in Section 5 as part of the risk characterization.

A number of information sources were investigated to identify the current land and river uses described in this section, including:

- Aerial photographs and maps.
- Field notes and observations of EPA and contractor field personnel who were on-site over the course of several years.
- Interviews with representatives of local recreational groups (marathon canoer), conservation groups (e.g., Massachusetts Audubon), school-based educational programs (St. Joseph's High School, Berkshire Community College), school-based outing clubs, and community organizations (e.g., the Boy Scouts) that may sponsor programs that use the river.
- Interviews and discussions with outdoorsmen club leaders and members who hunt and/or fish along the Housatonic River, including the Lenox Sportsmen's Club, the Lee Sportsmen's Club, and Berkshire League of Sportsmen—an umbrella group of local sportsmen's clubs.
- Interviews with owners/operators of sporting goods stores, summer camps, and resort hotels in the Housatonic River area.
- Discussions with regional representatives of MDEP, MDEM, and MassWildlife.
- Websites with information on uses of the Housatonic River and floodplain, including local farms advertising the sale of produce, marathon canoe sites listing races, Massachusetts and Connecticut fish and wildlife sites with fishery information and angling and hunting regulations, and sites maintained by local environmental and conservation organizations.
- Housatonic River Floodplain User Survey, a report prepared by consultants to GE (TER, 2003).
- Discussions with farmers, the United States Department of Agriculture (USDA) Farm Services Agency, the Massachusetts Department of Food and Agriculture (MDFA), regional agricultural groups (e.g., Berkshire Grown), and grocery stores that sell animal products and produce from area farms.

4.2.2.1 Reach 5

The Rest of River portion of the Housatonic River flows through one of the most biologically diverse regions of Massachusetts (Barbour et al., 1998) and Connecticut. The first 10.7 miles (17.3 km) from the confluence to the headwaters of Woods Pond is referred to as Reach 5. Reach 5 has a significant amount of forested, undeveloped land that supports a wide variety of recreational uses, including hunting, fishing, hiking, and canoeing. A large amount of the lower portion of this reach is included within the Housatonic River Valley Wildlife Management area, owned by the state and managed by MassWildlife, adjacent to October Mountain State Forest to the east. There are also residential areas, a few agricultural areas, including part of a commercial dairy farm operation, corn silage and hay production areas, and several commercial/industrial areas and utility easements. Portions of the river in this area are in the towns of Pittsfield and Lenox.

The floodplain, river, and other features of Reaches 5 and 6 comprise what is known as the Primary Study Area (PSA). Reach 5 is subdivided further into four subreaches. The acreages and features of the PSA are summarized below.

Primary Study Area Acreages and Features (Within the 10-Year Floodplain)

Reach	Floodplain Area (acres)	Backwater Areas (acres)	Main and Side Channels (acres)	Floodplain Width (minimum) (ft)	Floodplain Width (maximum) (ft)	Floodplain Width (average) (ft)
5A	382	NC	40	150	2,300	940
5B	178	NC	26	475	2,200	900
5C	546	NC	43	1,400	3,600	2,200
5D	NA	44	NA	NA	NA	NA
6	39	NA	68	NA	NA	NA

NA = Not applicable
NC = Not calculated, included in main channel area

Reach 5A extends from the confluence of the East and West Branches downstream to just above the Pittsfield Wastewater Treatment Plant (WWTP) discharge, and Reach 5B is from the WWTP downstream to the confluence with Roaring Brook. The river in Reaches 5A and 5B is free-flowing, oriented roughly north-northwest—south-southeast, with a narrow floodplain, numerous meanders and remnant oxbows, and riverbanks that are generally scoured and eroded. The width of the river in Reaches 5A and 5B ranges from 40 to 120 ft, but is commonly 60 to 70 ft, and ranges in depth from 2 to 11 ft. The sediment bed consists of coarse to fine sands with approximately 10 to 15% silt and clay. The floodplain in Reach 5A varies from several hundred feet wide near the confluence, to steep banks with little floodplain in the central part of Reach 5A, to floodplain with upland habitat that is annually flooded in the lower part of the reach near the WWTP. Aquatic habitat includes snags (large woody debris), undercut banks, and rocks. The land use in this area includes residential, recreational, and agricultural activities. The land near New Lenox Road is predominantly agricultural and forested. The portion of Reach 5B from the WWTP to New Lenox Road is similar to Reach 5A. The land near New Lenox Road is predominantly agricultural and forested. Below New Lenox Road, the river widens (60 to 160 ft) and becomes shallower (4 to 8 ft). This portion of Reach 5B is dominated by a broad wetland floodplain, ranging from 800 to 3,000 ft wide.

Reach 5C, downstream of the confluence with Roaring Brook, is influenced by the backwater effect from Woods Pond Dam. The river is oriented approximately north-south and is characterized by a broad floodplain (~800- to 3,000-ft width) on the west bank with numerous backwater areas, side channels, and meanders. The narrower floodplain on the east bank of the river is confined by the steep slopes of October Mountain. The width of the river channel ranges from about 70 to 200 ft (typically 80 to 90 ft) with depths of 8 to 16 ft. The sediment bed is characterized predominantly by fine sand and silt. Dense vegetation lines the banks of the river in the upper portion of this section, and extensive backwaters border the lower section.

Reach 5D consists of several upstream backwater areas associated with Woods Pond and covers more than 120 acres (49 ha). Reach 5D is characterized by stands of emergent vegetation, macrophytes, and surface algal mats. Under high-flow conditions, the numerous broad and shallow backwater areas are hydraulically connected to the main river channel. Under low-flow conditions, however, the backwater areas are largely isolated from the influence of flow in the main river channel.

Although the entire area is a warmwater fishery, most fishing activity has been observed in Reaches 5B through 5D, where the greatest fish biomass has been observed (WESTON, 2004). Fishing has been observed along the shoreline, generally at locations with easy access to the river or trails along the river. These locations are described in detail in Appendix B, the Phase 2 direct contact risk assessment. Fishing from boats has also been observed. John Decker Canoe Launch (JDCL), which is in Reach 5B near the end of New Lenox Road, is a popular launch site for fishing trips, recreational canoeing, and for paddlers training for marathon canoe races. Anglers typically launch at JDCL or at Woods Pond (Reach 6), while marathon canoeists paddle to

Woods Pond and back to JDCL. In addition, some canoeists launch at Fred Garner Park, which is in Pittsfield above the confluence (and outside of the Rest of River) and take out at JDCL.

4.2.2.2 Reach 6

Reach 6 begins 10.1 miles (16.3 km) downstream of the confluence and consists of Woods Pond, an impounded body of water formed by the construction of Woods Pond Dam in the late 1800s. This is the first impoundment downstream from the GE facility and is a depositional environment (HEC, 1996). Woods Pond itself is approximately 0.2 mile (0.3 km) in length and has an area of 54 acres (22 hectares). The maximum depth is 16 ft (4.9 m), but most of the pond is 1 to 3 ft (0.3 to 0.9 m) deep (HEC, 1996; Stewart Laboratories, Inc., 1982; CR Environmental, 1998). The water in Woods Pond is relatively slow-moving and contains aquatic habitat characteristic of a standing-water environment. The banks of the pond provide extensive cover, such as overhanging vegetation, woody debris, rock piles, and submerged macrophytes. The Town of Lenox is located west of Woods Pond.

Woods Pond is a popular recreational area, with easy access to the water at several locations for launching boats or fishing from shore. It is also a well-known ice-fishing location, with many cars observed in the vicinity on winter days, especially weekends. It is a warmwater fishery with good fishing for largemouth bass, yellow perch, sunfish, and brown bullhead.

4.2.2.3 Reach 7

Reach 7 extends 18.5 miles (29.8 km from Woods Pond to the upstream end of Rising Pond in Great Barrington (Figure 1-2). There are five dams in this reach, and the river has an average depth of between 3 and 5 ft (0.9 and 1.5 m) in the faster-flowing sections of the river channel and upwards of 20 feet (6 m) just upstream of the dams. Agricultural activity becomes more common in this area than in the upstream reaches and is dominated by corn silage production with some hay production. One private resident living along this reach keeps a herd of beef cattle. The Towns of Lee and Stockbridge control most of the floodplain area in this reach.

The best fishing in this reach is reportedly just below Woods Pond Dam and near the Glendale Dam (Tom Keefe, MassWildlife, personal communication, 2002). Two areas were designated catch and release areas by MassWildlife in 2004: (1) from the Route 20 Bridge in Lee downstream to the Willow Mill Dam in South Lee and (2) from the Glendale Dam downstream to the Railroad Bridge. MassWildlife began stocking trout in the Housatonic River in these areas in spring 2004.

4.2.2.4 Reach 8

Reach 8, known as Rising Pond (Figure 1-2), is a 45-acre (18-hectare) pond created by the construction of a dam at the Rising Paper Company (WESTON, 2000). Rising Pond has depositional characteristics similar to Woods Pond, and is located just south of the Town of Housatonic. Route 183 borders the eastern shore with residential areas on the eastern side of the road. The west side has a narrow floodplain with undeveloped land.

4.2.2.5 Reach 9

Reach 9 begins downstream of Rising Pond and extends for approximately 23.9 miles (38.5 km) to the Massachusetts/Connecticut state line (Figure 1-2). It contains low-gradient sections with deeper river habitat, as well as moderate gradient sections with riffle habitat. This reach is wide with flat floodplains and several oxbows, and includes the towns of Great Barrington and Sheffield.

Agriculture is a predominant land use in this reach. Most of the agricultural acreage is devoted to commercial dairy farms and corn silage production, followed by commercial production of vegetables and free-range poultry. In this and other reaches, lactating dairy animals do not graze in the floodplain, but they consume feed crops grown in the floodplain. However, non-lactating animals graze in one small part of this reach.

MassWildlife maintains a canoe launch in Great Barrington, providing public access to the river. Stretches of Reach 9 are used for recreational canoeing, with trips sponsored, for example, by the Berkshire Chapter of the Appalachian Mountain Club. The fishery in Reach 9 is typical of a warmwater fishery.

4.2.3 Future Uses of the Site

Future plans regarding land use in the towns and communities along the river are important to the determination of reasonably foreseeable uses of the site, including those that could increase future contact with the Housatonic River and its floodplain. The City of Pittsfield and five towns (Lenox, Lee, Stockbridge, Great Barrington, and Sheffield) are located along the Housatonic River in the Massachusetts portion of Rest of River. Downstream of Sheffield is the Massachusetts/Connecticut border. No information on future land use trends was collected in Connecticut, with the exception of the Schaghticoke tribal area in Kent, because of the limited floodplain area and because PCB concentrations in floodplain soil in Reach 9, immediately upstream, were largely below detection limits (0.5 ppm tPCB).

The following sources provided information for the determination of reasonably anticipated future land uses:

- Interviews with planning officials for Berkshire County, Pittsfield, Lenox, Lee, Great Barrington, Stockbridge, and Sheffield (conducted in 2001 and 2004).
- Town and regional planning documents, including the April 2004 Housatonic River Restoration Plan by Housatonic River Restoration, Inc. (HRR, 2004).
- United States Census of Agriculture statistics on agricultural trends in Berkshire County.
- Relevant laws and regulations such as the Massachusetts Wetlands Protection Act, and deed restrictions, especially on state-owned land.
- Discussions between EPA and representatives of the Schaghticoke Tribal Nation on April 29, 2004.
- Discussions with Rachel Fletcher of Housatonic River Restoration, Inc., about future agricultural use in the floodplain (Fletcher, personal communication, 2004).

4.2.3.1 Planning Agency Interviews and Documents Regarding Land Use Trends

The Berkshire Regional Planning Commission supports the Berkshire community with town planning and other related issues. Some of the towns discussed in the following sections had their Master Plans developed through the Commission, whereas others developed their plans independently from the Commission. In an interview with the Commission (Berkshire Regional Planning Commission, personal communication, 2001) it was recommended that the town planners be contacted directly to discuss future land use trends and to obtain copies of their Master Plans for the most up-to-date information on potential future uses.

4.2.3.2 City of Pittsfield

In 2001, the City of Pittsfield's principal planner indicated that few, if any, land use changes were anticipated for the portions of Pittsfield along the river (Pittsfield Department of Community Development, personal communication, 2001). A follow-up telephone interview with the town planner conducted in May 2004 confirmed earlier assessments that no other plans or proposals are currently being considered that would alter the use of the floodplain in Pittsfield downstream of the confluence (Pittsfield Department of Community Development, personal communication, 2004). The planner also noted that most of the other land along the river is likely to be maintained in its current use because of state ownership or deed restrictions. There are no plans to change the land use of parcel K3-1-19 (EA 27), which is a city-owned property.

In the 2001 interview, the planner mentioned an earlier proposal to develop a bicycle trail along a portion of the river, but that proposal was abandoned because of lack of funding, opposition from homeowners along the proposed path, and PCB contamination issues. However, the Housatonic River Restoration Plan indicates that the Berkshire Bike Path Council (BBPC) has renewed interest in developing a bike and pedestrian trail from Fred Garner Park, just upstream of the confluence, to Canoe Meadows, much of which would be in the floodplain in Reach 5 (HRR, 2004).

4.2.3.3 Town of Lenox

An interview was conducted with the planner for the Town of Lenox in August 2001 (Lenox Planning Board, personal communication, 2001). The following information was obtained during that interview, from a review of the Town of Lenox Comprehensive Master Plan (Lenox Master and Open Space/Recreation Task Force and Lenox Planning Board, 1999) and the Housatonic River Restoration Plan (HRR, 2004), and a follow-up phone interview with the town planner in May 2004 (Lenox Planning Board, personal communication, 2004):

- The only potential agricultural issue relates to the former DeVos farm, and what the future use of that parcel could be. Because it was purchased by GE, it was assumed that this parcel would not be used for farmland or residential development in the future.

- The large expanse of the Eastover Resort (tax parcels 13-1, 18-84, 18-85, 18-86, and 19-5) is owned by a single family. No future uses have been proposed for these parcels, but a variety of uses are possible, including future development of residential properties. Tax parcel 19-5 is not identified as being suitable for residential development because it is located entirely within the floodplain and therefore subject to development restrictions. For the remaining parcels, because much of the area in the floodplain is wetlands, future residential development of the portion in the floodplain is unlikely. It should also be noted that the PCB concentrations at these properties are less than 2 mg/kg, which is the cleanup goal for residential use specified in the Consent Decree.

- Parcel 14-4, owned by the Town of Lenox (EA 51) is deeded as conservation land and is assumed to be "forever green."

- There could be additional commercial development along the river to the west of Lenoxdale (south of Woods Pond), but this is outside of the floodplain, and thus not part of the Rest of River site.

- Additional recreational development has been discussed in general terms for the area around the perimeter of Woods Pond, such as walking or bicycle trails that could increase the public use of this area. However, no definitive plans or proposals have been submitted to the town. The HRR Plan (HRR, 2004) also identifies the area near Woods Pond and October Mountain as a potential location of future trail routes.

4.2.3.4 Town of Lee

A meeting with the Town of Lee's planner was conducted in September 2001 (Lee Planning Board, personal communication, 2001) and a follow-up telephone interview was conducted in 2004 (Lee Planning Board, personal communication, 2004). The following information was taken from the two interviews and from a review of the Lee Comprehensive Master Plan (Lee Planning Task Force, 2000):

- Residentially-zoned property located along Route 102 south of the Massachusetts Turnpike could have the zoning changed to allow for other uses, including commercial, although it is unlikely to be retail. A change from residential to commercial would result in less potential exposure to floodplain soil.

- A portion of the open space along Meadow Street is zoned commercial or residential, which leaves open the possibility for future development. Future use of these locations as residential properties is evaluated as part of the HHRA. The approximately 6-acre truck stop located on the south side of the Massachusetts Turnpike just off the Route 20/Lee exit may be developed into a number of uses (e.g., hotel, convenience store, car wash, and gas station) pending zoning changes. This potential change from industrial to commercial use would not affect the risk assessment because commercial and industrial uses result in similar soil exposures. In addition, this parcel was eliminated in the Phase 1 screening analysis based on a comparison of PCB concentrations at the site to conservative, health-based screening concentrations (HHRA Volume I, Section 6).

- The residential area along Meadow Street (Oak N' Spruce Resort) continues to expand with more units planned. Future residential exposure at this location is evaluated as part of the HHRA.

- A 30-acre tract of land located along Meadow Street abutting the river (tax parcel 35-2) was recently purchased and a conservation deed restriction placed on it to prevent future development (Lahr, *Berkshire Eagle*, 2002). The HRR Project Plan (HRR, 2004) indicates potential consideration of a trail from the pavilion to the athletic fields on Route 20 as well as interest in a canoe launch in the same area. The potential land use changes in this tract of land will not affect the risk assessment. As discussed in Section 6, this parcel was eliminated in the Phase 1 screening analysis based on a comparison of PCB concentrations at the site to conservative, health-based screening concentrations for residential use.

4.2.3.5 Town of Stockbridge

A telephone interview was conducted with the Town of Stockbridge planner in August 2001 (Stockbridge Planning Board, personal communication, 2001). There were no planned changes to any property in the floodplain at that time. Stockbridge did not have a recent Master Plan available at that time. A follow-up telephone interview was held with a Town Selectman (Stockbridge Town Selectman, personal communication, 2004), who noted two potential industrial developments in Stockbridge at properties currently used for industrial purposes. This does not represent a change of use in the future.

The HRR Plan indicated that the Laurel Hill Association had constructed the Mary Flynn Trail from the bottom of Park Street at the Goodrich Bridge heading east along the old trolley bed (HRR, 2004). The HRR plan indicated that a canoe launch was installed at the town park on Route 7 at Park Street. The canoe launch is considered both a current and a foreseeable future use. The portion of the trail that is within the floodplain was eliminated from further evaluation based on the screening risk assessment.

4.2.3.6 Town of Great Barrington

A meeting with the Town of Great Barrington's planner and a local, long-time resident was held in August 2001 (Great Barrington Planning Board, personal communication, 2001) and a follow-up telephone conversation was held in May 2004 (Great Barrington Planning Board, personal communication, 2004) with the same planner. The following information was provided in the meeting, telephone interview, and a review of the Great Barrington Community Master Plan (Great Barrington Planning Board, 1997):

- Various proposals have been presented over the years regarding the fairgrounds that directly abut the river, including housing, gardens, flea market areas, etc.
- Development pressure is mainly residential although there are no current plans or proposals for actual development near the floodplain area.
- Rising Paper Company (now the Rising Paper Division of Fox River Paper Co.), below Rising Pond, has expanded some of its area recently and may have plans for additional expansion in the future.

Most PCB sample concentrations in the floodplain soil and sediment in Reach 9, which includes Great Barrington, range from below the limit of detection (0.5 ppm tPCB) to 2 ppm, which is the cleanup level for residential properties. Two of 205 samples are between 2.0 to 2.6 ppm; one sample had 6 ppm tPCB. However, other soil samples in the vicinity of this one sample with elevated PCBs were below 2 ppm. Thus, changes in land use, such as future trails, canoe launches, or developments in the fairgrounds, would not result in unacceptable risk levels.

4.2.3.7 Town of Sheffield

Based on communications with a planner from the Town of Sheffield in 2001 (Sheffield Planning Board, personal communication, 2001), there were no proposals pending for any land-use changes on land adjacent to the river, and there were no foreseeable plans for anything similar in the future. Most of the land along the river is owned by the Nature Conservancy and is currently used for agricultural activities. The Town of Sheffield is within Reach 9. As discussed above for Great Barrington (Reach 9), all PCB concentrations in the floodplain soil and sediment in this area are very low to non-detect. Thus, changes in land use, such as future trails, canoe launches, or developments in the fairgrounds, would not result in unacceptable risk levels.

4.2.3.8 Schaghticoke Tribal Nation Reservation, Kent, CT

On April 29, 2004, EPA held discussions with representatives of the Schaghticoke Tribal Nation. The Tribal Nation obtained federal recognition in January 2004, which is currently under appeal. The current reservation encompasses about 400 acres. Efforts are underway that may expand the reservation by more than an additional 2,000 acres. There is currently a moratorium on building at the reservation that is expected to be lifted in the future, and the residential population of the reservation may increase. The tribe has a housing authority that plans to construct housing, possibly for elder members, in the future.

4.2.4 Identification of Potentially Exposed Human Populations

Based on the known or plausible current and future land and water uses, the types of activities, and the transport of contamination to various media in the Rest of River, four populations were identified for evaluation in this risk assessment:

- Adult and child residents.
- Adult and child recreational users, including hikers, hunters and anglers, waders, campers, picnickers, dirt bike riders, and boaters.
- Adult and child farmers.
- Outdoor utility workers and groundskeepers.

Because of differences in behavior between children and adults and the specific exposure scenarios being evaluated, younger children, older children, and adults were evaluated separately. The younger child's age was defined to range from 1 through 6 years. The older child's age was defined to range from 7 through 18 years of age, and the adult was defined to be 19 years and older (EPA, 2002a).

4.3 CONCEPTUAL SITE MODEL

A conceptual site model describes the contaminant sources, release mechanisms, transport and receiving media, exposure media, exposure routes, and potentially exposed populations. One objective of the conceptual site model is to identify complete and incomplete exposure pathways. A complete exposure pathway has all of the above-listed components, whereas an incomplete pathway is missing one or more. Figure 4-1 illustrates the conceptual site model that was developed for the Rest of River human health risk assessment, with the direct contact exposure pathways clearly highlighted. Each component of the conceptual site model for direct contact exposure is examined in detail in the following sections.

4.3.1 Sources of Contamination, Release and Transport Mechanisms, and Receiving Media

Migration of contaminated sediment in the Housatonic River has resulted in contamination of floodplain soil downstream from the site. Sediment contamination has resulted from surface water runoff from contaminated source areas, migration of nonaqueous phase liquids (NAPLs), direct discharge of PCBs from outfalls and the GE facility Building 68 tank implosion, and inundation/erosion of contaminated floodplain.

Current or past contaminant sources for the Housatonic River include the following:

- Former oxbows of the Housatonic River that have been filled with materials, including hazardous materials.
- NAPLs and soil contaminated with hazardous substances, including PCBs, volatile organic compounds (VOCs), metals, and semivolatile organic compounds (SVOCs) as a result of spills from a number of aboveground storage tanks (ASTs), underground storage tanks (USTs), and process pipelines currently or formerly located on GE property.
- Unkamet Brook Landfill and contaminated soil and sediment on the banks or in Unkamet Brook.
- PCB-contaminated soil used as fill material.
- Former waste stabilization basin.
- Silver Lake.
- Stormwater and wastewater discharges.
- Contaminated groundwater discharge to the river.
- Contaminated soil and sediment on the banks or in the river itself.

Additional information regarding source areas in and releases from the GE facility can be found in the *Source Area Characterization Report* (WESTON, 1998).

4.3.2 Secondary Release and Transport Mechanisms

The contaminant release and transport processes affecting the fate and effect of PCBs within the Housatonic River and its floodplain are interrelated and complex. The following potential PCB transport pathways have been identified:

- Erosion and downstream transport of contaminated bank soil. Bank contamination has occurred as a consequence of historical cut and fill operations that used fill material contaminated with PCBs, as well as PCB spills and light nonaqueous phase liquid (LNAPL) seeps.

- Sediment contamination via runoff carrying suspended soil particles contaminated with PCBs.

- Surface water contamination from flux of soluble PCBs from contaminated sediment, and resuspension of contaminated sediment particles.

- Floodplain soil contamination via deposition of suspended river sediment during flood events.

- Erosion of contaminated floodplain soil (surface and subsurface) during flood events, and subsequent deposition as contaminated river sediment.

- Bioaccumulation and cycling of PCBs within the terrestrial and aquatic food chains exposed to contaminated soil, surface water, and sediment, via diffusion across the epidermis or gill membrane of aquatic species, consumption of contaminated food items, or sediment/soil/surface water directly.

4.3.3 Primary Exposure Media

4.3.3.1 Surface Water, Sediment, Air, and Soil

Based on the review of land and water uses, Figure 4-1 shows the following primary exposure media of potential concern to humans in the Rest of River:

- Soil (floodplain and riverbank).
- Sediment.
- Air.
- Surface water.

Historical and recently collected sample results have indicated that these media are contaminated with PCBs and other contaminants. A detailed discussion of the air and surface water pathways and their elimination from further analysis based on conservative screening risk assessments is included in Section 5 of HHRA Volume I.

4.3.3.2 Groundwater

Groundwater sampling results have indicated little to no contamination with PCBs or other contaminants in the Rest of River area. Therefore, this medium was not considered to be a significant current or future direct exposure pathway and was not evaluated in the risk assessment.

4.3.4 Secondary Exposure Media – Biota

Fish, ducks, and other waterfowl are commonly hunted or caught in the Rest of River and wetlands and then consumed by humans. These species may contain significant levels of contaminants, especially those that bioaccumulate and biomagnify (such as PCBs), as a result of ingestion of sediment, surface water, aquatic or terrestrial vegetation, or lower tropic organisms that have been contaminated. Local residents and farmers may raise animals for consumption or grow vegetables and silage in areas of the floodplain contaminated by PCBs. In addition, the local harvesting and ingestion of wild crops such as fiddlehead ferns from the floodplain may contribute to contaminant exposure. As indicated in Figure 4-1, these media are included in the overall risk assessment, but not as part of the direct contact risk assessment. These secondary exposure media were evaluated separately and provided in Appendix C, Consumption of Fish and Waterfowl Risk Assessment, and Appendix D, Agricultural Product Consumption Risk Assessment.

4.3.5 Determination of Exposure Areas

The large area of floodplain to be evaluated for direct contact exposure was divided into separate exposure areas based on the following considerations:

- Exposure areas did not extend beyond the boundaries of the site, as defined by the Consent Decree. The site extends to the 1-ppm PCB isopleth, which is approximated by the 10-year floodplain in Reaches 5 and 6, and the 100-year floodplain in Reaches 7 through 9 (the 10-year floodplain has not been mapped for these downstream reaches).

- Individual tax parcels (portion within floodplain) were the starting point for defining individual EAs. These parcels were kept intact, subdivided, or combined with adjacent parcels based on the following criteria:
  - Similarity of land use.
  - Similarity of ownership.
  - Number of available soil samples.

4.3.6 Exposure Scenarios and Routes of Exposure

Based on current and reasonably anticipated future land uses (EPA, 1995), the activities common in the area, and the known transport of PCB contamination to various media, four primary exposure scenarios were identified for soil and sediment exposure: residential, recreational, agricultural, and commercial/industrial.

Seven variations of the recreational scenario and two variations of the commercial/industrial scenario were evaluated to estimate the exposure associated with these types of activities in greater detail. These scenarios were developed, in part, based upon discussions and information received from the community. The recreational scenarios were:

- General recreation.
- All-terrain vehicle (ATV)/dirt and mountain bike riding.
- Marathon canoeist.
- Recreational canoeist/boater.
- Angler.
- Waterfowl hunter.
- Sediment exposure.

The variations of the commercial/industrial scenario were:

- Groundskeeper.
- Utility worker.

There were also two alternatives considered for future residential exposure that differ based on whether the area includes an actual/potential lawn area or less-frequented areas such as inundated wetland and steep banks. A single scenario was used to evaluate risks for farmers. All of the scenarios considered soil exposures, with the exception of the sediment exposure scenario, which considered sediment exposure from a composite of recreational activities (e.g., wading, swimming, fishing, waterfowl hunting, canoeing, and other related activities).

The construction worker scenario was not considered a complete exposure pathway because flooding and the Massachusetts Wetland Protection Act will exclude major construction in the floodplain. Therefore, this scenario was eliminated from further evaluation in the risk assessment.

The following sections describe the direct contact soil and sediment exposure scenarios. The conceptual site model (Figure 4-1) illustrates these pathways and scenarios. Table 4-1 summarizes the exposure scenarios, the receptors (people potentially exposed to contamination), and the media evaluated.

4.3.6.1 Residential Scenario

This evaluation included both current and future residential exposure. The residential scenario for current land use evaluated contact with inundated wetlands and steep bank portions of residential property because other, more readily accessible residential property areas (defined as "actual or potential lawn" areas) were evaluated separately in the Phase 1 report (see Appendix A) as required in the Consent Decree. Contact with soil could occur to children (younger and older) and adults while playing or engaging in other activities in these areas. Dose and risk estimates were calculated for two exposure groups: children (1 through 6 years) and others from age 7 through 45 years (see Section 4.5.3.1.2 for a discussion of the exposure duration for residential exposure). When estimating lifetime carcinogenic risk, residential exposure was age-adjusted to consider a single individual living consecutively as a young child and adult at the same location (EPA RAGS, 1989). This approach accounts for the difference in ingestion rates, exposed skin surface area, body weight, and exposure duration for young children (1 to 6 years old), and older children/adults (7 to 45 years old). When estimating noncancer hazards, exposure doses and HQs were calculated separately for each age group. The future residential scenario includes properties that are not currently developed as residential properties but which may be developed in the future. Although all non-residential properties have, in theory, the potential for residential development in the future unless future use restrictions are in place or other reasons exist that would preclude such development, only properties that had a reasonable potential for future residential development were evaluated as future residential. For example, it was assumed that current farms or commercial properties could be developed for housing in part or in the entirety in the future (e.g., a school converted to condominiums, townhouses built along a golf course). Conversely, because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, future residential use was not evaluated at any of these locations. In general, based on restrictions associated with building in the floodplain, and based on interviews with town planners from Pittsfield downstream to the border with Connecticut, there is little momentum toward the creation of additional residential areas along the Rest of River. Therefore, the identification of future residential areas in this risk assessment is likely to be inclusive of all areas that have a reasonable potential for future residential development. The age groups described above were also used for the future residential scenario.

4.3.6.2 Recreational Scenarios

The Housatonic River downstream from the confluence of the East and West Branches is one of the most attractive recreational venues in the area, and supports a wide variety of recreational activities. These activities include, but are not limited to, hiking, camping, canoeing, picnicking, fishing, hunting, wading, swimming, and riding horses and dirt bikes and all-terrain vehicles. It is reasonably anticipated that these activities would occur even more frequently in the absence of consumption advisories and the PCB contamination. Six variations of the recreational exposure scenario were developed to evaluate soil exposure and one recreational scenario was developed to evaluate sediment exposure.

<u>Soil</u>

- General recreation – includes a variety of activities that could result in exposure to soil.
- All-terrain vehicle (ATV)/dirt and mountain bike riding
- Marathon canoeist
- Recreational canoeist/boater
- Angler
- Waterfowl hunter

Sediment

- Sediment exposure – includes a variety of activities that could result in exposure to sediment.

4.3.6.2.1 General Recreational Scenario

The general recreation exposure scenario consists of children (both the young and older groups) and adults who might come into contact with soil during general recreational activities such as walking, hiking, running, horseback riding, bird watching, upland hunting (not including waterfowl), wild crop gathering, camping, educational field trips, ball playing, and other activities in the floodplain (e.g., adolescent gatherings). Other activities such as canoe and/or boat launching, fishing from the riverbank, riding ATVs, dirt bikes, and mountain bikes, hunting for waterfowl, and wading were evaluated separately (see Sections 4.3.6.2.2 through 4.3.6.2.7). The receptor or receptors evaluated depended on the specific exposure area (parcel or property) and the activity most likely associated with that area.

The older child and adult were the most frequently evaluated receptors. Given the nature of the areas, the types of recreational activities, and the location of many of the exposure areas, the young child was included only at those areas where there were well-defined trails that are frequently used, such as designated nature areas and parks, or where young children were observed by EPA and/or GE personnel. The adult was most frequently evaluated under the general recreation scenario in the Direct Contact Risk Assessment because the exposure potential at the majority of the EAs results from activities that adults rather than children are most likely to participate in.

4.3.6.2.2 All-Terrain Vehicle/Dirt and Mountain Bike Riding Scenario

The ATV/dirt and mountain bike riding exposure scenario consists of older children who come into contact with floodplain soil while riding ATVs, dirt bikes, or mountain bikes. Although it is likely that adults also ride ATVs and dirt/mountain bikes, it was assumed that the exposure frequency would be less for an adult than for an older child while other exposure parameters, with the exception of body weight, would be similar for both the older child and adult. Thus, the adult exposure would be less conservative than that of the older child and was not quantitatively evaluated.

4.3.6.2.3 Marathon Canoeist Scenario

The marathon canoeist exposure scenario consists of adults who use the John Decker Canoe Launch as a launching area for training for competitive canoe races. Members of the Berkshire Paddlers paddle the 9-mile round trip to Woods Pond and back daily or nearly daily from spring to fall. Approximately 12 members of the group perform the round trip three to four times a day in preparation for a 70-mile marathon race (WESTON, 2001). It was assumed that the marathon canoeists contact soil while launching and removing their canoes from the river.

4.3.6.2.4 Recreational Canoeist/Boater Scenario

The recreational canoeist/boater exposure scenario consists of adults and older children who use certain areas along the river as launching points for recreational outings. The adult RME scenario is based on the leaders of canoe trips/field trips for local outdoors clubs and educational institutions. The older child was assumed to accompany trip leaders, but for fewer days.

It was assumed that the recreational canoeist/boaters contacted soil while launching and removing their canoes from the river. These canoeists may also contact soil while assisting others in launching their canoes or while conducting natural history activities.

4.3.6.2.5 Angler Scenario

Fishing is a popular pastime in the Rest of River area. The angler scenario evaluated older children and adults who fish from certain areas along the riverbank. It was assumed that the angler comes into contact with soil, and that a 6-meter stretch of floodplain along the water's edge was the area most routinely contacted by anglers. The evaluation of the angler scenario was limited to the area from New Lenox Road to Woods Pond (Reaches 5B through 5D and Reach 6) and Reach 7, because anglers have been observed to fish from shore in these areas. Consistent with this observation, fish biomass data indicate greater fish population density in the reaches below Reach 5A.

4.3.6.2.6 Waterfowl Hunter Scenario

Hunting is a popular activity in Berkshire County (see Section 1.6.3.2 of HHRA Volume I). The waterfowl hunter scenario evaluated older children and adults who hunt ducks and other waterfowl. It was assumed that the waterfowl hunter comes into contact with soil, and that a 6-meter stretch of floodplain along the water's edge and the areas near duck blinds were the areas most routinely contacted by waterfowl hunters.

4.3.6.2.7 Sediment Exposure Scenario

A single sediment exposure scenario was developed to evaluate sediment exposure from a variety of different activities that could result in contact with sediment such as launching canoes, wading, swimming, fishing, waterfowl hunting, and other related activities. Each of these activities results in a similar exposure scenario. Because of this similarity, it was not necessary to develop a separate sediment exposure scenario for each activity.

Sediment exposure scenarios were evaluated for older children and adults. It was assumed that, while younger children may occasionally be included in these activities, it would be a low frequency (and certainly lower frequency than the older child). Thus, the evaluation for the older child would also be protective of the younger child.

4.3.6.3 Agricultural Scenario

The agricultural exposure scenario consisted of adults who might contact floodplain soil during typical farming activities such as planting, cultivating, and harvesting. Consumption of locally grown crops, farm animals, eggs, and dairy products was evaluated separately in the Agricultural Product Consumption Risk Assessment (see Appendix D, Volume V).

4.3.6.4 Commercial/Industrial Scenarios

Two commercial/industrial scenarios were evaluated based on different activities and intensities of contact with floodplain soil: groundskeeper and utility worker. The groundskeeper exposure scenario consisted of adults who would contact soil during typical groundskeeping activities, such as mowing lawns and gardening. This scenario was utilized at certain commercial and industrial properties. The utility worker exposure scenario consisted of adults who would contact soil during activities such as easement or equipment maintenance, and/or installation of new equipment (such as utility poles or piping) in the easement. This scenario was evaluated on utility easements located in the floodplain.

4.3.6.5 Selection of Exposure-Area-Specific Exposure Scenarios

In many cases, multiple activities could plausibly occur at a particular exposure area. To simplify the process for evaluating the large number of exposure areas that were retained after the Phase 1 assessment, only the exposure scenario(s) and receptor(s) that would result in the greatest exposure and resulting risk at the particular exposure area was selected for evaluation. Evaluation of the activity with the greatest exposure was performed to ensure the assessment was protective of all activities that may reasonably occur in the exposure area.

In addition, several exposure areas were divided into subareas based on the observation that distinct activities could occur at different locations within the exposure area. In these cases, a risk assessment was conducted for the activity in the subarea. In addition, a risk assessment was conducted for the exposure area as a whole.

Exposure was assumed to occur randomly across an EA or subarea. However, a number of these EAs and subareas are large, and, if an individual's actual exposure occurs primarily to areas of higher contamination, risks may be underestimated (see Section 7, Uncertainty Analysis).

4.4 EXPOSURE POINT CONCENTRATIONS

An exposure point concentration (EPC) is a conservative estimate of the mean concentration to which a receptor is exposed during each exposure event in an exposure scenario. The EPC for each exposure area (or subarea) is the 95% UCL of the mean or the maximum detected concentration, whichever is lower. Consistent with EPA policy, the uncertainty associated with estimating the true mean concentration was accounted for by using a 95% UCL of the mean (EPA, 1992b). EPCs were calculated for each exposure area (or subarea) based on the 95% UCL of the mean, using the appropriate equation for the distribution of the sampling data (EPA, 2004); these EPCs apply to both the RME and CTE evaluations. Because of different methods in evaluating the soil data in Reaches 5 and 6 and Reach 7, and the sediment data from Reaches 5 through 8, different approaches were employed to calculate the EPCs. The following sections present these different approaches. Figure 4-2 presents a flow chart of the EPC calculation methods.

4.4.1 Reaches 5 and 6 Soil

A spatial weighting approach was used in Reaches 5 and 6 to generate a surface of interpolated PCB data from which EPCs were calculated. Spatial weighting is an appropriate and useful tool for interpreting data in the floodplain, because of its size and the assumption that concentrations are spatially correlated due to the conceptual model of fate and transport of PCBs via contaminated sediment transported during flood events. The spatial weighting approach is described in Attachment 3 of HHRA Volume I with respect to how EPCs were calculated using spatially weighted data. Use-weightings were also applied to account for differences in frequency of exposure in areas that are more difficult to access. The following section describes the spatial weighting procedure and use-weightings that were used.

4.4.1.1 Inverse Distance Weighting

The spatially weighted surface of tPCB concentrations in the Reaches 5 and 6 floodplain was generated from the measured concentrations in floodplain soil samples using the inverse distance weighting (IDW) procedure contained in ArcView Spatial Analyst (Environmental Systems Research Institute, Inc. [ESRI], 1996). The basic IDW approach was modified to include information on the habitat types delineated in the floodplain as part of the Ecological Characterization (WESTON, 2004, Appendix A).

PCBs are transported onto the floodplain during storms, including those that have occurred over the last 70 years. The frequency and extent of such inundations at a particular location in the floodplain is governed by the topographic and hydrologic factors that also control the distribution of wetland habitats. Accordingly, it was appropriate to consider data from similar habitat types in conducting the spatial weighting exercise. The use of habitat-restricted spatial weighting also reduced the effect of nonrandom sampling and the clustering of samples in areas of known or suspected high PCB concentrations.

Data on PCB concentrations in floodplain soil from the 0- to 6-inch depth interval were extracted from the project datamart and exported to a dBase file (dbf), which was imported to ArcView Version 3.2 (ESRI, 1992) as an event theme. Values reported as non-detects were replaced with one-half of the reported sample quantitation limit (detection limit). The habitat boundary theme previously developed for the Rest of River Ecological Characterization (WESTON, 2004, Appendix A) was also imported and modified to group similar habitats into six "super habitats." This grouping step was necessary to avoid large numbers of habitat polygons without sampling data, and also had the advantage of reducing computational time. The super habitat groupings were:

- Shallow emergent marsh, deep emergent marsh, and wet meadow.
- Transitional floodplain forest, black ash-red maple-tamarack calcareous seepage swamp, and red maple swamp.
- High terrace floodplain forest, northern hardwoods-hemlock-white pine forest, red oak-sugar maple transition forest, rich mesic forest, successional northern hardwoods, cultural grassland, and agricultural field.
- Shrub swamp.
- Low-gradient stream, medium-gradient stream, high-gradient stream, riverine point bar.
- Moderately alkaline lake/pond.

This grouping reduced the number of habitat polygons in the theme from the original 870 to 744 and greatly decreased the number of polygons without data. A series of test runs was used to establish that a 3-square-meter (3 m^2) grid produced spatially weighted surfaces that were essentially identical to those generated with a much more computationally intensive 1-m^2 grid and was sufficient to adequately resolve concentration boundaries for the purposes of determining exposures. Although the habitat boundaries were respected throughout the analysis, no such distinction was made for tax parcel boundaries; grid elements were populated from the closest points in each habitat polygon regardless of parcel boundaries.

The 3-m^2 grid was populated from the sample data using the standard IDW algorithm in ArcView Spatial Analyst:

$$G(x, y) = \sum_{i}^{n} w_i \, f(x_i, y_i)$$

Where:

G(x,y)	=	the IDW estimation at (x,y);
w_i	=	$1/d_i^{\,p}$;
d_i	=	the distance from (x,y) to (x_i,y_i);
p	=	power, a real number; and
$f(x_i,y_i)$	=	the measured value at (x_i,y_i).

This interpolation assumes that each input point has a local influence that diminishes with distance. Hence, the interpolated points (the new surface) will be more influenced by nearby points than more distant points. The weights are inversely related to distance and are scaled such that the sum of all the weights will add to 1. The number of points or "neighbors" (n) used in the interpolation and the power term (p) are user-specified.

The EPA FIELDS cross-validation procedure was used to optimize the values of n and p for this application. Cross validation is an iterative technique in which a datum at a particular location is temporarily discarded from the sample data set. The value at that location is then estimated using the remaining samples (Isaaks and Srivastava, 1989). The difference between these two values is the cross-validated residual. Cross validation is performed for each unique interpolation permutation (e.g., neighbors =1, power=1; neighbors=2, power=1, etc.) for the IDW interpolator, and the combination of n and p that produces the lowest sum of residuals is used for calculation of the final surface.

These recommended variables from the cross-validation process were passed to the IDW processor and the interpolated grid surface was created for that habitat polygon. The grid surface was stored temporarily and the next polygon in the list of boundary polygons (habitat) was processed. Once all surface grids were created, they were merged to form one continuous grid covering the entire floodplain within Reaches 5 and 6.

Because the IDW interpolation was not allowed to cross the habitat boundaries, if there was only one data point in a particular polygon, each 3-m^2 cell in the polygon was assigned the value of that single point. If there were no samples in a particular polygon, the entire area of that polygon was assigned the value “no data.” In such cases, the polygon was examined and manually linked to the nearest most similar habitat with sampling data, then recalculated. Because of the grouping of individual habitats into the six “super habitats” described above, this final adjustment was necessary for only a very small amount of the total area in the floodplain.

4.4.1.1.1 Accessibility Classifications and Use-Weighting

For purposes of the direct contact risk assessment, super-habitat groupings (Section 4.4.1.1) were identified based upon the vegetation and hydrology of the different wetland habitats which occur in the floodplain. A weighting approach was developed to account for the variation in accessibility and overall attractiveness of these habitats to children and adults engaged in recreational or residential and other activities. For example, areas considered walkable, such as forested habitats, cultural grasslands, and agricultural fields, would be accessed more frequently than areas considered difficult to access. Use-weighting factors were applied to the interpolated grid data that are located within each of these categories. The accessibility categories and the representative habitats included within them are listed below:

- **Walkable—**Areas that can readily be accessed by an individual wearing athletic shoes or boots. Habitats included within this accessibility category include all of the forested habitats in the assessed study area as well as cultural grasslands and agricultural fields.

- **Difficult to Access—**Areas that would be difficult to access due to varying water depth, i.e., 1 to 2 ft deep, and soft substrate during part of the year, particularly April. During the remainder of the year, these areas are dominated by dense vegetation. Habitats considered to be within this accessibility category include shrub swamps that are not dominated by buttonbush.

- **Wadable—**Areas that can be accessed by wading through water less than 3 ft deep during the early part of the growing season, generally April and May. These areas are dry or accessible with waders during the remainder of the year. Vegetation in wadable areas is typically less dense than in the difficult-to-access areas because they are underwater for a longer period of the year. The balance between the shorter period of accessibility and the greater ease of accessibility compared to difficult-to-access areas suggests that the net result of overall use would be similar. Habitats considered to be in this accessibility category include buttonbush-dominated shrub swamps, shallow emergent marshes, and deep emergent marshes.

- **Boatable—**Areas that are accessible only by using a boat (i.e., deeper than 3 ft). This category is not accessible during any part of the year.

Use-weighting factors were established for each of the accessibility categories (boatable was assigned a factor of 0) based on the likelihood that an individual would access a particular habitat within an exposure area within the 7-month period of time when the ground is not frozen or snow covered.

Habitats included within the walkable category were considered the most desirable for recreational users and were assigned a use-weighting factor of 1.0 for the 7-month exposure period. The difficult-to-access and wadable categories, however, are too wet to access for part of the 7-month period, and are less attractive and more difficult to access during times when they are not flooded. Therefore, use-weighting factors for periods of flooding and attractiveness/accessibility were applied for these categories to account for these two characteristics.

The duration of flooding of the habitats included within the difficult-to-access and wadable use categories varies from year to year. Some years may be characterized by flooding during long periods of rainy spring weather and others by short-lived but frequent floods associated with rain events throughout the spring. In general, however, it was assumed based upon the hydrology of the site that habitats included in the difficult-to-access category were flooded or otherwise inaccessible for 1 of the 7 months, and habitats included in the wadable category were flooded or otherwise inaccessible for 2 of the 7 months. Therefore, the maximum “flooding” factor for the difficult-to-access category was 0.86 (6 months accessible/7-month exposure period) and for the wadable category was 0.71 (5 months accessible/7-month exposure period).

These factors were further reduced based on the assumption that most recreational users would find habitats included within the difficult-to-access and wadable categories less desirable to recreate in than the habitats in the walkable category even during times when they were not flooded, and would therefore spend proportionately less time in those habitats. An estimate of the amount of time spent in habitat in the walkable category, compared to difficult-to-access or wadable, was based on estimates of use by professional ecologists and by HRA residents who engage in upland hunting. Upland hunting is considered the activity most likely to lead to contact with soil in difficult-to-access or wadable areas, and thus the use in these areas would be lower for other recreational users. The ecologists estimated, and the upland hunters agreed, that they would frequent habitats in the walkable category at least four times more often than habitats in the difficult-to-access and wadable categories. Therefore an "accessibility" factor of 0.25 was applied to difficult-to-access areas and wadable areas. The result of the combined "flooding" and "accessibility" factors is the maximum use-weighting factor. Thus, the maximum use-weighting factor for difficult-to-access areas (0.86 x 0.25) is 0.22, and the maximum use-weighting factor for wadable areas (0.71 x 0.25) is 0.18. Rounded to 1 significant figure, the use-weighting factor is 0.2 for both categories.

The one exception to the use-weighting approach was for the waterfowl hunter. No decreased use-weighting factors were applied for this exposure scenario because of the waterfowl hunter's increased contact with wadable and difficult-to-access areas as part of typical hunting activities. Consequently, all use categories for the waterfowl hunter were given a factor of 1.0.

The exposure point concentration calculation is based on the assumption that a receptor contacts the soil randomly throughout the exposure area. This use-weighting approach was used as a practical alternative to modifying exposure frequency values for each accessibility category within each exposure area. The exposure frequency was kept constant within each exposure area, but the relative contribution to the EPC from wadable and difficult-to-access areas was reduced to simplify the overall analysis at the numerous EAs. This approach results in the same exposure as applying exposure frequency modifications at each accessibility category.

4.4.1.1.2 Calculation of 95% Upper Confidence Limit

For each exposure area or subarea, the 95% UCL of the mean was calculated for use in the exposure dose calculations. The computational method used depended upon the shape of the distribution and the number of samples collected in the exposure area or subarea. In all cases, if the 95% UCL concentration exceeded the maximum detected concentration, the maximum detected concentration was used as the EPC. The use of the conservative estimate of the mean is consistent with EPA guidance (EPA, 2002b, 1992b).

If the data appeared to be normally distributed, then the UCL was computed using the *t*-statistic (EPA, 2002b, 1992b; Gilbert, 1987; Student, 1908). If the data appeared to be lognormally distributed, the UCL was based on Land's method using the *H*-statistic (EPA, 2002b, 1992b; Gilbert, 1987; Land, 1971; Land, 1972; and Land, 1975). If the data were neither normal nor lognormal in distribution, a modified bootstrap procedure devised by Hall (EPA, 2002b; Zhou and Gao, 2000; Schulz and Griffin, 1999; Manly, 1997; Hall, 1988; and Hall, 1992) that takes some account of bias and skewness was used.

Although a parametric statistical method that depends on a distributional assumption is usually more efficient than a nonparametric one when it is appropriate, the assumption that the data fit a particular distribution shape may be empirically untenable. Although bootstrap procedures assume that samples are representative of the underlying distribution of concentrations, they require no assumptions about the shape of that distribution and are applicable to a variety of situations.

The use of spatial weighting introduced statistical complications that do not arise when conducting calculations based on original data. As explained in Section 4.4.1.1, to adjust for the non-randomness of the original placement of sample sites across the study area, spatial weighting was used to interpolate estimated concentration values at each point on a grid of 3-square-meter (3-m^2) cells across the site. A large number of data values were thereby interpolated from this grid, depending upon the size of the exposure area or subarea.

In the absence of spatial weighting, the statistical degrees of freedom are determined by the number of samples. However, spatial weighting results in an artificially high number of concentration points (interpolated data) in an exposure area, with the number determined by the grid size selected. Thus, the number of grid cells is not the appropriate basis for the statistical degrees of freedom needed in the calculation of UCLs. Instead, the number of samples originally collected from each exposure area or subarea was used to determine the degrees of freedom for use in the calculation of the UCL. However, the determination of distribution shape was made using the larger spatially weighted data set rather than the underlying data set. For example, in a hypothetical exposure area, 20 soil samples were spatially weighted and resulted in 1,000 interpolated data points. The shape of the distribution is determined from the 1,000 data points, as are the arithmetic mean and standard deviation used to calculate the UCL. However, the test statistic and degrees of freedom are based on the 20 actual data points.

ProUCL, a statistical software package developed by EPA through its Office of Research and Development, and which has undergone peer review by EPA and has been approved for use by EPA (EPA, 2004), was used to test for normality and lognormality. The interpolated grid data were evaluated using the Shapiro-Wilk test (alpha = 0.05) for sample sizes less than 50 interpolated data points and the Lilliefors test (alpha = 0.05) for samples sizes greater than or equal to 50 interpolated data points. The bootstrap calculation, using the method elaborated by Hall, was implemented using a software program developed for this site. The documentation and code for the program, along with coverage rates of the Hall's bootstrap method under certain assumptions about the underlying distribution of concentrations, are provided in Attachment 4 to the HHRA.

The equations for each of the UCL calculation methods are presented below.

Normal Distribution

$$UCL = \overline{X} + t\,(s/\sqrt{n})$$

Where:

UCL	=	95% upper confidence limit of the arithmetic mean,
$\overline{X}$	=	the arithmetic mean of the interpolated data, $\overline{X} = \frac{1}{m}\sum_{i=1}^{m} X_i$,
s	=	the standard deviation of the interpolated data, $s = \sqrt{\frac{1}{m}\sum_{i=1}^{m}\left(X_i - \overline{X}\right)^2}$,
t	=	the 95th percentile of Student's t distribution with n–1 degrees of freedom,
n	=	the original number of samples, and
m	=	the number of interpolated values from the spatially weighted grid.

In principle, the Student formulation is correct when the sample size is small, as long as the concentrations are normally distributed. The method is robust to non-normality if sample size is sufficiently large. But for moderate or small *n*, this method of computing the UCL can be incorrect if the underlying data are not normally distributed. Therefore, it is important to test the data for normality.

Lognormal Distribution

$$UCL = \exp\left(\overline{\ln X} + s_{\ln}^2 / 2 + H s_{\ln} / \sqrt{n-1}\right)$$

Where:

UCL	=	95% upper confidence limit of the arithmetic mean,
$\overline{\ln X}$	=	the mean of the log-transformed interpolated data, $\overline{\ln X} = \frac{1}{m}\sum_{i=1}^{m} \ln(X_i)$,
$s_{\ln}$	=	the associated standard deviation, $s_{\ln} = \sqrt{\frac{1}{m-1}\sum_{i=1}^{m}\left(\ln(X_i) - \overline{\ln X}\right)^2}$,
H	=	H-statistic associated with $s_{\ln}$ and n (Land, 1975; Gilbert, 1987, Table A12),
n	=	the original sample size for contaminant in the designated media set, and
m	=	the number of interpolated values from the spatially weighted grid.

The Land formulation is known to be sensitive to deviations from lognormality. The formula may commonly yield estimated UCLs substantially larger than necessary when distributions are not truly lognormal if variance or skewness is large (Gilbert, 1987). Because the Land method is so sensitive to violations of the assumption of lognormality, it is important to test this assumption.

Hall's Bootstrap

$$UCL = \overline{X} + W s$$

Where:

UCL	=	95% upper confidence limit of the arithmetic mean,
$\overline{X}$	=	the arithmetic mean of the interpolated data, $\overline{X} = \frac{1}{m}\sum_{i=1}^{m} X_i$,
s	=	the standard deviation of the interpolated data, $s = \sqrt{\frac{1}{m}\sum_{i=1}^{m}\left(X_i - \overline{X}\right)^2}$,
W	=	Hall's modifier, $W = \frac{3}{k}\left(\left(1 + k\left(Q_{0.05} - \frac{k}{6n}\right)\right)^{1/3} - 1\right)$,

k = the sample skewness, $k = \frac{1}{ms^3}\sum_{i=1}^{m}\left(X_i - \overline{X}\right)^3$,

n = the original sample size for contaminant in the designated media set,

m = the number of interpolated values from the spatially weighted grid, and

$Q_{0.05}$ = the 5th percentile of the distribution of values $Q = w + \frac{kw^2}{3} + \frac{k^2w^3}{27} + \frac{k}{6n}$.

The Q values were computed for bootstrap samples of size n from the interpolated data where $w = (\overline{X}_b - \overline{X})/s_b$, and $\overline{X}_b$ is the arithmetic mean of the bootstrap sample and s_b is the associated standard deviation.

Table 4-2 presents the EAs and subareas in Reaches 5 and 6, along with the data distribution, the method used to calculate the 95% UCL, and the value used as the EPC (i.e., the maximum detected concentration or the UCL) for each area.

4.4.2 Reach 7 Soil

Spatial weighting was not used to calculate EPCs in Reach 7. Habitats and other features were not delineated in Reach 7 with the resolution that is available for Reaches 5 and 6. Thus, the approach using IDW could not be applied. Instead, the 95% UCLs were calculated using the soil data in each EA or subarea, with no spatial weighting or area use factors, which is the typical approach used in risk assessments.

The statistical procedure used to calculate the 95% UCLs was the same as described in Reaches 5 and 6. Specifically, normality was tested using the ProUCL software (EPA, 2004) and the UCLs were calculated based on the appropriate distribution. The equations used to calculate UCLs are presented in Section 4.4.1.1.2.

Table 4-3 presents the EAs and subareas in Reaches 7 and 8, along with the data distribution, the method used to calculate the 95% UCL, and the value used as the EPC (i.e., the maximum detected concentration or the UCL) for each area.

4.4.3 Sediment

Sediment was evaluated in three large area groupings in Reaches 5 and 6, and five impoundment areas in Reaches 7 and 8. These groupings were selected for two reasons: (1) activities involving sediment contact, such as canoeing, take place over large stretches of river, and (2) there has been documented movement of sediment during high-flow periods. Thus, the exposure areas were selected based on river conditions and likely activities. The sediment data were not weighted in any way within these areas. Data collected from locations up to 20 feet (6 meters) from the water's edge in impoundments were used in the calculation of the 95% UCLs. This approach was based on the assumption that receptors were not likely to come into contact with sediment beyond this distance from shoreline, because in most cases, the water would be too deep for direct contact to occur. However, at free-flowing areas of the river, all sediment data were used in the development of the EPCs, given the low flow conditions that occur during the summer months, and the movement of sediment during periods of high flow.

Table 4-4 presents the sediment EAs, along with the data distribution, the method used to calculate the 95% UCL, and the value used as the EPC (i.e., the maximum detected concentration or the UCL) for each area. Figure 5-1C presents the locations of the sediment exposure areas.

4.5 IDENTIFICATION OF EXPOSURE MODELS AND PARAMETERS

The exposure dose was represented as the daily intake of a contaminant an individual receives through each exposure pathway (e.g., soil ingestion, dermal contact). Doses were calculated based on two different averaging times:

- Average daily doses (ADDs), in which the doses were averaged over the assumed exposure duration, were used to evaluate noncancer health effects.

- Lifetime average daily doses (LADDs), in which the doses were averaged over a 70-year lifetime, were used to evaluate potential cancer risks.

The exposure doses are expressed as either administered (oral) or absorbed (dermal) doses in milligrams of contaminant per kilogram of body weight per day (mg/kg-day). The general equation for calculating a contaminant dose by any exposure pathway is shown in Table 4-5.

The ADD or LADD for each contaminant and pathway was used in conjunction with the contaminant-specific CSF and RfD, respectively to calculate cancer risks and the potential for noncancer health effects.

The following exposure parameters were used to estimate the exposure doses:

- Body weight (BW)
- Averaging time (AT) – cancer and noncancer, respectively
- Exposure frequency (EF)
- Exposure duration (ED)
- Ingestion rate (IR)
- Fraction ingested (FI)
- Exposed skin surface area (SA)
- Skin adherence factor (AF)
- Dermal absorption factor (ABS_d)

The amount of exposure to soil or sediment is a function of the frequency and duration of exposure (i.e., days/year and total years), the amount ingested, and the amount absorbed through the skin. The latter is dependent upon the amount of skin exposed, the amount of soil or sediment that adheres to the skin, and the absorption properties of the contaminant. The approach used in the following sections was to identify the exposure parameters that applied to each exposure scenario. For example, the general recreation scenario is described in Section 4.5.3.2 along with each of the applicable exposure parameters.

A preliminary discussion of each of the exposure parameters is presented prior to the scenario-specific discussions. Exposure parameters were separated into two categories. The first category is the constant (or nearly constant) exposure parameters that are similar for all of the exposure scenarios. These exposure parameters are described in Section 4.5.1 and listed in Table 4-6. These exposure parameters are not repeated in each scenario-specific discussion. The second category of exposure parameters is the variable exposure parameters. In this case, variable simply means that they are usually different for each exposure scenario and require an explanation and justification in each case. These exposure parameters are described briefly in Section 4.5.2. More detailed discussions are provided in the scenario-specific descriptions.

4.5.1 Constant Exposure Parameters

The parameters with values that are constant are listed below:

- Body weight (BW)
- Averaging time (AT) – cancer and noncancer
- Fraction ingested (FI)
- Dermal absorption factor (ABS_d)

Table 4-6 summarizes the values used for the constant exposure parameters.

4.5.1.1 Body Weight

The average body weights (BWs) for the young child (1 through 6 years) and the adult were assumed to be 15 kg and 70 kg, respectively (EPA, 1989). For the older child (7 through 18 years), the BW was assumed to be 45 kg, which was calculated by obtaining the 50^{th} percentile BW values for male and female children aged 7 through 18 years from Tables 7-6 and 7-7 of EPA's *Exposure Factors Handbook* (EFH) (EPA, 1997a). These BW values were used in both the RME and CTE evaluations and are constant across all of the scenarios as noted in Table 4-6. This parameter will not be repeated in the subsequent scenario-specific discussions.

4.5.1.2 Averaging Time

Averaging times were developed for both cancer and noncancer evaluations. The carcinogenic averaging time (AT) was based on a 70-year lifetime for all age groups and equates to 25,550 days (70 years x 365 days/year) (EPA, 1989). The noncancer AT for each of the scenarios was based on the receptor- and scenario-specific ED (in years) multiplied by 365 days/year. The carcinogenic AT value is constant across all of the scenarios as noted in Table 4-6. The noncancer AT also is similar across all of the scenarios in that it is always the ED multiplied by 365 days/year. However, as discussed in Section 4.5.2.2, different EDs were developed for different exposure scenarios.

4.5.1.3 Fraction Ingested

Fraction ingested (FI) is a unitless term that represents the fraction of the soil or sediment ingested from the contaminated source. A FI of 1.0 was used in the RME evaluation for all of the scenarios to represent a high-end exposure in which all soil or sediment ingested was assumed to be from the contaminated area during the number of days specified in the exposure frequency. A factor of 1.0 was also used in the CTE evaluation for the residential scenario because it was assumed that an individual has a higher probability of ingesting soil from a single source when it is their primary place of residence. A factor of 0.5 was used in the CTE evaluation for all other scenarios. The factor of 0.5 for the angler CTE is based on data from Ebert et al. (1996) for anglers in the CT portion of the Housatonic River, and supported with information from the Maine Angler Survey (Ebert et al., 1993). This FI was assumed to be applicable to all scenarios other than residential.

Ebert et al. (1996) summarized information from a creel survey of Housatonic River anglers in Connecticut from the Massachusetts border to Stevenson Dam (downstream end of Lake Zoar) that was conducted from 1984 to 1986. With respect to a preference for fishing the Housatonic River, Ebert et al. (1996) reported a median value of 30% of total fishing trips were taken to the Housatonic. However, this value is too low an estimate of the CTE for two reasons. First, the presence of a fish advisory at the time of the survey likely decreased the number of trips and the preference for the Housatonic River (Connelly et al., 1992). Second, the underlying distribution of trip frequencies to the Housatonic River was not available, but most likely the average trip frequency is higher than the median frequency because distributions contributing to exposure are frequently skewed, and better represented as lognormal rather than normal distributions. The Maine Angler Survey indicates that approximately 80% of anglers fish from two or more water bodies. Assuming that anglers fish equally from each of two water bodies results in a FI of 0.5. The FI for RME of 1 and of CTE of 0.5 are constant across all of the scenarios as noted in Table 4-6.

4.5.1.4 Dermal Absorption Factor

The dermal absorption factor (ABS_d) is a unitless term that represents the fraction of contaminant that is assumed to penetrate the skin following dermal contact with contaminated soil. Dermal absorption of chemicals can be affected by many factors, including skin type and location, duration of exposure, frequency of exposure, whether the contaminant is in water or soil, temperature, degree of hydration of the skin, lipid content of the skin, solubility of the test substance in water, and solubility of the test substance in lipids (EPA, 2001). For the point estimate risk assessment, a single estimate of absorption was used for the dermal exposure. The probabilistic risk assessment (Section 6) addresses the variability and uncertainty associated with dermal absorption.

In the point estimate risk assessment, a dermal absorption factor of 14% was used for PCB-contaminated soil for all RME and CTE exposure scenarios. This value (EPA, 2001), is based on a study conducted by Wester et al. (1993) in which the dermal absorption of PCBs in adult rhesus monkeys was assessed. In this study, ^{14}C-labeled Aroclor 1242 and 1254 were separately administered to the monkeys either intravenously or by application, in various media, including soil, to shaved skin for 24 hours. Excretion (both urinary and fecal) was measured for 30 days after the initial dosing. The percentage of dose absorbed following dermal exposure was calculated as the ratio of the percent of dermal dose excreted and the percent of an intravenous dose excreted. It was assumed that 100% of the intravenous dose was absorbed. The soil in this study had an organic content of 0.9%.

GE recently conducted a study of the dermal absorption of PCBs in rhesus monkeys, *Percutaneous Absorption of ^{14}C-Aroclor 1260 from Freshly Spiked and Aged Soil in Rhesus Monkeys* (GE, 2001). This study was designed to address some of the uncertainties that were discussed in the EPA 1992 dermal risk assessment guidance (EPA, 1992c) regarding PCB exposures from soil, namely, the length of time since the PCBs were mixed with the soil, or aging factor, and the organic carbon content of the soil. It was also designed to follow the protocol used by Wester et al. (1993) that was used as a basis for the PCB fraction absorbed from soil discussed in EPA, 2001. Although this study used soil from the Housatonic River floodplain and the Aroclor mixture that most closely resembles the environmental mixture at this site, EPA has concerns with two aspects of the study protocols used. First, after application of the soil to the test monkeys, the animals were not restrained during the 24-hour exposure period and, thus, movement during the exposure period would disturb the soil contact on the skin. Second, the study did not control for monolayer conditions based on the soil particle size. The reported amount of soil applied to the skin would result in a fivefold excess of the monolayer. If the study results are corrected for this fivefold excess, the percent absorbed values from this study exceed EPA's current recommendation. Therefore, EPA believes that the value of 14% is appropriate to retain as the dermal absorption value for all PCBs.

A dermal absorption factor of 3% was used for dioxins/furans for all RME and CTE exposure scenarios. This value, currently recognized by EPA (2001) for soil with low organic content, is based on an analysis of three dermal absorption studies of TCDD in animals and in vitro systems (EPA, 1992c). The results of these studies were adjusted to reflect in vivo absorption from soil by humans, and ranged from 0.1 to 3% (EPA, 1992c).

4.5.2 Variable Exposure Parameters

For purposes of this discussion, the variable exposure parameters are those that typically vary among the scenarios and require a detailed scenario-specific discussion. They are as follows:

- Exposure frequency (EF)
- Exposure duration (ED)
- Ingestion rate (IR)
- Dermal contact parameters
  - Exposed skin surface area (SA)
  - Adherence factor (AF)

The following sections briefly describe these parameters along with the types of supporting documentation used in the exposure parameter selection process. Specific parameters are included in the scenario-specific discussions (Section 4.5.3).

4.5.2.1 Exposure Frequency

Exposure frequency (EF) represents the number of days per year that a receptor (e.g., adult) was estimated to engage in a particular activity that could result in exposure. It was assumed for all of the scenarios that direct contact exposure occurs during the 7 months (30 weeks) of the year when the ground is not typically snow covered or frozen. This generalization applied to all of the exposure scenarios except for the waterfowl hunter, for which the EF was limited to the hunting season.

A variety of sources were used as the basis for EF values, either directly or as the basis for formulating a professional judgment based on site-specific conditions. The specific source(s) depended upon the scenario and the exposure area being evaluated and included the following:

- EPA (1989, 1997a, 1997b, 1997c).
- ChemRisk (1994).
- Ebert et al. (1993).
- Ebert at al. (1996).
- United States Fish and Wildlife Service (USFWS, 2001).
- Massachusetts Executive Office of Environmental Affairs (EOEA) Statewide Comprehensive Outdoor Recreation Plan (SCORP) (EOEA, 2000).
- Massachusetts Department of Public Health (MDPH, 1997; 2001).
- Massachusetts Department of Environmental Protection (MDEP, 1995).
- Personal communications with local recreational leaders (WESTON, 2001).
- Housatonic River Floodplain User Survey Summary Report (TER, 2003).

4.5.2.2 Exposure Duration

Exposure duration (ED) is the estimate of the total time of exposure (in years) that a particular receptor (e.g., adult) engages in a particular activity that could result in exposure.

The young child was assumed to be exposed from ages 1 through 6 years. Accordingly, the young child exposure duration was assumed to be 6 years (EPA, 1991). This value applied to both the RME and CTE evaluations.

The older child was assumed to be exposed from ages 7 through 18 years for all scenarios except waterfowl hunters, where hunting regulations preclude children under age 12. The older child exposure duration was assumed to be 12 years for all but the waterfowl hunter scenario, which assumed an ED of 6 years. These values applied to both the RME and CTE evaluations. The adult ED varied according to the scenario evaluated. The scenario-specific adult EDs are presented in Section 4.5.3.

A variety of sources were used as the basis for ED values either directly or as the basis for formulating a professional judgment based on site-specific conditions. The specific source(s) depended upon the scenario and included the following:

- EPA (EPA, 1991, 1997a, 1997b, and 1997c).
- MDPH (MDPH, 2001, 1997).

4.5.2.3 Incidental Ingestion

Inadvertent or incidental soil and sediment ingestion is an important route of exposure to contaminants. Although data are limited, ingestion rates are generally higher for young children than for adults with the exception of contact-intensive activities such as dirt bike riders, farmers, and utility workers. Soil ingestion rates applicable to specific exposure scenarios are discussed in Section 4.5.3.

No guidance regarding sediment ingestion rates is available for either children or adults, nor have any studies been located that provide such information. In the absence of specific sediment ingestion information, the same ingestion rates were assumed for soil and sediment.

EPA's recommended soil ingestion rate for the RME scenario is 200 mg/day for children and 100 mg/day for older children and adults (EPA, 1991). Central tendency estimates of 100 mg/day and 50 mg/day were used for children and older children/adults, respectively, in the CTE scenario. Ingestion rates for older children and adults engaged in contact-intensive activities might be considerably higher (EPA, 1991, 1997a). Soil ingestion rates applicable to specific scenarios are provided in the detailed discussion of each exposure scenario.

Soil ingestion rate studies for children and adults were evaluated by EPA in the *Exposure Factors Handbook* (EPA, 1997a). Simon (1998) also reviewed soil ingestion data including studies related to radioactively contaminated soil. The studies that formed the basis for the ingestion rates employed a tracer or mass balance approach to determining soil ingestion rates. The basic principle of the tracer technique is to measure the amount of soil tracer element in fecal matter and back-calculate the amount of soil the subject needed to ingest to achieve that amount of tracer. Tracer concentrations in samples of soil in areas frequented by the individual subject are analyzed for this calculation. The best studies also collect duplicate samples of food, beverages, and medicine ingested by study subjects to correct for tracer contributions from those sources. The best tracers are those that are poorly absorbed in the gastrointestinal tract and have low concentrations in food compared to soil. Aluminum, silicon, and yttrium are considered the most reliable tracers, although rare earth elements such as cerium, lanthanum, and neodymium are seeing increasing use, especially if soil particle size is considered (Stanek and Calabrese, 2000; EPA, 1997). Titanium has also been frequently measured, but it shows the greatest variability and may have additional, unmeasured sources that contribute to the dose (Calabrese et al., 1996; Stanek and Calabrese, 2000). EPA (1997) does not include titanium in its calculations to estimate soil ingestion.

In the *Exposure Factors Handbook*, EPA (1997 lists an adult soil ingestion of 50 mg/day, primarily based on Calabrese et al. (1990). This study had a small sample number (i.e., six adults ranging from 25 to 41 years of age), was 3 weeks in duration, and was originally designed for other objectives. However, the tracer methodology was reliable and the study design allowed soil ingestion calculations. Calabrese et al. (1990) reported mean rates of soil ingestion over 3 weeks for its most reliable tracers that ranged from 5 mg/day (silicon) to 77 mg/day (aluminum). Median ingestion rates ranged from 1 mg/day (silicon) to 65 (yttrium). The study supports an annual mean soil ingestion rate for adults of 50 mg/day. However, the six individuals in this study were office and laboratory workers, and were not known to have substantial outdoor recreational exposures to soil during the study (Calabrese, 2002). Hawley (1985) suggested that adults engaged in outdoor activities ingest soil at a rate of 480 mg/day based on the extent of dirt on hands and activity patterns. Thus, the 50-mg/day ingestion rate may underpredict soil exposure from the outdoor recreational activities evaluated in this assessment.

EPA recommends higher adult soil ingestion rates for contact-intensive activities (Supplemental Soil Screening, EPA, 2002c). Stanek et al. (1997) conducted a tracer study on 10 adults over a 4-week period. The 95th percentile soil ingestion rate, 331 mg/day, is recommended for contact-intensive activities such as construction work. The 90th percentile ingestion rate from the Stanek study, 200 mg/day, was used for the RME value in the ATV/dirt and mountain bike riding and farmer scenarios. The 95th percentile ingestion rate, 330 mg/day, was used for the RME value in the utility worker scenario, in which construction-type activities are assumed. The RME adult residential rate of 100 mg/day was selected as the central tendency estimate for contact-intensive activities.

For soil ingestion by children, the *Exposure Factors Handbook* (EPA, 1997) lists a mean value of 100 mg/day for children and an upper percentile of 400 mg/day, and notes that 200 mg/day may be used as a conservative estimate of the mean. The RME soil ingestion value for a resident child of 200 mg/day is also suggested in other guidance (EPA, 1991).

The values listed in the EPA guidance are based on tracer studies of young children (ages 1 to 5) conducted in several locations (Amherst, MA; southeastern Washington; East Helena, MT; and The Netherlands). Study duration ranged from a few days to a few weeks. For most of the studies, the children were engaged in normal play activities at home or at their daycare center. However, one study by Van Wijnen et al. (1990) measured soil ingestion rates in children attending daycare, at campgrounds, and in hospitals. The authors detected nearly twice the rate of soil ingestion for children at the campgrounds compared to daycare centers after correcting the ingestion rate for background using the hospitalized children (assumed not to be exposed to soil). The corrected ingestion rate for the children at the campground was 120 mg/day.

Based on these studies and the evaluations documented in the EPA guidance, soil ingestion rates were selected for different exposure scenarios based on age and intensity of soil exposure associated with each activity. For most exposure scenarios, lower soil ingestion rates were incorporated into the CTE than the RME exposure calculation. For a young child, soil ingestion rates of 200 and 100 mg/day were selected for RME and CTE children, respectively. For an older child, soil ingestion rates of 100 and 50 mg/day were selected for the RME and CTE receptor for most scenarios (general recreational, canoeing, angling). However, for the more intense soil exposures in the ATV/dirt and mountain bike scenarios, and the waterfowl hunter scenarios, soil ingestion rates of 200 and 100 mg/day were used for the RME and CTE respectively. Similar ingestion rates were used for adult exposures, with the exception of the utility worker for which more intense exposure was assumed (330 and 100 mg/day for the RME and CTE) and the marathon canoeist for which less intense exposure was assumed (50 mg/day for both the RME and CTE). The soil ingestion rates for each receptor in each exposure scenario are listed in Table 4-24.

4.5.2.4 Dermal Contact

Dermal contact with soil and sediment was evaluated following the approach suggested in EPA guidance (EPA, 2001). The factors that determine the potential for exposure to contaminants through dermal contact are the exposed skin surface area, the soil-to-skin adherence factor, and the dermal absorption of COPCs. Dermal absorption factors are discussed in Section 4.5.1.4. This section focuses on exposed skin surface area and dermal adherence factors. Because of the limited information available regarding dermal exposure to sediment, EPA suggests that the same approach taken for soil exposures be used for sediment (EPA, 2001).

4.5.2.4.1 Exposed Skin Surface Area

Exposed skin surface area (SA) represents the amount of skin exposed to contaminated media and is typically reported in square centimeters (cm^2). SA estimates used in the point estimate risk assessment represent 50^{th} percentile values to correlate with average body weights used for all scenarios and pathways (EPA, 1997a; 2001). This was done to prevent inconsistent parameter combinations because body weight and SA are dependent variables (EPA, 2001). Table 4-7 presents the 50^{th} percentile SA estimates by body part for the young child, older child, and adult. These values were used in the various exposure scenarios to estimate skin surface area for each of the receptors.

Dermal exposure to soil was assumed to occur during 7 months of the year when the ground was not frozen or snow-covered (EPA, 1999). The time-weighted approach incorporated into this assessment assumed that 5 months were warmer and more skin was exposed and that 2 months were cooler and less skin was exposed. The total surface area exposed during the warmer months was designated as SA_1. The total surface area exposed during the cooler months was designated as SA_2. This time-weighted approach to dermal exposure was applied to residential and recreational soil exposure scenarios, except the waterfowl hunter. For sediment exposure, only warm weather exposure was assumed because of the likelihood of the receptor becoming wet during exposure to sediment. For occupational exposures (farmer, groundskeeper, and utility worker), only one clothing scenario and thus a single SA was utilized.

The exposure scenario-specific discussions in Section 4.5.3 present in detail the SA value(s) used for each scenario and the reason for selection.

4.5.2.4.2 Soil-to-Skin Adherence Factors

The soil-to-skin adherence factor (AF), expressed as milligrams of soil per square centimeter of skin surface area (mg/cm^2), describes the amount of soil that adheres to the skin per surface area unit for specified body parts. Studies cited in EPA guidance (2001) show that: (1) soil properties influence adherence, (2) soil adherence varies considerable across different parts of the body, and (3) soil adherence varies with activity. Kissel et al. (1996, 1998) and Holmes et al. (1999) have conducted studies of soil adherence for a range of activities and age groups. These studies provide soil-to-skin adherence values for specific body parts and specific activities. EPA recommends selecting an activity that best represents the exposure scenario of concern and using the corresponding adherence values for body parts assumed to be exposed. To maintain consistency with a conservative, health-protective value (EPA, 1989), a high-end soil contact activity and corresponding central tendency AF are recommended.

AFs were obtained from EPA's dermal risk assessment guidance (EPA, 2001) for each age group according to specific body part and soil contact activity. Because soil contact activities evaluated in experimental studies are limited, EPA recommends "that an activity which best represents all soil, body parts, and activities be selected" (EPA, 2001). The AFs used for each scenario were selected from the soil contact activity in the guidance that provides a reasonable, but conservative representation of the scenario being evaluated.

The central tendency (i.e., geometric mean) AFs for high-end exposure activities were used as the basis for RME AF values. This approach was followed to compensate for the limited data set used to estimate the 95^{th} percentile AF values and still result in an RME value. The approach of using the central tendency AF of a conservative soil contact activity scenario is recommended because "the 50^{th} percentile is a more stable estimation of the true AF (i.e., it is not affected as significantly by outliers as the 95^{th} percentile)" (EPA, 2001). In cases where an activity lacked an adherence factor for a specific body part, an AF from a similar activity was used as a surrogate. Table 4-8 presents the soil contact activities used in the risk assessment and the corresponding body-part-specific AFs.

As discussed previously, a time-weighted approach was used to evaluate dermal exposure to soil for residential and most recreational scenarios. The activity and body-part-specific AF values were surface-area-weighted for total exposed skin SA during each of the two exposure periods (i.e., the warmer months and the cooler months). The surface area-weighted AF based on the body parts exposed during the warmer months was designated as AF_1. The surface area-weighted AF based on the body parts exposed during the cooler months was designated as AF_2. The following equation was used to estimate the surface area-weighted AFs:

$$\text{Weighted AF} = \frac{(AF_a)(SA_a) + (SA_b)(AF_b) + \ldots + (AF_i)(SA_i)}{SA_a + SA_b + \ldots + SA_i}$$

Where:

AF = Adherence factor of soil to skin (mg/cm^2-event),
AF_i = Body-part-specific adherence factor of soil to skin (mg/cm^2-event), and
SA_i = Skin surface area available for contact for body part "i" (cm^2).

Data on soil-to-skin adherence are collected by measuring the soil load on multiple body parts both before and after exposure. Soil is collected by washing the skin. Skin surface areas are calculated for each individual based on their height and weight. Soil adherence studies used in this assessment are discussed below.

Young child receptors were evaluated based on a study of children playing in wet soil with toys and implements for 20 minutes in a preconstructed 8 ft x 8 ft soil bed (a "staged" activity). Thirteen children aged 8 to 12 participated in this study. This activity is considered to represent high-end contact because the children were in direct contact with the soil for the full duration of the activity and they played in wet soil, which is known to have higher AFs than dry soil.

Adult residential, older child and adult general recreational, and groundskeeping activities were evaluated based on data collected on volunteers from a local community garden. The volunteers performed various activities including weeding, pruning, digging small irrigation trenches, picking fruit, and cleaning up. A total of 15 gardeners participated in this study (Holmes et al., 1999). The gardening scenario is considered to represent high-end contact because gardening is likely to be the most soil-intensive activity routinely conducted by residents. Similarly, general recreation includes activities such as hiking and bird watching, which are likely to be less soil intensive, as well as picnics and nature study, which are well represented by the activities performed during the experiment.

Dirt biking, mountain biking, and ATV activities were evaluated as heavy equipment operators. On two separate occasions, a group of four excavation workers, categorized as "heavy equipment operators" participated in a soil-to-skin adherence study in which they were primarily engaged in operating an earth scraper to prepare a field for construction. All four workers wore long pants and shoes. Some wore long-sleeve shirts, others short-sleeve; some wore hats; some wore gloves. Heavy equipment operator is considered an appropriate high-end scenario because dirt biking and ATVs generate dust that then adheres to skin. Child in wet soil was also considered, as both the bikers and the ATVs are known to cross the wetlands and get wet. The heavy equipment operator and child in wet soil result in nearly the same AF for the summer; the wet soil AF is substantially higher than the heavy equipment operator in the colder months. Because it is considered less likely that the biker/ATVer would get wet in the colder weather, the heavy equipment operator scenario was selected.

Canoers, anglers, and waterfowl hunters were evaluated based on data collected on reed gatherers. These data were also used for sediment exposure. Reed gatherers were exposed to soil in tidal flats for a 2-hour period. Of the four individuals who participated in this study, two wore short sleeves and knee-length pants (Kissel et al., 1996).

Farmers were evaluated based on data collected on 10 farmers who manually weeded or mechanically cultivated vegetable crops (Kissel et al., 1996).

Utility workers were evaluated based on data collected from two groups of utility workers who were cleaning and fixing mains, connecting water pipes, jack-hammering, and excavating trenches. A total of 11 workers participated in this study (Holmes et al., 1999).

The exposure scenario-specific discussions in Section 4.5.3 present in detail the AF value(s) used for each scenario and the reason for selection.

4.5.3 Scenario-Specific Exposure Parameters

The following sections present the scenario-specific exposure parameters used in the direct contact risk assessment. The previous sections presented general information on each of these parameters. As noted previously, only the variable parameters are discussed in detail in this section to reduce unnecessary repetition. Along with the selection of the parameter value, the rationale for the selected value is also presented.

4.5.3.1 Residential Scenario

This scenario includes both current and future residential exposure. The residential scenario for current land use evaluated contact with inundated wetlands and steep bank portions of residential property because other, more readily accessible residential property areas (defined as "actual or potential lawn" areas) were evaluated separately in the Phase 1 report (see Appendix A) as required in the Consent Decree. The future residential scenario includes properties that are not currently developed as residential properties but have the potential for future development, as discussed in Section 4.3.5.

Contact with soil resulting from residential exposure could occur to children (younger and older) and adults while playing, gardening, or engaging in other outdoor activities. Dose and risk estimates were calculated for two exposure groups: children (1 through 6 years) and others from age 7 to 45 years (see Section 4.5.3.1.2 for a discussion of the ED). When estimating lifetime carcinogenic risk, residential exposure was age-adjusted for a young child and adult because it was assumed that exposure occurs at the same location (EPA RAGS, 1989). This approach accounts for the difference in ingestion rates, exposed skin surface area, body weight, and exposure duration for young children (1 to 6 years old), and others (7 to 45 years old). When estimating noncancer hazards, exposure doses and HQs were calculated separately for each age group.

4.5.3.1.1 Exposure Frequency

Two variations of a residential scenario were evaluated. The first pertained to future potential residential locations; i.e., locations that are not currently used for residential purposes but could be at some point in the future. The second pertained to less accessible areas of current residential properties; i.e., inundated wetlands and steep slopes and banks. For the future potential residential scenario (equivalent to the current residential "actual/potential lawn" areas addressed separately by GE under the terms of the Consent Decree), an EF of 150 days/year was used for both the RME and CTE evaluations and is consistent with previous evaluations of residential properties (EPA, 1999, 1994). This value is equivalent to an exposure frequency of 5 days/week over a 30-week period, which is consistent with residential exposure frequencies recommended under the Massachusetts Contingency Plan (MDEP, 1995) and was, therefore, used as a site-specific value. The EFs used for the current and future residential scenarios associated with exposure to inundated wetlands or steep banks were lower because the locations are, by definition, less accessible. In these instances, an EF of 90 days per year (i.e., 3 days per week for 30 weeks) was used in the RME scenario and 30 days per year (i.e., 1 day per week for 30 weeks) was used in the CTE scenario.

4.5.3.1.2 Exposure Duration

As part of the Housatonic River Area PCB Exposure Assessment Study, MDPH (1997) asked participants "how long have you lived at your current address?" MDPH reported the summary statistics of the 1,882 respondents to this question as follows (rounded to the nearest whole number of years): mean = 15 yrs, 25^{th} percentile = 3 yrs, 50^{th} percentile (median) = 10 yrs, 75^{th} percentile = 22 yrs, 95^{th} percentile = 45 yrs, and maximum = 80 yrs (MDPH, 2001). Because these data represent the results of a large study of the population of concern, and because the survey question was directly relevant for the residential duration exposure parameter, the survey results were considered the most appropriate data on which to base exposure duration for residents within the study area.

The adult residential RME ED, which also included the older child, was 39 years and was derived by subtracting the young child ED (6 years) from the 95^{th} percentile number of years (45) a person lives at a single residence. Similarly, the adult residential CTE ED, which also included the older child, was 9 years and was derived by subtracting the young child ED (6 years) from the mean number of years (15) a person lives at a single residence in the study area. The site-specific exposure duration is longer than the EPA default value for residential ED of 30 years (6 as a child, 24 as an adult), which is based on a 90th percentile value (EPA, 1991).

4.5.3.1.3 Ingestion Rates

For the residential scenario, the EPA recommended soil ingestion rates of 200 mg/day and 100 mg/day (EPA, 1991, 1997a) were used for the young child in the RME and CTE cases, respectively. The soil ingestion rates for the adult resident were 100 mg/day and 50 mg/day (EPA, 1991, 1997a) in the RME and CTE cases, respectively.

4.5.3.1.4 Dermal Contact

During the warmer months the child resident was assumed to wear a short-sleeved shirt and shorts with no shoes (EPA, 2001). Thus, the hands, forearms, lower legs, feet, and head were exposed to soil. During the cooler months, it was assumed that the hands and face were exposed to soil. SA values for each body part are provided in Table 4-7. SA_1 (warmer months) was 2,800 cm^2 (rounded) and SA_2 (cooler months) was 684 cm^2. The SA values were applied to both the RME and CTE evaluations.

During the warmer months, the adult resident was assumed to wear a short-sleeved shirt, shorts, and shoes (EPA, 2001). Thus, the hands, forearms, lower legs, and head were exposed to soil. During the cooler months, it was assumed that the hands and face were exposed to soil. The total surface area for SA_1 (warmer months) was 5,700 cm^2 (rounded) and SA_2 (cooler months) was 1,306 cm^2. The SA values were applied to both the RME and CTE evaluations.

The soil-contact activity "children playing in wet soil" was selected as the high-end activity for the child resident. The 50th percentile weighted AFs for children playing in wet soil (Table 4-8) were selected as the central tendency estimate of a high-end soil contact activity (EPA, 2001). Based on the equation presented in Section 4.5.2.4.2, the surface area-weighted AFs for AF_1 (warmer months) and AF_2 (cooler months) are 0.2 mg/cm^2 and 0.35 mg/cm^2, respectively. The AF values were applied to both the RME and CTE evaluations.

The soil-contact activity "gardeners" was selected as the high-end activity for the adult resident (EPA, 2001). The 50th percentile AFs (Table 4-8) for the gardener was selected as the central tendency of the high-end soil-contact activity. Based on the equation in Section 4.5.2.4.2, the surface area-weighted AFs for AF_1 (warmer months) and AF_2 (cooler months) are 0.07 mg/cm^2 and 0.15 mg/cm^2, respectively. The AF values were applied to both the RME and CTE evaluations.

Tables 4-9 through 4-11 summarize the residential soil exposure parameters and present the equations used to estimate the exposure doses using the age-adjusted approach.

4.5.3.2 General Recreation Scenario

The general recreation exposure scenario consists of children (both the young and older groups) and adults who might come into contact with soil during general recreational activities such as walking, hiking, running, horseback riding, bird watching, upland hunting (not including waterfowl), wild crop gathering, camping, educational field trips, ball playing, and other activities in the floodplain (e.g., adolescent gatherings). Other activities such as canoe and/or boat launching, fishing from the riverbank, riding ATVs, dirt bikes, and mountain bikes, hunting for waterfowl, and wading in the water were evaluated separately. The receptor or receptors evaluated depended on the specific exposure area and the activity most likely associated with that area.

4.5.3.2.1 Exposure Frequency

The EFs for the general recreation exposure scenario were EA-specific and were based on a variety of information sources and considerations:

- Observations by EPA field personnel while conducting the site investigation beginning in 1998.
- Observations reported in the GE Housatonic River Floodplain User Survey (TER, 2003).
- Survey of wildlife-associated recreation conducted by the U.S. Fish and Wildlife Service (USFWS, 2001).
- Exposure area-specific characteristics such as the presence of access points (e.g., roads and trails) and terrain.

The Housatonic River Floodplain User Survey was conducted by Triangle Economic Research (TER, 2003) on behalf of GE to collect information on recreational activities and land use within the floodplain in Reaches 5 and 6. Data were collected from April 29, 2002 through October 31, 2002 using three methods:

- Roving car-based counts at access points and parking areas.
- Roving walking counts on utility easements and trails.
- Canoe-based counts.

The information from this survey contributed to the assessment of high, medium and low frequency of use for a particular exposure area. In addition, if young children were observed in an exposure area, young child receptors were included in the assessment of that area.

The U.S. Fish and Wildlife Service has conducted national surveys of fishing, hunting, and wildlife-associated recreation every 5 years since 1955. This survey of "American sportsmen" quantifies participation in wildlife-associated recreation to determine demand for wildlife-associated recreation. The 2001 Survey (USFWS, 2001) provides data for the Commonwealth of Massachusetts as a whole, including estimates of the number of Massachusetts residents (older than 16) who fish, hunt, and engage in nonconsumptive wildlife-associated activities such as observing, feeding, and photographing birds and other animals.

Wildlife watching is one of the activities included as part of the general recreation scenario. The average Massachusetts wildlife watcher participates in this activity 27 days per year at locations more than 1 mile from their home. Those who observe wild birds around their homes (within 1 mile of their residence) typically do so 130 days/year. Based on these survey statistics, a range of 15 to 90 days of exposure at a single, nonresidential location appears reasonable. However, there are large uncertainties associated with this range, and for any particular location, the exposure frequency could be higher or lower.

For older children and adults, three different sets of exposure frequencies were used for this scenario to represent areas considered high, medium, and low use.

For areas considered high use, an RME exposure frequency of 90 days/year and a CTE exposure frequency of 30 days/year were used. The RME value of 90 days/year represents exposure three days a week over the 30 weeks of the year when the ground is typically not frozen or snow-covered. The CTE value of 30 days/year represents exposure one day per week over the same time period. An EA was considered high use if general recreation activities were observed by EPA and/or GE personnel or consultants and one or more of the following criteria were met:

- Existing trails or easements are present on the EA or the potential exists for the development of trails in the future.
- EA is readily accessible from nearby homes, roads, railroad tracks, and other access points.
- EA is a well-known recreational area.
- Access to the EA is unimpeded (e.g., it is not isolated from access points).

For areas considered medium use, an RME exposure frequency of 60 days/year and a CTE exposure frequency of 30 days/year were used. The RME value of 60 days/year represents exposure two days a week over the 30 weeks of the year when the ground is typically not frozen or snow-covered. The CTE value of 30 days/year represents exposure one day a week over the same time period. An EA was considered medium use if general recreation activities were observed by EPA and/or GE personnel or consultants and one or more of the following criteria were met:

- A portion of the EA is accessible from nearby access points (e.g., trails and roads).
- Portions of the EA are more isolated because of limitations of access due to isolation by surrounding wetlands and dense vegetation.
- EA has limited area in the floodplain because of a steep slope.

For areas considered low use, exposure frequencies of 30 days/year and 15 days/year were used for the RME and CTE, respectively. The RME value of 30 days/year represents exposure one day a week over the 30 weeks of the year when the ground is typically not frozen or snow-covered. The CTE value of 15 days/year represents exposure one day every two weeks over the same time period. An EA was considered low use if a limited number of general recreational activities were observed and one or more of the following criteria were met:

- EA is remotely located from residences.
- EA has no readily accessible points of entry.

For young children, two different sets of exposure frequencies were used. At popular, high use recreational areas with well-defined trails such as nature areas and parks (e.g., Canoe Meadows), an RME exposure frequency of 90 days/year and a CTE exposure frequency of 30 days/year were used. In other general recreation exposure areas in which a young child was observed by EPA and/or GE personnel, an exposure frequency of 15 days/year was used in these areas for both the RME and CTE. For the remaining areas, it was assumed that young children visit these areas at a lower frequency than older children and adults.

4.5.3.2.2 Exposure Duration

As part of the Housatonic River Area PCB Exposure Assessment Study, MDPH (1997) asked participants "Can you estimate how long you have lived in the Housatonic River Area?" MDPH reported the summary statistics of the 1,882 respondents to this question as follows (rounded to the nearest whole number of years): mean = 31 yrs, 25^{th} percentile = 12 yrs, 50^{th} percentile (median) = 29 yrs, 75^{th} percentile = 48 yrs, 90^{th} percentile = 65 yrs, 95^{th} percentile = 73 yrs, and maximum = 95 yrs (MDPH, 2001). The duration of residency in the Housatonic River Area, rather than at a single residence, is considered the better representation of the duration a person is likely to use nearby attractive recreational areas such as those along the Housatonic River.

Because these data represent the results of a large study of the population of concern, and because the survey question was directly relevant for the recreational duration exposure parameter, the survey results were considered the most appropriate data on which to base exposure duration for recreational scenarios. The value for the ED for the RME is based on the 90^{th} percentile value (65 years) and the CTE value is based on the mean value (31 years). To adjust for the exposure during adulthood, the childhood exposure period (18 years) was subtracted from the 90^{th} percentile value (65 years) to yield an adult RME ED value of 47 years. Similarly, the mean value of 31 years living in the Housatonic River Area (HRA) was adjusted in the same way for the childhood exposure period. Therefore, the adult CTE ED was 13 years.

4.5.3.2.3 Ingestion Rates

General recreation includes a range of activities that vary in intensity of soil contact. Because of the potential for different activities to occur in the future, and the lack of data regarding soil ingestion during recreational activities, it was assumed that general recreation soil ingestion rates were similar to those in a residential setting. The EPA-recommended soil ingestion rates of 200 mg/day and 100 mg/day were used for the young child in the RME and CTE cases, respectively (EPA, 1991, 1997a). The older child and adult soil ingestion rates of 100 mg/day and 50 mg/day, based on Calabrese (1990) as described above, were used in the RME and CTE cases, respectively (EPA, 1991, 1997a).

4.5.3.2.4 Dermal Contact

It was assumed that the general recreation scenario is similar to the residential scenario with respect to dermal exposure. Thus, the exposed body parts and adherence factors assumed for the general recreation scenario were the recommended values in EPA's dermal risk assessment guidance (EPA, 2001) for the residential scenario. Data specific to dermal contact for older children are not available; therefore, the assumptions used for the adult body parts exposed and adherence factors were applied to the older child receptor.

During the warmer months the child engaged in recreational activities was assumed to wear a short-sleeved shirt and shorts with no shoes (EPA, 2001). Thus, the hands, forearms, lower legs, feet, and head were exposed to soil. During the cooler months, it was assumed that the hands and face were exposed to soil. SA values for these body parts are provided in Table 4-7. SA_1 (warmer months) for the young child in the general recreation scenario was 2,800 cm^2 (rounded) and SA_2 (cooler months) was 684 cm^2. The SA_1 value is consistent with the exposed SA for the child resident recommended by the EPA dermal risk assessment guidance (EPA, 2001). The SA values were applied to both the RME and CTE evaluations.

During the warmer months, the adult engaged in recreational activities was assumed to wear a short-sleeved shirt, shorts, and shoes (EPA, 2001). Thus, the hands, forearms, lower legs, and head were exposed to soil. During the cooler months, it was assumed that the hands and face were exposed to soil. As previously discussed, the older child and adult receptors were assumed to have the same body parts exposed. SA values for these body parts are provided in Table 4-7. SA_1 (warmer months) for the older child and adult receptors in the general recreation scenario was 4,400 cm^2 (rounded) and 5,700 cm^2 (rounded), respectively. The SA_2 (cooler months) was 1,125 cm^2 and 1,306 cm^2 for the older child and adult receptors, respectively. The adult SA_1 value is consistent with the exposed SA for the adult resident recommended by the EPA dermal risk assessment guidance (EPA, 2001). The SA values were applied to both the RME and CTE evaluations.

The soil-contact activity “children playing in wet soil” was selected as the high-end activity for a child engaged in recreational activity. The 50th percentile weighted AFs for children playing in wet soil (Table 4-8) were selected as the central tendency estimate of a high-end soil contact activity. Based on the equation in Section 4.5.2.4.2, the surface area-weighted AFs for AF_1 (warmer months) and AF_2 (cooler months) are 0.2 mg/cm^2 and 0.35 mg/cm^2, respectively. The AF values were applied to both the RME and CTE evaluations.

The soil-contact activity “gardeners” was selected to represent the high-end activity for an adult engaged in recreational activities (EPA, 2001). The 50th percentile weighted AFs for gardeners (Table 4-8) were selected as the central tendency estimate of a high-end soil-contact activity. As previously discussed, the older child and adult receptors were assumed to have the same adherence factors. Based on the equation in Section 4.5.2.4.2, the surface area-weighted AFs for AF_1 (warmer months) and AF_2 (cooler months) are 0.07 mg/cm^2 and 0.14 mg/cm^2 for the older child, respectively. The surface area-weighted AFs for AF_1 (warmer months) and AF_2 (cooler months) are 0.07 mg/cm^2 and 0.15 mg/cm^2 for the adult, respectively. The AF values were applied to both the RME and CTE evaluations.

Table 4-12 summarizes all of the general recreation soil exposure parameters and presents the equation used to estimate the exposure doses.

4.5.3.3 All Terrain Vehicle/Dirt and Mountain Bike Riding Scenario

The all-terrain vehicle (ATV)/dirt and mountain bike riding exposure scenario consists of older children who come into contact with soil while riding ATVs, dirt bikes, or mountain bikes on floodplain soil. Although it is likely that adults also ride ATVs and dirt/mountain bikes, it was assumed that the frequency would be less for an adult than for an older child while other exposure parameters, with the exception of body weight, would be similar for both the older child and adult. Thus, the adult exposure would be less than that of the older child and was not evaluated quantitatively.

4.5.3.3.1 Exposure Frequency

The older child was assumed to ride ATVs, dirt, and/or mountain bikes 90 days/year in the RME case and 30 days/year in the CTE case. The RME and CTE EFs equate to 3 days/week and 1 day/week for the 30-week period, respectively. The EFs for the ATV/dirt and mountain bike riders were based on professional judgment.

4.5.3.3.2 Exposure Duration

The older child was assumed to be exposed from ages 7 through 18; therefore, the ED was 12 years and applied to the RME and CTE cases. The older child is the only age class evaluated in this risk assessment.

4.5.3.3.3 Ingestion Rates

The soil ingestion rates for the older child ATV/dirt and mountain biker were 200 mg/day and 100 mg/day in the RME and CTE cases, respectively. Given the nature of these activities, where dust can be generated in dry weather and dirt splashed in wet weather, soil ingestion rates representative of contact-intensive activities are appropriate. As noted above, there are no soil ingestion data specific to adults engaged in recreational activities. Estimates of high-end ingestion rates for adults range from 100 mg/day for residential activity (EPA, 1997a) to 330 mg/day in a 28-day study of adults (Stanek et al., 1997). The 200-mg/day rate, which represents the 90th percentile in this 28-day study, was selected for the RME case. The ingestion rate for residential activity (100 mg/day) was selected for the CTE case.

4.5.3.3.4 Dermal Contact

It was assumed during the warmer months that the hands, forearms, lower legs, and face of the ATV/dirt and mountain bike rider were exposed to soil. During the cooler months, it was assumed that the hands and face were exposed to soil. SA values for these body parts are provided in Table 4-7. SA_1 (warmer months) was 3,522 cm^2 and SA_2 (cooler months) was 1,125 cm^2. The SA values were applied to both the RME and CTE evaluations.

The soil-contact activity "heavy equipment operators" was selected as the high-end activity for the ATV/dirt and mountain bike rider. The central tendency weighted AFs (Table 4-8) were used to estimate the surface area-weighted AF values. In the absence of an adherence factor for the lower legs for this activity, the adherence factor for the "construction worker" activity was used as a surrogate. Based on the equation in Section 4.5.2.4.2, the surface area-weighted AFs for AF_1 (warmer months) and AF_2 (cooler months) are 0.14 mg/cm^2 and 0.24 mg/cm^2, respectively. The AF values were applied to both the RME and CTE evaluations.

Table 4-13 summarizes the ATV/dirt and mountain bike riding exposure parameters and presents the equation used to estimate the exposure doses.

4.5.3.4 Marathon Canoeist Scenario

The marathon canoeist exposure scenario consists of adults who use the John Decker Canoe Launch as a launching area for training for competitive canoe races as described in Section 4.3.6.2.3. It was assumed that the marathon canoeists contacted soil while launching and removing their canoes from the river, and while stretching and/or snacking in the parking area. Because the marathon canoeists typically train for physically intensive competitive races, it is assumed that training is frequent during the season.

Marathon and recreational canoeist scenarios were evaluated separately because the marathon canoeists were assumed to have less soil contact for each exposure event than recreational canoeists, but the exposure events were assumed to be more frequent.

4.5.3.4.1 Exposure Frequency

The EFs for the marathon canoeist exposure scenario were based on site-specific information from a telephone interview with an outdoor leader and member of the Berkshire Paddlers, the group that includes the marathon canoe race participants. It was stated that the racers trained daily or semi-daily starting in the spring and continuing through the fall (WESTON, 2001). Based on this information, it was assumed that marathon canoeists contacted the soil at the John Decker Canoe Launch 150 days/year in the RME case and 90 days/year in the CTE case. The RME and CTE EFs equate to 5 days/week and 3 days/week for the 30-week period, respectively.

4.5.3.4.2 Exposure Duration

The EDs for the marathon canoeist exposure scenario were based on site-specific information from a telephone interview with an outdoor leader and member of the Berkshire Paddlers. It was stated that the club had been in existence for more than 20 years, and that the John Decker Canoe Launch was the location of formal races from the 1980s to the early 1990s (WESTON, 2001). Because marathon racing and training has been occurring for over 20 years and is continuing, and because some individuals are long-time members, the ED values for the marathon canoeist scenario were assumed to be 30 and 15 years for the RME and CTE cases, respectively. The CTE value was half of the RME value and was based on professional judgment.

4.5.3.4.3 Ingestion Rates

Because marathon canoeing is considered less contact-intensive compared to residential and general recreational activities, an average soil ingestion rate was used. For marathon canoeists, both the RME and CTE receptors were assumed to ingest 50 mg soil/day and 50 mg sediment/day. Marathon canoeists may have contact with soil while loading and unloading their canoes and eating or stretching in the parking area. In addition, soil may be tracked into the canoes and inadvertently ingested while eating or drinking while on the river. As noted in Section 4.5.2.3, an adult ingestion rate of 50 mg/day is a mean value based on residential (rather than soil-intensive recreational) activities, and may underpredict exposure in this scenario. EPA has consistently used 100 mg/day as the high-end soil ingestion value for an adult resident in past risk assessments. However, the 50 mg/day value is more likely a central tendency estimate for an outdoor recreational scenario such as canoeing.

4.5.3.4.4 Dermal Contact

It was assumed that during the warmer months the hands, forearms, lower legs, and feet of the marathon canoeist were exposed to soil. During the cooler months, it was assumed that the hands were exposed to soil. SA values for these body parts are provided in Table 4-7. SA_1 (warmer months) was 5,672 cm^2 and SA_2 (cooler months) was 904 cm^2. The SA values were applied to both the RME and CTE evaluations.

The soil-contact activity "reed gatherers" was selected to represent the high-end activity for the marathon canoeist. The central tendency weighted AFs (Table 4-8) were used to estimate the surface area-weighted AF values. Based on the equation in Section 4.5.2.4.2, the surface area-weighted AFs for AF_1 (warmer months) and AF_2 (cooler months) are 0.32 mg/cm^2 and 0.658 mg/cm^2, respectively. The AF values were applied to both the RME and CTE evaluations.

Table 4-14 summarizes the marathon canoeist exposure parameters and presents the equation used to estimate the exposure doses.

4.5.3.5 Recreational Canoeist/Boater Scenario

The recreational canoeist/boater exposure scenario consists of adults and older children who use certain areas along the river as launching points for recreational outings as described in Section 4.3.6.2.4. It was assumed that the recreational canoeist/boaters contacted soil while launching and removing their canoes from the river, or while conducting naturalist-type activities along the shore. The RMEs in this scenario are the guides (adults) or their assistants (older children) who lead canoe trips on the river.

4.5.3.5.1 Exposure Frequency

The EFs for the recreational canoeist/boater exposure scenario were based on site-specific information obtained during telephone interviews with leaders of several outdoor recreational organizations in the Pittsfield area (WESTON, 2001). In the RME case, it was assumed that the adult recreational canoeist/boater led two outings/week for 30 weeks of the year, resulting in an EF of 60 days/year. This EF was within the range described by several recreational canoeists, naturalists, and teachers contacted by the EPA project team (WESTON, 2001). In the CTE case, it was assumed that the adult recreational canoeist/boater leads one outing/week for 30 weeks of the year, resulting in an EF of 30 days/year.

These values are supported by data obtained during the Housatonic River Area PCB Exposure Assessment Study (MDPH, 1997). One survey question asked: "Have you ever participated in the following activities on or next to the Housatonic River? If yes, how often?" The activities asked for were canoeing, bird watching, and others. In regard to canoeing, 241 of the 1,882 persons surveyed responded that they had canoed the Housatonic River at least once. MDPH reports the following frequency distribution (times/year): mean = 18, 25^{th} percentile = 1, 50^{th} percentile (median) = 2, 75^{th} percentile = 7, 95^{th} percentile = 104, and maximum = 365 (MDPH, 2001). This is consistent with an exposure scenario that distinguishes between leaders of recreational and educational outings and occasional participants in canoe outings.

For the older child, the RME was assumed to have an EF of 30 days/year, one trip a week during the 30-week period. Similar to the adult scenario, it is assumed that the older child RME has a leadership role in an outdoors club, and helps lead trips on a regular basis. In the CTE case, the older child was assumed to have an EF of 15 days/year, one-half of the RME value. These values were based on professional judgment.

4.5.3.5.2 Exposure Duration

The EDs for the recreational canoeist/boater exposure scenario were based on site-specific information obtained during telephone interviews with leaders of several outdoor recreational organizations in the Pittsfield area. The ED in the RME evaluation for the adult recreational canoeist/boater scenario was 40 years and was based on an estimate of the upper bound of the number of years individuals may lead recreational canoe outings. The ED is higher than the number of years (25 years) described to WESTON personnel as the number of years leading recreational outings (WESTON, 2001), but lower than the ED for the RME angler and waterfowl hunter (38 years) scenarios, which was based on the 1,886-respondent survey conducted by MDPH (1997). In the CTE case, the ED was 20 years, which was half of the RME value, and was based on professional judgment.

The older child was assumed to be exposed from ages 7 through 18; therefore, the ED was 12 years and applied to the RME and CTE cases.

4.5.3.5.3 Ingestion Rates

Recreational boaters may contact and subsequently ingest soil while loading equipment and passengers, while taking canoes in and out of water, while eating or drinking during launch and removal, and while examining the flora and fauna of the area. These activities are moderately soil intensive, and appear to be similar to activities that may occur during typical residential activities. Thus, the same ingestion rates were utilized as for residential scenarios. Specifically, for the older child and adult recreational canoeist/boater scenario, the soil ingestion rates were 100 mg/day and 50 mg/day in the RME and CTE cases, respectively (EPA, 1991, 1997a). However, because the soil in the launch area may be wet, or the soil contacted with wet hands, the ingestion rate (from hand to mouth activities) may be higher than the rate that results from residential activities. This uncertainty has not been accounted for in the ingestion rate, and may result in an underestimate of the risk.

4.5.3.5.4 Dermal Contact

It was assumed during the warmer months that the hands, forearms, lower legs, feet, and face of the recreational canoeist/boater were exposed to soil. During the cooler months, it was assumed that the hands and face were exposed to soil. SA values for these body parts are provided in Table 4-7. SA_1 (warmer months) was 4,471 cm^2 and 6,074 cm^2 for the older child and adult, respectively. SA_2 (cooler months) was 1,125 cm^2 and 1,306 cm^2 for the older child and adult, respectively. The SA values were applied to both the RME and CTE evaluations.

The soil-contact activity “reed gatherers” was selected to represent high-end activity for the recreational canoeist/boater. The central tendency weighted AFs (Table 4-8) were used to estimate the surface area-weighted AF values. In the absence of an AF for the face for this activity, the AF (for the face) for the “gardeners” activity was used as a surrogate. Based on the equation in Section 4.5.2.4.2, the surface area-weighted AFs for AF_1 (warmer months) and AF_2 (cooler months) are 0.31 mg/cm^2 and 0.43 mg/cm^2 for the older child, respectively. The surface area-weighted AFs for AF_1 (warmer months) and AF_2 (cooler months) are 0.3 mg/cm^2 and 0.47 mg/cm^2 for the adult, respectively. The AF values were applied to both the RME and CTE evaluations.

Table 4-15 summarizes the recreational canoeist/boater exposure parameters and presents the equation used to estimate the exposure doses.

4.5.3.6 Angler Scenario

The angler scenario evaluated older children and adults who fish from along the riverbank. It was assumed that the angler comes into contact with soil, and that a 6-meter stretch of floodplain soil along the water's edge was the area most routinely contacted by anglers. The evaluation of the angler scenario was limited to the area from New Lenox Road to Woods Pond, and Reach 7, because this area has a higher quality fishery compared to the area between the confluence and New Lenox Road.

4.5.3.6.1 Exposure Frequency

The EFs for the angler scenario were based on data reported by ChemRisk (1994), the U.S. Fish and Wildlife Service (USFWS, 2001), and Ebert et al. (1996).

ChemRisk conducted a creel survey, under contract to GE, characterizing angler activity and consumption practices among anglers who fished the Massachusetts portion of the Housatonic River (ChemRisk, 1994). For the purposes of the survey, this section of the Housatonic River was divided into two study areas. The first extended from the Newell Street Bridge in Pittsfield to Woods Pond Dam (Location 1) in Lee, and the second from Woods Pond Dam to the Massachusetts/Connecticut border (Location 2). A total of 62 creel survey days were completed on the river, and a total of 85 anglers were interviewed. Anglers fished an average of 5 months per year. Eighty percent of the anglers in Location 1 and 67% of the anglers in Location 2 reported that they had fished those reaches of the river once a week or less. Therefore, an average of 25% of the anglers, from both locations combined, fished in those reaches of the river more than once a week (i.e., more often than approximately 22 days/year). Many of the anglers indicated they frequently fished the same locations.

It should be noted that a fish consumption advisory was in effect when this survey was conducted, which may have reduced the frequency that anglers fished the Housatonic River in favor of waterbodies where they could keep their catch (Connelly et al., 1992).

The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation has been conducted since 1955 to compile information on participation in angling, hunting, and wildlife-watching in the United States, as well as spending associated with these activities. The 2001 survey (USFWS, 2001). Indicated that, in the Commonwealth of Massachusetts, there was a total of 278,000 residents ages 16 and up that fished freshwater a total of 4.35 million days within Massachusetts, yielding an annual average of 16 days/angler for freshwater angling. The average EF for fishing ponds, lakes, and reservoirs was 15 days/year and the average EF for rivers or streams was 9 days/year.

The Maine Angler Survey (Ebert et al., 1993) provided information of frequency of fishing trips to lakes and ponds, and to rivers and streams based on 1-year recall. The mean number of trips taken to rivers and streams was 10.4 and the 95th percentile was 30 days/year. The angler survey data are summarized below. These data also form the basis for the exposure frequency distribution in the probabilistic exposure assessment (Section 6).

Percentile	Massachusetts Freshwater Fishing [a]	Maine Angling Freshwater Days [b]	Maine Angling River Days [b]
5th	1	3	1
50th	13	16	6
95th	84	70	30
Maximum	170	180	180
Mean	22	24	10

Notes:
[a] Source: USFWS, 2001 (National Survey of Fishing, Hunting and Wildlife Associated Recreation).
[b] Source: Ebert et al., 1993 (Maine Angler Survey).

For the point estimate, an RME EF of 30 days/year and a CTE EF of 10 days/year were used to calculate risk for the angler scenario. These values were based on the Maine Angler Survey (Ebert et al., 1993). As shown in Table 4-22, the Maine angler data are consistent with Massachusetts data provided in the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation—Massachusetts (USFWS, 2001) for all freshwater fishing. No river-specific data are available for Massachusetts. These results are also consistent with the Housatonic River-specific data collected in Connecticut, in which a median of 10 trips per year to the Housatonic River were reported (Ebert et al., 1996).

4.5.3.6.2 Exposure Duration

As part of the Housatonic River Area PCB Exposure Assessment Study, MDPH (1997) asked participants a series of questions related to consumption of freshwater fish that, together, allow the inference of how long people have fished the Housatonic River. The ED values were based on the responses to the question "Can you estimate the frequency and total number of years you have been eating these types of fish [referring to freshwater fish]?" MDPH reported the summary statistics of the 705 respondents to this question as follows (rounded to the nearest whole number of years): mean = 23 yrs, 25^{th} percentile = 10 yrs, 50^{th} percentile (median) = 20 yrs, 75^{th} percentile = 33 yrs, 90^{th} percentile = 50 yrs, 95^{th} percentile = 60 yrs, and maximum = 82 yrs (MDPH, 2001). Similar, although somewhat higher, durations were obtained when the statistics were computed based on the respondents who indicated they had ever consumed fish from rivers, or specifically the Housatonic River. However, the sample size decreased in the subpopulations, and thus the values from the entire freshwater fish consumption data set were considered the most robust and form the basis for the ED. The use of data regarding freshwater fish consumption for angler exposure duration is further strengthened by the result that for 75% of the freshwater fish, consumers either caught the fish themselves or ate fish caught by family or friends.

The 90^{th} percentile value of 50 years included the older child and adult years of exposure. To adjust for the exposure during adulthood, the older childhood exposure period (12 years) was subtracted from the 90^{th} percentile value to yield an adult RME ED value of 38 years. Similarly, the mean value of 23 was adjusted for the older child exposure period; therefore, the adult CTE ED was 11 years. For the older child, exposure was assumed to be from ages 7 through 18; therefore, the ED was 12 years and applied to the RME and CTE cases.

4.5.3.6.3 Ingestion Rates

It was assumed that soil ingestion rates for anglers, who may consume food and beverages or otherwise contact the soil while fishing, were similar to the general recreation soil ingestion rates. The older child and adult soil ingestion rates were 100 mg/day and 50 mg/day in the RME and CTE cases, respectively (EPA, 1991, 1997a).

4.5.3.6.4 Dermal Contact

It was assumed that during the warmer months the hands, forearms, lower legs, feet, and face of the angler were exposed to soil. During the cooler months, it was assumed that the hands and face were exposed to soil. SA values for each body part are provided in Table 4-7. The SA_1 (warmer months) values were 4,471 cm^2 and 6,074 cm^2 for the older child and adult, respectively. The SA_2 (cooler months) values were 1,125 cm^2 and 1,306 cm^2 for the older child and adult, respectively. The SA estimates were applied to both the RME and CTE evaluations.

The soil-contact activity “reed gatherers” was selected to represent high-end activity for the anglers. The 50^{th} percentile weighted AFs for “reed gatherers” (Table 4-8) was selected as the central tendency weighted AFs. In the absence of an adherence factor for the face for this activity, the adherence factor (for the face) for the “gardeners” activity was used as a surrogate. Based on the equation in Section 4.5.2.4.2, the surface area-weighted AFs for AF_1 (warmer months) and AF_2 (cooler months) are 0.31 mg/cm^2 and 0.43 mg/cm^2 for the older child, respectively. The surface area-weighted AFs for AF_1 (warmer months) and AF_2 (cooler months) are 0.3 mg/cm^2 and 0.47 mg/cm^2 for the adult, respectively. The AF values were applied to both the RME and CTE evaluations.

Table 4-16 summarizes the angler exposure parameters and presents the equations used to estimate the exposure doses.

4.5.3.7 Waterfowl Hunter Scenario

The waterfowl hunter scenario evaluated older children and adults who hunt ducks and other waterfowl. It was assumed that the waterfowl hunter comes in contact with soil, and that a 6-meter stretch of floodplain soil along the water’s edge and the areas near duck blinds were the areas most routinely contacted by waterfowl hunters. Contact with sediment during waterfowl hunting and other activities is evaluated separately (Section 4.5.3.8). It should be noted that no use-weighting factors were applied to areas for this scenario given waterfowl hunters’ contact with all accessibility classes (i.e., walkable, wadable, difficult-to-access, and boatable) at an area during typical hunting activities.

4.5.3.7.1 Exposure Frequency

Exposure frequencies for waterfowl hunters were based on data from the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (USFWS, 2001). This survey reported the mean number of days/year waterfowl hunting as 7 and the 95th percentile (and the maximum) as 14. The data for this distribution are summarized below and the data also form the basis for the exposure frequency distribution in the probabilistic exposure assessment (Section 6). An RME EF of 14 days/year and a CTE EF of 7 days/year were used to calculate risk for the waterfowl hunter scenario.

Percentile	Massachusetts Migratory Bird Hunting Days
5th	1
50th	5
95th	14
Maximum	14
Mean	7

Source: USFWS, 2001.

4.5.3.7.2 Exposure Duration

As described in the hunting regulations, Massachusetts allows a child ages 12 through 14 to hunt with adult supervision, and those over 15 years of age are permitted to hunt on their own with a license (MassWildlife, 2001). Thus, older child waterfowl hunting was assumed to occur from ages 12 through 18 years, with a resultant ED of 6 years. This ED was utilized in both the RME and the CTE exposure scenarios.

For adults, the ED was based on the site-specific data from the MDPH survey of the Housatonic River Area (MDPH, 1997; 2001) as discussed previously for the angler and the general recreation scenarios. In the absence of robust site-specific hunting-duration information, the angler ED was used as the waterfowl hunter RME ED. MDPH (2001) reported that the 90th percentile value for the number of years a person eats freshwater fish in the HRA was 50. The childhood years in which hunting is prohibited (12 years) were subtracted from the 90th

percentile value (50 years) to yield 38 years when hunting occurred. For the CTE, the mean value of 31 years living in the HRA was adjusted for the older child ED (6 years) to yield an adult ED of 25 years.

4.5.3.7.3 Ingestion Rates

For the waterfowl hunter scenario, the soil ingestion rate was 100 mg/day in the RME and CTE cases. This value is the residential adult ingestion rate (EPA, 1997a, 1991). Because of the high level of soil contact associated with waterfowl hunting, the 100-mg/day ingestion rate was considered a reasonable estimate.

4.5.3.7.4 Dermal Contact

Dermal exposure to the waterfowl hunter was assumed to occur only during the waterfowl hunting season (early September through December). A single set of clothing assumptions were made for this scenario, given the time of year and the nature of the activity. Therefore, only one SA and AF were derived for the hunter.

It was assumed that waterfowl hunters typically wear boots and waders, and only the hands and face of the waterfowl hunters are exposed to soil. SA values for these body parts are provided in Table 4-7. The surface area for the waterfowl hunter was 1,125 cm^2 and 1,306 cm^2 for the older child and adult, respectively. The SA values were applied to both the RME and CTE evaluations.

The soil-contact activity "reed gatherers" was selected to represent high-end activity for the waterfowl hunter's hands. In the absence of an AF for the face in the "reed gatherers" activity, the AF value (for the face) for the soil contact activity "gardeners" was selected to evaluate the waterfowl hunter's face. The 50^{th} percentile weighted AFs for these activities were selected as the central tendency weighted AFs (Table 4-8). Based on the equation in Section 4.5.2.4.2, the surface area-weighted AFs are 0.43 mg/cm^2 and 0.47 mg/cm^2 for the older child and adult, respectively. The AF values were applied to both the RME and CTE evaluations.

Table 4-17 summarizes the waterfowl hunter exposure parameters and presents the equation used to estimate the exposure doses.

4.5.3.8 Sediment Exposure Scenario

The sediment exposure scenario was developed to evaluate sediment exposure from a variety of activities that could result in contact with sediment such as wading, swimming, fishing, waterfowl hunting, canoeing, and other related activities. Older children and adults were the receptors included in this scenario, based on the assumption that older children and adults were likely to visit these areas and partake in these activities much more often than younger children.

4.5.3.8.1 Exposure Frequency

In contrast to the other scenarios, for which direct contact exposure was assumed to occur during 7 months of the year, the period of the year when significant exposure to sediment was assumed to occur was limited to the 3 summer months (12 weeks) in all cases except for the waterfowl hunter. The summer months, with warmer air and water temperatures, represent the most likely period when individuals would contact sediment. In the absence of site-specific information, professional judgment was used to develop the sediment-exposure scenarios EFs. An EF of 36 days/year was used for the sediment exposure scenario in the RME case, which equates to exposure 3 days/week for 12 weeks/year. An EF of 12 days/year was used for the sediment exposure scenario in the CTE case, which equates to exposure 1 day/week for 12 weeks/year.

For the waterfowl hunter, the same exposure frequency was used. However, for this exposure scenario a portion of the total exposure (approximately 4 months) was assumed to occur during the hunting season with the remaining exposure taking place during the 3 summer months in the form of different activities that would result in contact with sediment.

4.5.3.8.2 Exposure Duration

MDPH reported that the mean number of years a person lives in the HRA was 31, and the 95th percentile value was 73 years (MDPH, 2001). Because this was site-specific information and there was no available guidance on recreational exposure duration, it was used to estimate ED for individuals who recreate in the study area. However, since the average lifetime was assumed to be 70 years, which is the number of years on which the EPA-developed CSFs are based, the 95th percentile was reduced to 70 to maintain consistency with EPA’s 70-year lifetime assumptions.

To further adjust for the exposure during adulthood, the childhood exposure period (18 years) was subtracted from the assumed average lifetime value (70 years) to yield an adult RME ED value of 52 years. The mean value of 31 years living in the HRA was adjusted for the older childhood exposure period (7 through 18 years). Therefore, the adult CTE ED was 19 years. The older child was assumed to be exposed from ages 7 through 18; therefore, the ED was 12 years for both the RME and CTE cases.

4.5.3.8.3 Ingestion Rates

No EPA guidance regarding sediment ingestion rates is available for either children or adults, nor have any studies been located that provide such information. In the absence of specific sediment ingestion information, the same ingestion rates were assumed for soil and sediment.

Sediment exposure includes a range of activities that vary in intensity of sediment contact. It was assumed that the sediment ingestion rates were similar to those in the general recreational setting. The older child and adult soil ingestion rates were 100 mg/day and 50 mg/day in the RME and CTE cases, respectively (EPA, 1991, 1997a).

4.5.3.8.4 Dermal Contact

Dermal exposure to sediment was assumed to occur during the 3 summer months (June through August). For the older children and adults, it was assumed that the hands, forearms, lower legs, feet, and face were exposed to sediment. SA values for these body parts are provided in Table 4-7. The SA values were 4,471 cm^2 and 6,074 cm^2 for the older child and adult, respectively. The SA values were applied to both the RME and CTE evaluations.

The soil-contact activity "reed gatherers" was selected to represent high-end activity for the older child and adult. The 50^{th} percentile weighted AFs for "reed gatherers" (Table 4-8) were selected as the central tendency weighted AFs. In the absence of an adherence factor for the face for this activity, the adherence factor (for the face) for the "gardeners" activity was used as a surrogate. Based on the equation in Section 4.5.2.4.2, the surface area-weighted AFs are 0.31 mg/cm^2 and 0.3 mg/cm^2 for the older child and adult, respectively. The AF values were applied to both the RME and CTE evaluations.

Table 4-18 summarizes the sediment exposure parameters and presents the equation used to estimate the exposure doses.

4.5.3.9 Agricultural Scenario

The agricultural exposure scenario consisted of adults who might contact floodplain soil during typical farming activities such as planting and harvesting. It was applied to locations that are currently used for agricultural purposes. Consumption of locally grown crops and dairy products were evaluated separately in the Agricultural Product Consumption Risk Assessment (see Appendix D).

4.5.3.9.1 Exposure Frequency

The RME exposure frequency for the farmer scenario was assumed to be 40 days/year. It was assumed that vegetables are hand-cultivated each day during the approximate 200-day growing season (Noble, personal communication, 2003) and that, based on the percent of farms in Reach 5 that are within the 10-year floodplain, this activity occurs in the floodplain 20% of the time (40 days/year).

The CTE exposure frequency for the farmer scenario was 10 days/year. For this scenario, it was assumed that a farmer grows corn or hay and spends 5 days/year planting and 5 days/year harvesting.

4.5.3.9.2 Exposure Duration

The exposure duration (ED) for the agricultural scenario was based on the assumption that the older child would be exposed in the same way as the adult; therefore, the ED combined both older child and adult exposure. As previously discussed, MDPH provided data on the number of years living in the Housatonic River Area; the mean value was 31 years and the 95th percentile value was 73 years (MDPH, 2001). Because the 95th percentile exceeded EPA's default lifetime exposure of 70 years, for the purposes of averaging lifetime dose for the cancer risk assessment, the value was reduced to 70 years. Based on this site-specific information, the agricultural scenario RME ED was 64 years. This value was derived by subtracting the number of young childhood years (6) from the 70-year lifetime. The CTE ED was 29 years and was based on professional judgment. This value was derived by assuming exposure occurs for half of a 70-year lifetime (35 years). The number of young childhood years (6) was subtracted from 35 years to result in a CTE ED of 29 years.

4.5.3.9.3 Ingestion Rates

The soil ingestion rate for the adult farmer was 200 mg/day and 100 mg/day in the RME and CTE cases, respectively. These rates apply to the planting and harvesting activities in which heavy equipment is used and fugitive dust generated. Thus, soil ingestion rates representative of contact-intensive activities are appropriate. Estimates of high-end ingestion rates for adults range from 100 mg/day for residential activity (EPA, 1997a) to 330 mg/day in a 28-day study of adults (Stanek et al., 1997). The 200-mg/day rate, which represents the 90th percentile, was selected in the RME case. The ingestion rate for residential activity (100 mg/day) was selected in the CTE case.

4.5.3.9.4 Dermal Contact

No specific information regarding the exposed body parts for the farmer is presented in EPA dermal risk assessment guidance (EPA, 2001). It was assumed, however, that the exposed body parts for the farmer would closely resemble that of the commercial/industrial worker (EPA, 2001). The farmer was assumed to wear a short-sleeved shirt, long pants, and shoes. Thus, the hands, forearms, and head were exposed to soil. The dermal exposure for the farmer was not time-weighted for the warmer and cooler months because of the time the farmer was assumed to be in the floodplain (i.e., 5 days in the early spring while planting and 5 days in the late summer/fall for harvesting). SA values for these body parts are provided in Table 4-7. The SA for the farmer was 3,300 cm^2 (rounded) and was applied to both the RME and CTE evaluations.

The soil-contact activity "farmers" was selected to represent high-end activity for the farmer. The 50th percentile weighted AFs for "farmer" activity (Table 4-8) were selected as the central tendency weighted AFs. Based on the equation in Section 4.5.2.4.2, the surface area-weighted AF is 0.21 mg/cm^2. The AF values were applied to both the RME and CTE evaluations.

Table 4-19 summarizes the farmer exposure parameters and presents the equation used to estimate the exposure doses.

4.5.3.10 Groundskeeper Scenario

The groundskeeper exposure scenario consisted of adults who might contact soil during typical groundskeeping activities, such as mowing lawns and gardening. It was applied to commercial and industrial properties.

4.5.3.10.1 Exposure Frequency

The EFs for the commercial groundskeeper exposure scenario were area-specific and were based on professional judgment. Exposure frequencies for this scenario ranged from 15 to 150 days/year depending on the exposure area and the type of evaluation (i.e., RME or CTE). For example, a golf course groundskeeper would have a greater EF than a typical groundskeeper who might mow a lawn area one time per week or less.

4.5.3.10.2 Exposure Duration

For the groundskeeper scenario, the ED for the RME evaluation was 25 years. This value represented the upper-bound level for individuals working at the same location (EPA, 1991). The ED for the CTE case was 12 years, roughly half (rounded) of the RME value. This value was based on professional judgment.

4.5.3.10.3 Ingestion Rates

For the commercial groundskeeper scenario, the soil ingestion rates were 100 mg/day and 50 mg/day for the RME and CTE cases (EPA, 1991, 1997a), respectively. The groundskeeper's activity was assumed to be primarily lawn maintenance and some gardening. Therefore, the EPA-recommended soil ingestion rates for adults were used.

4.5.3.10.4 Dermal Contact

The commercial/industrial receptor was assumed to wear a short-sleeved shirt, long pants, and shoes (EPA, 2001). Thus, the hands, forearms, and head were exposed to soil. Because it was assumed a commercial groundskeeper would have a lower degree of dermal contact than a utility worker, it was assumed that the soil exposure to the head would be limited to the face. Therefore, the hands, forearms, and face were assumed to be exposed to soil in the commercial groundskeeper scenario. The dermal exposure for the commercial/industrial receptors was not time-weighted for the warmer and cooler months. It was assumed that the commercial workers are required by employers to wear the same clothes as part of the normal work attire (i.e., no shorts). SA values for these body parts are provided in Table 4-7. The SA value for the commercial groundskeeper was 2,479 cm^2 and was applied to both the RME and CTE evaluations.

The soil-contact activity "gardeners" were selected to represent high-end activity for the commercial groundskeeper. The 50^{th} percentile weighted AFs for the "gardeners" activity (Table 4-8) were selected as the central tendency weighted AFs. Based on the equation in Section 4.5.2.4.2, the surface area-weighted AF is 0.1 mg/cm^2. The AF values were applied to both the RME and CTE evaluations.

Table 4-20 summarizes the groundskeeper exposure parameters and presents the equations used to estimate the exposure doses.

4.5.3.11 Utility Worker Scenario

The utility worker exposure scenario consisted of adults who might contact soil during activities such as typical easement maintenance and installation of new equipment (such as utility poles or piping) in the floodplain.

4.5.3.11.1 Exposure Frequency

The utility worker scenario assumed an EF of 5 days/year for both the RME and CTE cases (Geraghty and Miller, 1993). This value is higher than the default value of 1 day/year used as a default EF in MDEP (1995) guidance, which was based on discussions with the utility industry. The rationale for increasing the EF in this situation was that the utility worker exposure is evaluated only in easements maintained by the utilities, and thus may require more frequent inspection and maintenance than utilities on streets and roads.

4.5.3.11.2 Exposure Duration

For the utility worker scenario, the ED for the RME evaluation was 25 years. This value represented the upper-bound level for individuals working at the same location (EPA, 1991). The ED for the CTE case was 12 years, roughly half (rounded) of the RME value. This value was based on professional judgment.

4.5.3.11.3 Ingestion Rates

The soil ingestion rate for the utility worker was 330 mg/day and 100 mg/day for the RME and CTE cases, respectively. These rates apply to the activities such as utility equipment maintenance and installation. Given the nature of this activity, soil ingestion rates representative of contact-intensive activities are appropriate. Estimates of high-end ingestion rates for adults range from 100 mg/day for residential activity (EPA, 1997a) to 330 mg/day in a 28-day study of adults (Stanek et al., 1997). The 330-mg/day rate, which represents the 95th percentile, was selected in the RME case and is consistent with the ingestion rate used for construction workers in the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (EPA, 2002c). Although 330 mg/day is higher than the soil ingestion rate used in an earlier risk assessment related to this site (EPA, 1999), this value was selected because of the uncertainty associated with soil ingestion rates for high-contact activities and its consistency with recent EPA guidance (EPA, 2001). The ingestion rate for residential activity (100 mg/day) was selected in the CTE case.

4.5.3.11.4 Dermal Contact

The commercial/industrial receptor was assumed to wear a short-sleeved shirt, long pants, and shoes (EPA, 2001). Thus, the hands, forearms, and head were assumed to be exposed to soil. The dermal exposure for the commercial/industrial receptors was not time-weighted for the warmer and cooler months. It was assumed that the industrial workers are required by employers to wear the same clothes as part of the normal work attire (i.e., no shorts). SA values for these body parts are provided in Table 4-7. The SA value for the industrial worker was 3,300 cm^2 (rounded). The SA value was applied to both the RME and CTE evaluations.

The soil-contact activity "utility workers" was selected to represent high-end activity for the industrial worker receptor. The 50^{th} percentile weighted AFs for the "utility worker" activity (Table 4-8) was selected as the central tendency weighted AFs. Based on the equation in Section 4.5.2.4.2, the surface area-weighted AF is 0.2 mg/cm^2. The AF values were applied to both the RME and CTE evaluations.

Table 4-21 summarizes the utility worker exposure parameters and presents the equation used to estimate the exposure doses.

4.5.3.12 Exposure Parameter Summary

Tables 4-22 through 4-26 summarize the parameters for each of the following variable exposure scenarios:

- Exposure frequency—Table 4-22.
- Exposure duration—Table 4-23.
- Soil/sediment ingestion rates—Table 4-24.
- Dermal contact factors—Tables 4-25 and 4-26.

4.6 EXPOSURE AREA SUMMARY

A total of 90 EAs were included in the evaluation of soil exposure in this risk assessment. In Reaches 5 and 6, 66 EAs were evaluated and, in Reach 7, 24 EAs were evaluated. Each EA had at least a single risk assessment completed based on the scenario and receptor that would result in the greatest risk. Additionally, a number of EAs had multiple risk assessments completed because of subareas with different potential exposures within EA. Section 5 (Risk Characterization) presents the results of soil EA-area-specific risk assessments.

A total of eight EAs were included in the evaluation of sediment exposure in this risk assessment. In Reaches 5 and 6, 3 EAs were evaluated and, in Reach 7, five EAs were evaluated. Section 5 (Risk Characterization) presents the results of sediment EA-specific risk assessments.

4.7 REFERENCES

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SECTION 4

TABLES

Table 4-1

Summary of the Exposure Scenarios Evaluated in the Direct Contact Risk Assessment

	Media		Receptors		
Exposure Scenarios	Soil	Sediment	Young Child (1 through 6 years)	Older Child (7 through 18 years)	Adult
Residential*	√		√	√	√
Recreational					
General recreation exposure	√		√	√	√
ATV/Dirt and mountain bike riding	√			√	
Marathon canoeist	√				√
Recreational canoeist/boater	√			√	√
Angler	√			√	√
Waterfowl hunter	√			√	√
Sediment exposure		√		√	√
Farmer	√				√
Commercial/Industrial					
Groundskeeper	√				√
Utility worker	√				√

*The residential exposure scenario includes receptors ages 1 through 45 years (MDPH, 2001).

Table 4-2

Summary of the Data Distributions and Methods Used to Calculate UCLs for Each Soil Exposure Area and Subarea[a], Reaches 5 and 6

Exposure Area/Subarea	Data Distribution	95% UCL Calculation Method	Value Used as EPC
1	undetermined	Hall's bootstrap	UCL
2	undetermined	Hall's bootstrap	UCL
2A	undetermined	Hall's bootstrap	UCL
2B	undetermined	Hall's bootstrap	UCL
3	undetermined	Hall's bootstrap	UCL
4	undetermined	Hall's bootstrap	UCL
5	undetermined	Hall's bootstrap	UCL
6	undetermined	Hall's bootstrap	UCL
7	undetermined	Hall's bootstrap	UCL
8	undetermined	Hall's bootstrap	UCL
9	normal	t-statistic	UCL
10	undetermined	Hall's bootstrap	UCL
10A	undetermined	NC	maximum
11	undetermined	Hall's bootstrap	UCL
12	undetermined	Hall's bootstrap	UCL
13	undetermined	Hall's bootstrap	UCL
14	undetermined	Hall's bootstrap	UCL
15	undetermined	NC	maximum
16	undetermined	Hall's bootstrap	UCL
17	undetermined	Hall's bootstrap	UCL
18	undetermined	Hall's bootstrap	UCL
19	undetermined	Hall's bootstrap	UCL
20	undetermined	Hall's bootstrap	UCL
21	undetermined	Hall's bootstrap	UCL
21-22	undetermined	Hall's bootstrap	UCL
22	undetermined	Hall's bootstrap	UCL
22A	undetermined	Hall's bootstrap	UCL
23	undetermined	Hall's bootstrap	UCL
24	undetermined	Hall's bootstrap	UCL
25	undetermined	Hall's bootstrap	UCL
26	undetermined	Hall's bootstrap	UCL
26A	undetermined	Hall's bootstrap	UCL
26B	undetermined	Hall's bootstrap	UCL
27	undetermined	Hall's bootstrap	UCL
27A	undetermined	NC	maximum
28	undetermined	Hall's bootstrap	UCL

Table 4-2

Summary of the Data Distributions and Methods Used to Calculate UCLs for Each Soil Exposure Area and Subarea[a], Reaches 5 and 6

Exposure Area/Subarea	Data Distribution	95% UCL Calculation Method	Value Used as EPC
28A	lognormal	H-statistic	UCL
29	undetermined	Hall's bootstrap	UCL
30	undetermined	Hall's bootstrap	maximum
31	undetermined	Hall's bootstrap	UCL
31A	undetermined	NC	maximum
32	undetermined	Hall's bootstrap	UCL
33	undetermined	Hall's bootstrap	UCL
34	undetermined	Hall's bootstrap	UCL
35	undetermined	Hall's bootstrap	UCL
35A	undetermined	Hall's bootstrap	maximum
36A	undetermined	Hall's bootstrap	UCL
36B	undetermined	Hall's bootstrap	UCL
37	undetermined	Hall's bootstrap	UCL
37A	undetermined	NC	maximum
37B	undetermined	Hall's bootstrap	UCL
38	undetermined	Hall's bootstrap	UCL
38A	undetermined	Hall's bootstrap	UCL
39	undetermined	Hall's bootstrap	UCL
40	undetermined	Hall's bootstrap	UCL
40A	undetermined	Hall's bootstrap	UCL
40B	undetermined	NC	maximum
41	undetermined	Hall's bootstrap	UCL
41A	undetermined	Hall's bootstrap	UCL
42	undetermined	Hall's bootstrap	UCL
42A	undetermined	NC	maximum
43	undetermined	Hall's bootstrap	UCL
43A	undetermined	NC	maximum
44	undetermined	Hall's bootstrap	UCL
45	undetermined	Hall's bootstrap	UCL
45[b]	undetermined	Hall's bootstrap	UCL
46	undetermined	Hall's bootstrap	UCL
46[b]	undetermined	Hall's bootstrap	UCL
47 (current use)	undetermined	Hall's bootstrap	UCL
47 (future use)	undetermined	Hall's bootstrap	UCL
48	undetermined	Hall's bootstrap	UCL

Table 4-2

Summary of the Data Distributions and Methods Used to Calculate UCLs for Each Soil Exposure Area and Subarea[a], Reaches 5 and 6

Exposure Area/Subarea	Data Distribution	95% UCL Calculation Method	Value Used as EPC
48[b]	undetermined	Hall's bootstrap	UCL
49	undetermined	Hall's bootstrap	UCL
49[b]	undetermined	NC	maximum
50	undetermined	Hall's bootstrap	UCL
50A	undetermined	Hall's bootstrap	UCL
51	undetermined	Hall's bootstrap	UCL
51A	undetermined	Hall's bootstrap	UCL
52	undetermined	Hall's bootstrap	UCL
53	undetermined	Hall's bootstrap	UCL
54	undetermined	Hall's bootstrap	UCL
54[b]	undetermined	Hall's bootstrap	UCL
55	undetermined	Hall's bootstrap	UCL
55A	undetermined	Hall's bootstrap	UCL
56	undetermined	Hall's bootstrap	UCL
56A	undetermined	Hall's bootstrap	UCL
57	undetermined	Hall's bootstrap	UCL
57[b]	undetermined	Hall's bootstrap	UCL
58	undetermined	Hall's bootstrap	UCL
59	undetermined	Hall's bootstrap	UCL
59A	undetermined	Hall's bootstrap	UCL
60	undetermined	Hall's bootstrap	UCL
60A	undetermined	Hall's bootstrap	UCL
61	undetermined	Hall's bootstrap	UCL
62	undetermined	Hall's bootstrap	UCL
63	undetermined	Hall's bootstrap	UCL
64	undetermined	NC	maximum
65	undetermined	Hall's bootstrap	UCL
66	undetermined	Hall's bootstrap	UCL

NC = not calculated. Too few samples to calculate 95% UCL.
UCL = upper-confidence limit.
[a] Based on spatially weighted data with use-weighting factors applied unless otherwise noted.
[b] Waterfowl hunter is evaluated at this area; thus, use-weighting factors are not applied to the spatially weighted data.

Table 4-3

Summary of the Data Distributions and Methods Used to Calculate UCLs for Each Soil Exposure Area and Subarea, Reaches 7 and 8

Exposure Area/Subarea	Data Distribution	95% UCL Calculation Method	Value Used as EPC
67	lognormal	H-statistic	maximum
68	lognormal	H-statistic	maximum
69	lognormal	H-statistic	maximum
70	lognormal	H-statistic	maximum
70A	lognormal	H-statistic	maximum
71	normal	t-statistic	UCL
72	lognormal	H-statistic	maximum
72-73	lognormal	H-statistic	maximum
73	lognormal	H-statistic	maximum
74	lognormal	H-statistic	maximum
75	lognormal	H-statistic	maximum
76	NA	NC	maximum
77	normal	t-statistic	UCL
78	lognormal	H-statistic	maximum
79	lognormal	H-statistic	UCL
80	undetermined	Hall's bootstrap	UCL
80A	lognormal	H-statistic	maximum
80B	undetermined	NC	maximum
81	lognormal	H-statistic	maximum
82	normal	t-statistic	UCL
83	normal	t-statistic	UCL
84	lognormal	H-statistic	maximum
85A	lognormal	H-statistic	maximum
85B	lognormal	H-statistic	maximum
86	lognormal	H-statistic	UCL
87	lognormal	H-statistic	maximum
87A	NA	NC	maximum
88	NA	NC	maximum
89	normal	t-statistic	UCL
90	lognormal	H-statistic	maximum

NA = not applicable. Too few samples to determine data distribution.
NC = not calculated. Too few samples to calculate 95% UCL.
UCL = upper-confidence limit.

Table 4-4

Summary of the Data Distributions and Methods Used to Calculate UCLs for Each Sediment Exposure Area

Sediment Exposure Area	Data Distribution	95% UCL Calculation Method	Value Used as EPC
1	undetermined	Hall's bootstrap	UCL
2	undetermined	Hall's bootstrap	UCL
3	undetermined	Hall's bootstrap	UCL
4	lognormal	H-statistic	maximum
5	lognormal	H-statistic	maximum
6	lognormal	H-statistic	UCL
7	lognormal	H-statistic	maximum
8	normal	t-statisitic	UCL

UCL = upper-confidence limit.

Table 4-5

General Equation for Calculating a Daily Exposure Dose*

	Dose (Intake, mg/kg-day) = (C x CR x EFD)/(BW x AT)
Where:	
Contaminated-Related Variable:	
C =	Exposure concentration of a contaminant in medium (soil or sediment) contacted during the exposure period, and expressed as amount of contaminant per weight of medium (e.g., mg contaminant/kg in soil).
Exposed Population Variables:	
CR =	Contact rate, expressed as the amount of medium contacted per unit of time (e.g., mg soil/day)
EFD =	Exposure frequency and duration; describes how long and how often exposure occurs. Usually calculated using two terms:
	EF = Exposure frequency (days/year).
	ED = Exposure duration (years).
BW =	Body weight; the average body weight over the exposure period (kg).
Assessment-Determined Variables:	
AT =	Averaging time; period over which exposure is averaged (days).

* EPA, 1989.

Table 4-6

Summary of the Exposure Parameters That Are Constant Across All Exposure Scenarios

Parameter	Constant Value	Reference
Young child BW	15 kg	EPA, 1989
Older child BW	45 kg	EPA, 1997a
Adult BW	70 kg	EPA, 1989
Carcinogenic AT	25,550 days	EPA, 1989
Noncancer AT	Scenario-specific ED X 365 days/year	EPA, 1989
FI – Residential	1.0 for RME and CTE	Professional judgment
FI – Other scenarios	1.0 for RME; 0.5 for CTE	Professional judgment
ABS_d for PCBs	0.14	EPA, 2001
ABS_d for dioxins/furans	0.03	EPA, 2001

BW = body weight.

AT = averaging time.

FI = fraction of contaminated soil ingested.

ABS_d = dermal absorption factor.

Table 4-7

Summary of the 50th Percentile Skin Surface Area (SA) Values*

Body Part	Receptor		
	Young Child (cm^2)	Older Child (cm^2)	Adult (cm^2)
Head	977	1,276	1,206
Face	326	425	402
Hands	358	700	904
Forearms	393	787	1,173
Lower legs	650	1,610	2,370
Feet	451	949	1,225

* EPA, 2001.

Table 4-8

Summary of the Soil-to-Skin Adherence Factors (AF)* by Contact Activity

Soil Contact Activity	Body-Part-Specific AF (mg/cm^2)				
	Hands	Arms	Legs	Face	Feet
Children in wet soil	0.656	0.015	0.026	0.004	--
Gardeners	0.19	0.052	0.033	0.052	0.197
Reed gatherers	0.658	0.036	0.159	0.052[a]	0.633
Farmers	0.448	0.093	0.018	0.029	--
Utility workers	0.293	0.25	--	0.102	--
Heavy equipment operators	0.288	0.155	0.066[b]	0.154	--

* EPA, 2001.

[a] Gardeners value.

[b] Construction workers value.

Table 4-9

Age-Adjusted Cancer Dose Calculation for the Residential Scenario

$$\text{Soil Ingestion Dose (mg/kg-day)} = \frac{CS \times EF \times IFS \times FI \times CF}{AT}$$

$$\text{Dermal Absorption Dose from Soil (mg/kg-day)} = \frac{CS \times EF \times SFS \times ABS_d \times CF}{AT}$$

Where:			**RME**	**CTE**
CS	=	Contaminant concentration in soil (mg/kg).	Exposure area-specific	
EF	=	Exposure frequency (days/year).	150 (future lawns)	150 (future lawns)
			90 (nonlawns)	30 (nonlawns)
IFS	=	Age-adjusted soil ingestion factor, see Table 4-10 (mg-year/kg-day).	135.7	46.4
FI	=	Fraction of contaminated soil ingested (unitless).	1.0	1.0
CF	=	Conversion factor (kg/mg).	0.000001	0.000001
AT	=	Averaging time (days).	25,550	25,550
SFS	=	Age-adjusted soil contact factor, see Table 4-10 (mg-year/kg-day).	377.3	231.2
ABS_d	=	Dermal absorption factor (unitless).	PCBs-0.14; dioxins and furans-0.03	

Table 4-10

Calculation of Age-Adjusted Factors for Residential Exposure

$$\text{IFS (mg-year/kg-day)} = \frac{ED_c \times IRS_c}{BW_c} + \frac{ED_a \times IRS_a}{BW_a}$$

Where:			RME	CTE
IFS	=	Age-adjusted soil ingestion factor (mg-year/kg-day).	135.7	46.4
ED_c	=	Child exposure duration (years).	6	6
ED_a	=	Adult exposure duration (years).	39	9
IRS_c	=	Child ingestion rate (mg/day).	200	100
IRS_a	=	Adult ingestion rate (mg/day).	100	50
BW_c	=	Child body weight (kg).	15	15
BW_a	=	Adult body weight (kg).	70	70

$$\text{SFS (mg-year/kg-day)} = \frac{ED_c \times [[(SA_{c1} \times AF_{c1} \times AD_1) + (SA_{c2} \times AF_{c2} \times AD_2)]/AD_1 + AD_2]}{BW_c} + \frac{ED_a \times [[(SA_{a1} \times AF_{a1} \times AD_1) + (SA_{a2} \times AF_{a2} \times AD_2)]/AD_1 + AD_2]}{BW_a}$$

Where:			RME	CTE
SFS	=	Age-adjusted soil contact factor (mg-year/kg-day).	377.3	231.2
ED_c	=	Child exposure duration (years).	6	6
ED_a	=	Adult exposure duration (years).	39	9
SA_{c1}	=	Child skin surface area available for contact during warmer months (cm^2/day) (see Tables 4-25 and 4-26).	2,800	2,800
AF_{c1}	=	Child weighted soil-to-skin adherence factor during warmer months (mg/cm^2) (see Table 4-26).	0.2	0.2
SA_{c2}	=	Child skin surface area available for contact during cooler months (cm^2/day) (see Tables 4-25 and 4-26).	684	684
AF_{c2}	=	Child weighted soil-to-skin adherence factor during cooler months (mg/cm^2) (see Table	0.35	0.35

Table 4-10

Calculation of Age-Adjusted Factors (Continued)

IFS (mg-year/kg-day)	=	$\frac{EDc \times IRSc}{BWc} + \frac{EDa \times IRSa}{BWa}$		
		4-26).		
SA_{a1}	=	Adult skin surface area available for contact during warmer months (cm^2/day) (see Tables 4-25 and 4-26).	5,700	5,700
AF_{a1}	=	Adult weighted soil-to-skin adherence factor during warmer months (mg/cm^2) (see Table 4-26).	0.07	0.07
Where:			**RME**	**CTE**
SA_{a2}	=	Adult skin surface area available for contact during cooler months (cm^2/day) (see Tables 4-25 and 4-26).	1,306	1,306
AF_{a2}	=	Adult weighted soil-to-skin adherence factor during cooler months (mg/cm^2) (see Table 4-26).	0.15	0.15
AD_1	=	Activity duration for warmer months (months).	5	5
AD_2	=	Activity duration for cooler months (months).	2	2
BW_c	=	Child body weight (kg).	15	15
BW_a	=	Adult body weight (kg).	70	70

Table 4-11

Noncancer Dose Calculation for the Residential Scenario

Soil Ingestion Dose (mg/kg-day)

$$= \frac{CS \times IR \times FI \times EF \times ED \times CF}{BW \times AT}$$

Dermal Absorption Dose from Soil (mg/kg-day)

$$= \frac{CS \times EF \times ED \times [[(SA_1 \times AF_1 \times AD_1) + (SA_2 \times AF_2 \times AD_2)]/AD_1 + AD_2] \times ABS_d \times CF}{BW \times AT}$$

Where:			RME	CTE
CS	=	Contaminant concentration in soil (mg/kg).	Exposure area-specific	
IR	=	Ingestion rate (mg/day).	200 (child) 100 (adult)	100 (child) 50 (adult)
FI	=	Fraction of contaminated soil ingested (unitless).	1.0	1.0
EF	=	Exposure frequency (days/year).	150 (future lawns) 90 (nonlawns)	150 (future lawns) 30 (nonlawns)
ED	=	Exposure duration (years).	6 (child) 39 (adult)	6 (child) 9 (adult)
CF	=	Conversion factor (kg/mg).	0.000001	0.000001
SA_1	=	Skin surface area available for contact during warmer months (cm^2/day) (see Tables 4-25 and 4-26).	2,800 (child) 5,700 (adult)	2,800 (child) 5,700 (adult)
SA_2	=	Skin surface area available for contact during cooler months (cm^2/day) (see Tables 4-25 and 4-26).	684 (child) 1,306 (adult)	684 (child) 1,306 (adult)
AF_1	=	Weighted soil-to-skin adherence factor during warmer months (mg/cm^2) (see Table 4-26).	0.2 (child) 0.07 (adult)	0.2 (child) 0.07 (adult)
AF_2	=	Weighted soil-to-skin adherence factor during cooler months (mg/cm^2) (see Table 4-26).	0.35 (child) 0.15 (adult)	0.35 (child) 0.15 (adult)
AD_1	=	Activity duration for warmer months (months).	5	5
AD_2	=	Activity duration for cooler months (months).	2	2
ABS_d	=	Dermal absorption factor (unitless).	PCBs-0.14; dioxins and furans-0.03	
BW	=	Body weight (kg).	15 (child) 70 (adult)	15 (child) 70 (adult)
AT	=	Averaging time (days).	2,190 (child) 14,235 (adult)	2,190 (child) 3,285 (adult)

Table 4-12

Dose Calculation for the General Recreation Scenario

$$\text{Soil Ingestion Dose (mg/kg-day)} = \frac{CS \times IR \times FI \times EF \times ED \times CF}{BW \times AT}$$

$$\text{Dermal Absorption Dose from Soil (mg/kg-day)} = \frac{CS \times EF \times ED \times [[(SA_1 \times AF_1 \times AD_1) + (SA_2 \times AF_2 \times AD_2)]/AD_1 + AD_2] \times ABS_d \times CF}{BW \times AT}$$

Where:			**RME**	**CTE**
CS	=	Contaminant concentration in soil (mg/kg).	Exposure area-specific	
IR	=	Ingestion rate (mg/day).	200 (young child) 100 (older child) 100 (adult)	100 (young child) 50 (older child) 50 (adult)
FI	=	Fraction of contaminated soil ingested (unitless).	1.0	0.5
EF	=	Exposure frequency (days/year).	High use: 90 Medium use: 60 Low use: 30	High use: 30 Medium use: 30 Low use: 15
ED	=	Exposure duration (years).	6 (young child) 12 (older child) 47 (adult)	6 (young child) 12 (older child) 13 (adult)
CF	=	Conversion factor (kg/mg).	0.000001	0.000001
SA_1	=	Skin surface area available for contact during warmer months (cm^2/day) (see Tables 4-25 and 4-26).	2,800 (young child) 4,400 (older child) 5,700 (adult)	2,800 (young child) 4,400 (older child) 5,700 (adult)
SA_2	=	Skin surface area available for contact during cooler months (cm^2/day) (see Tables 4-25 and 4-26).	684 (young child) 1,125 (older child) 1,306 (adult)	684 (young child) 1,125 (older child) 1,306 (adult)
AF_1	=	Weighted soil-to-skin adherence factor during warmer months (mg/cm^2) (see Table 4-26).	0.2 (young child) 0.07 (older child) 0.07 (adult)	0.2 (young child) 0.07 (older child) 0.07 (adult)
AF_2	=	Weighted soil-to-skin adherence factor during cooler months (mg/cm^2) (see Table 4-26).	0.35 (young child) 0.14 (older child) 0.15 (adult)	0.35 (young child) 0.14 (older child) 0.15 (adult)
AD_1	=	Activity duration for warmer months (months).	5	5
AD_2	=	Activity duration for cooler months (months).	2	2
ABS_d	=	Dermal absorption factor (unitless).	PCBs-0.14; dioxins and furans-0.03	
BW	=	Body weight (kg).	15 (young child) 45 (older child) 70 (adult)	15 (young child) 45 (older child) 70 (adult)
ATc	=	Carcinogenic averaging time (days).	25,550	25,550
ATnc	=	Noncancer averaging time (days).	2,190 (young child) 4,380 (older child) 17,155 (adult)	2,190 (young child) 4,380 (older child) 4,745 (adult)

Table 4-13

Dose Calculation for the All-Terrain Vehicle/Dirt and Mountain Biker Scenario*

$$\text{Soil Ingestion Dose (mg/kg-day)} = \frac{CS \times IR \times FI \times EF \times ED \times CF}{BW \times AT}$$

$$\text{Dermal Absorption Dose from Soil (mg/kg-day)} = \frac{CS \times EF \times ED \times [[(SA_1 \times AF_1 \times AD_1) + (SA_2 \times AF_2 \times AD_2)]/AD_1 + AD_2] \times ABS_d \times CF}{BW \times AT}$$

Where:			RME	CTE
CS	=	Contaminant concentration in soil (mg/kg).	Exposure area-specific	
IR	=	Ingestion rate (mg/day).	200	100
FI	=	Fraction of contaminated soil ingested (unitless).	1.0	0.5
EF	=	Exposure frequency (days/year).	90	30
ED	=	Exposure duration (years).	12	12
CF	=	Conversion factor (kg/mg).	0.000001	0.000001
SA_1	=	Skin surface area available for contact during warmer months (cm^2/day) (see Tables 4-25 and 4-26).	3,522	3,522
SA_2	=	Skin surface area available for contact during cooler months (cm^2/day) (see Tables 4-25 and 4-26).	1,125	1,125
AF_1	=	Weighted soil-to-skin adherence factor during warmer months (mg/cm^2) (see Table 4-26).	0.14	0.14
AF_2	=	Weighted soil-to-skin adherence factor during cooler months (mg/cm^2) (see Table 4-26).	0.24	0.24
AD_1	=	Activity duration for warmer months (months).	5	5
AD_2	=	Activity duration for cooler months (months).	2	2
ABS_d	=	Dermal absorption factor (unitless).	PCBs-0.14; dioxins and furans-0.03	
BW	=	Body weight (kg).	45	45
ATc	=	Carcinogenic averaging time (days).	25,550	25,550
ATnc	=	Noncancer averaging time (days).	4,380	4,380

* The all terrain vehicle/dirt and mountain biker scenario includes the older child receptor only (see Section 4.5.3.3)

Table 4-14

Dose Calculation for the Marathon Canoeist Scenario

$$\text{Soil Ingestion Dose (mg/kg-day)} = \frac{CS \times IR \times FI \times EF \times ED \times CF}{BW \times AT}$$

$$\text{Dermal Absorption Dose from Soil (mg/kg-day)} = \frac{CS \times EF \times ED \times [[(SA_1 \times AF_1 \times AD_1) + (SA_2 \times AF_2 \times AD_2)]/AD_1 + AD_2] \times ABS_d \times CF}{BW \times AT}$$

Where:			**RME**	**CTE**
CS	=	Contaminant concentration in soil (mg/kg).	Exposure area-specific	
IR	=	Ingestion rate (mg/day).	50	50
FI	=	Fraction of contaminated soil ingested (unitless).	1.0	0.5
EF	=	Exposure frequency (days/year).	150	90
ED	=	Exposure duration (years).	30	15
CF	=	Conversion factor (kg/mg).	0.000001	0.000001
SA_1	=	Skin surface area available for contact during warmer months (cm^2/day) (see Tables 4-25 and 4-26).	5,672	5,672
SA_2	=	Skin surface area available for contact during cooler months (cm^2/day) (see Tables 4-25 and 4-26).	904	904
AF_1	=	Weighted soil-to-skin adherence factor during warmer months (mg/cm^2) (see Table 4-26).	0.32	0.32
AF_2	=	Weighted soil-to-skin adherence factor during cooler months (mg/cm^2) (see Table 4-26).	0.658	0.658
AD_1	=	Activity duration during warmer months (months).	5	5
AD_2	=	Activity duration during cooler months (months).	2	2
ABS_d	=	Dermal absorption factor (unitless).	PCBs-0.14; dioxins and furans-0.03	
BW	=	Body weight (kg).	70	70
ATc	=	Carcinogenic averaging time (days).	25,550	25,550
ATnc	=	Noncancer averaging time (days).	10,950	5,475

Table 4-15

Dose Calculation for the Recreational Canoeist/Boater Scenario

$$\text{Soil Ingestion Dose (mg/kg-day)} = \frac{CS \times IR \times FI \times EF \times ED \times CF}{BW \times AT}$$

$$\text{Dermal Absorption Dose from Soil (mg/kg-day)} = \frac{CS \times EF \times ED \times [[(SA_1 \times AF_1 \times AD_1) + (SA_2 \times AF_2 \times AD_2)]/AD_1 + AD_2] \times ABS_d \times CF}{BW \times AT}$$

Where:			**RME**	**CTE**
CS	=	Contaminant concentration in soil (mg/kg).	Exposure area-specific	
IR	=	Ingestion rate (mg/day).	100 (older child) 100 (adult)	50 (older child) 50 (adult)
FI	=	Fraction of contaminated soil ingested (unitless).	1.0	0.5
EF	=	Exposure frequency (days/year).	30 (older child) 60 (adult)	15 (older child) 30 (adult)
ED	=	Exposure duration (years).	12 (older child) 40 (adult)	12 (older child) 20 (adult)
CF	=	Conversion factor (kg/mg).	0.000001	0.000001
SA_1	=	Skin surface area available for contact during warmer months (cm^2/day) (see Tables 4-25 and 4-26).	4,471 (older child) 6,074 (adult)	4,471 (older child) 6,074 (adult)
SA_2	=	Skin surface area available for contact during cooler months (cm^2/day) (see Tables 4-25 and 4-26).	1,125 (older child) 1,306 (adult)	1,125 (older child) 1,306 (adult)
AF_1	=	Weighted soil-to-skin adherence factor during warmer months (mg/cm^2) (see Table 4-26).	0.31 (older child) 0.3 (adult)	0.31 (older child) 0.3 (adult)
AF_2	=	Weighted soil-to-skin adherence factor during cooler months (mg/cm^2) (see Table 4-26).	0.43 (older child) 0.47 (adult)	0.43 (older child) 0.47 (adult)
AD_1	=	Activity duration for warmer months (months).	5	5
AD_2	=	Activity duration for cooler months (months).	2	2
ABS_d	=	Dermal absorption factor (unitless).	PCBs-0.14; dioxins and furans-0.03	
BW	=	Body weight (kg).	45 (older child) 70 (adult)	45 (older child) 70 (adult)
ATc	=	Carcinogenic averaging time (days).	25,550	25,550
ATnc	=	Noncancer averaging time (days).	4,380 (older child) 14,600 (adult)	4,380 (older child) 7,300 (adult)

Table 4-16

Dose Calculation for the Angler Scenario

$$\text{Soil Ingestion Dose (mg/kg-day)} = \frac{CS \times IR \times FI \times EF \times ED \times CF}{BW \times AT}$$

$$\text{Dermal Absorption Dose from Soil (mg/kg-day)} = \frac{CS \times EF \times ED \times [[(SA_1 \times AF_1 \times AD_1) + (SA_2 \times AF_2 \times AD_2)]/AD_1 + AD_2] \times ABS_d \times CF}{BW \times AT}$$

Where:			**RME**	**CTE**
CS	=	Contaminant concentration in soil (mg/kg).	Exposure area-specific	
IR	=	Ingestion rate (mg/day).	100 (older child) 100 (adult)	50 (older child) 50 (adult)
FI	=	Fraction of contaminated soil ingested (unitless).	1.0	0.5
EF	=	Exposure frequency (days/year).	30	10
ED	=	Exposure duration (years).	12 (older child) 38 (adult)	12 (older child) 11 (adult)
CF	=	Conversion factor (kg/mg).	0.000001	0.000001
SA_1	=	Skin surface area available for contact during warmer months (cm^2/day) (see Tables 4-25 and 4-26).	4,471 (older child) 6,074 (adult)	4,471 (older child) 6,074 (adult)
SA_2	=	Skin surface area available for contact during cooler months (cm^2/day) (see Tables 4-25 and 4-26).	1,125 (older child) 1,306 (adult)	1,125 (older child) 1,306 (adult)
AF_1	=	Weighted soil-to-skin adherence factor during warmer months (mg/cm^2) (see Table 4-26).	0.31 (older child) 0.3 (adult)	0.31 (older child) 0.3 (adult)
AF_2	=	Weighted soil-to-skin adherence factor during cooler months (mg/cm^2) (see Table 4-26).	0.43 (older child) 0.47 (adult)	0.43 (older child) 0.47 (adult)
AD_1	=	Activity duration for warmer months (months).	5	5
AD_2	=	Activity duration for cooler months (months).	2	2
ABS_d	=	Dermal absorption factor (unitless).	PCBs-0.14; dioxins and furans-0.03	
BW	=	Body weight (kg).	45 (older child) 70 (adult)	45 (older child) 70 (adult)
ATc	=	Carcinogenic averaging time (days).	25,550	25,550
ATnc	=	Noncancer averaging time (days).	4,380 (older child) 13,870 (adult)	4,380 (older child) 4,015 (adult)

Table 4-17

Dose Calculation for the Waterfowl Hunter Scenario

$$\text{Soil Ingestion Dose (mg/kg-day)} = \frac{CS \times IR \times FI \times EF \times ED \times CF}{BW \times AT}$$

$$\text{Dermal Absorption Dose from Soil (mg/kg-day)} = \frac{CS \times EF \times ED \times SA \times AF \times ABS_d \times CF}{BW \times AT}$$

Where:			**RME**	**CTE**
CS	=	Contaminant concentration in soil (mg/kg).	Exposure area-specific	
IR	=	Ingestion rate (mg/day).	100 (older child) 100 (adult)	100 (older child) 100 (adult)
FI	=	Fraction of contaminated soil ingested (unitless).	1.0	0.5
EF	=	Exposure frequency (days/year).	14	7
ED	=	Exposure duration (years).	6 (older child) 38 (adult)	6 (older child) 25 (adult)
CF	=	Conversion factor (kg/mg).	0.000001	0.000001
SA	=	Skin surface area available for contact (cm^2/day) (see Tables 4-25 and 4-26).	1,125 (older child) 1,306 (adult)	1,125 (older child) 1,306 (adult)
AF	=	Weighted soil-to-skin adherence factor (mg/cm^2) (see Table 4-26).	0.43 (older child) 0.47 (adult)	0.43 (older child) 0.47 (adult)
ABS_d	=	Dermal absorption factor (unitless).	PCBs-0.14; dioxins and furans-0.03	
BW	=	Body weight (kg).	45 (older child) 70 (adult)	45 (older child) 70 (adult)
ATc	=	Carcinogenic averaging time (days).	25,550	25,550
ATnc	=	Noncancer averaging time (days).	2,190 (older child) 13,870 (adult)	2,190 (older child) 9,125 (adult)

Table 4-18

Dose Calculation for the Sediment Exposure Scenario

$$\text{Soil Ingestion Dose (mg/kg-day)} = \frac{CS \times IR \times FI \times EF \times ED \times CF}{BW \times AT}$$

$$\text{Dermal Absorption Dose from Soil (mg/kg-day)} = \frac{CS \times EF \times ED \times SA \times AF \times ABS_d \times CF}{BW \times AT}$$

Where:			**RME**	**CTE**
CS	=	Contaminant concentration in soil (mg/kg).	Exposure area-specific	
IR	=	Ingestion rate (mg/day).	100 (older child) 100 (adult)	50 (older child) 50 (adult)
FI	=	Fraction of contaminated soil ingested (unitless).	1.0	0.5
EF	=	Exposure frequency (days/year).	36	12
ED	=	Exposure duration (years).	12 (older child) 52 (adult)	12 (older child) 19 (adult)
CF	=	Conversion factor (kg/mg).	0.000001	0.000001
SA	=	Skin surface area available for contact (cm^2/day) (see Tables 4-25 and 4-26).	4,471 (older child) 6,074 (adult)	4,471 (older child) 6,074 (adult)
AF	=	Weighted soil-to-skin adherence factor (mg/cm^2) (see Table 4-26).	0.31 (older child) 0.3 (adult)	0.31 (older child) 0.3 (adult)
ABS_d	=	Dermal absorption factor (unitless).	PCBs-0.14; dioxins and furans-0.03	
BW	=	Body weight (kg).	45 (older child) 70 (adult)	45 (older child) 70 (adult)
ATc	=	Carcinogenic averaging time (days).	25,550	25,550
ATnc	=	Noncancer averaging time (days).	4,380 (older child) 18,980 (adult)	4,380 (older child) 6,935 (adult)

Table 4-19

Dose Calculation for the Farmer Scenario

$$\text{Soil Ingestion Dose (mg/kg-day)} = \frac{CS \times IR \times FI \times EF \times ED \times CF}{BW \times AT}$$

$$\text{Dermal Absorption Dose from Soil (mg/kg-day)} = \frac{CS \times EF \times ED \times SA \times AF \times ABS_d \times CF}{BW \times AT}$$

Where:			**RME**	**CTE**
CS	=	Contaminant concentration in soil (mg/kg).	Exposure area-specific	
IR	=	Ingestion rate (mg/day).	200	100
FI	=	Fraction of contaminated soil ingested (unitless).	1.0	0.5
EF	=	Exposure frequency (days/year).	40	10
ED	=	Exposure duration (years).	64	29
CF	=	Conversion factor (kg/mg).	0.000001	0.000001
SA	=	Skin surface area available for contact (cm^2/day) (see Tables 4-25 and 4-26).	3,300	3,300
AF	=	Weighted soil-to-skin adherence factor (mg/cm^2) (see Table 4-26).	0.21	0.21
ABS_d	=	Dermal absorption factor (unitless).	PCBs-0.14; dioxins and furans-0.03	
BW	=	Body weight (kg).	70	70
ATc	=	Carcinogenic averaging time (days).	25,550	25,550
ATnc	=	Noncancer averaging time (days).	23,360	10,585

Table 4-20

Dose Calculation for the Groundskeeper Scenario

Soil Ingestion Dose (mg/kg-day) $= \frac{CS \times IR \times FI \times EF \times ED \times CF}{BW \times AT}$

Dermal Absorption Dose from Soil (mg/kg-day) $= \frac{CS \times EF \times ED \times SA \times AF \times ABS_d \times CF}{BW \times AT}$

Where:			RME	CTE
CS	=	Contaminant concentration in soil (mg/kg).	Exposure area-specific	
IR	=	Ingestion rate (mg/day).	100	50
FI	=	Fraction of contaminated soil ingested (unitless).	1.0	0.5
EF	=	Exposure frequency (days/year).	Site-specific	Site-specific
ED	=	Exposure duration (years).	25	12
CF	=	Conversion factor (kg/mg).	0.000001	0.000001
SA	=	Skin surface area available for contact (cm^2/day) (see Tables 4-25 and 4-26).	2479	2479
AF	=	Weighted soil-to-skin adherence factor (mg/cm^2) (see Table 4-26).	0.1	0.1
ABS_d	=	Dermal absorption factor (unitless).	PCBs-0.14; dioxins and furans-0.03	
BW	=	Body weight (kg).	70	70
ATc	=	Carcinogenic averaging time (days).	25,550	25,550
ATnc	=	Noncancer averaging time (days).	9,125	4,380

Table 4-21

Dose Calculation for the Utility Worker Scenario

$$\text{Soil Ingestion Dose (mg/kg-day)} = \frac{CS \times IR \times FI \times EF \times ED \times CF}{BW \times AT}$$

$$\text{Dermal Absorption Dose from Soil (mg/kg-day)} = \frac{CS \times EF \times ED \times SA \times AF \times ABS_d \times CF}{BW \times AT}$$

Where:			**RME**	**CTE**
CS	=	Contaminant concentration in soil (mg/kg).	Exposure area-specific	
IR	=	Ingestion rate (mg/day).	330	100
FI	=	Fraction of contaminated soil ingested (unitless).	1.0	0.5
EF	=	Exposure frequency (days/year).	5	5
ED	=	Exposure duration (years).	25	12
CF	=	Conversion factor (kg/mg).	0.000001	0.000001
SA	=	Skin surface area available for contact (cm^2/day) (see Tables 4-25 and 4-26).	3,300	3,300
AF	=	Weighted soil-to-skin adherence factor (mg/cm^2) (see Table 4-26).	0.2	0.2
ABS_d	=	Dermal absorption factor (unitless).	PCBs-0.14; dioxins and furans-0.03	
BW	=	Body weight (kg).	70	70
ATc	=	Carcinogenic averaging time (days).	25,550	25,550
ATnc	=	Noncancer averaging time (days).	9,125	4,380

Table 4-22

Summary of Exposure Frequencies

Exposure Scenario	Exposure Frequency (days/year)			
	RME	**Source**	**CTE**	**Source**
Residential				
Future lawns	150	EPA, 1994	150	EPA, 1994
Non-lawns	90	Professional judgment	30	Professional judgment
General Recreation				
Older Children and Adults				
High use	90	Field observations, TER, 2003, USFWS 2001, Site-specific characteristics	30	Field observations, TER, 2003, USFWS 2001, Site-specific characteristics
Medium use	60	Field observations, TER, 2003, USFWS 2001, Site-specific characteristics	30	Field observations, TER, 2003, USFWS 2001, Site-specific characteristics
Low Use	30	Field observations, TER, 2003, USFWS 2001, Site-specific characteristics	15	Field observations, TER, 2003, USFWS 2001, Site-specific characteristics
Young Children				
High use	90	Field observations, TER, 2003, Site-specific characteristics	30	Field observations, TER, 2003, Site-specific characteristics
Low use	15	Field observations, TER, 2003, Site-specific characteristics	15	Field observations, TER, 2003, Site-specific characteristics
ATV/Dirt and Mountain Biking	90	Professional judgment	30	Professional judgment
Marathon Canoeist	150	WESTON, 2001	90	WESTON, 2001
Recreational Canoeist				
Older child	30	Professional judgment	15	Professional judgment
Adult	60	WESTON, 2001	30	WESTON, 2001
Angler	30	ChemRisk, 1994; Ebert, 1996	10	USFWS, 2001; Ebert 1996; EOEA, 2000
Waterfowl Hunter	14	USFWS 2001; EOEA, 2000	7	U.S.FWS 2001; EOEA, 2000
Sediment Exposure	36	Professional judgment	12	Professional judgment
Farmer	10	Fries, 2002	10	Fries, 2002
Groundskeeper				
High Use	150	Professional judgment	150	Professional judgment
Low Use	30	Professional judgment	15	Professional judgment
Utility Worker	5	Geraghty and Miller, 1993	5	Geraghty and Miller, 1993

Table 4-23

Summary of Exposure Durations

Exposure Scenario	Exposure Duration (years)			
	RME	Source	CTE	Source
Residential				
Young child	6	EPA, 1991	6	EPA, 1991
Adult	39	MDPH, 2001	9	MDPH, 2001
General Recreation				
Young child	6	EPA, 1991	6	EPA, 1991
Older child	12	MDPH, 2001	12	MDPH, 2001
Adult	47	MDPH, 2001	13	MDPH, 2001
ATV/Dirt and Mountain Biking				
Older child	12	Calculated	12	Calculated
Marathon Canoeist				
Adult	30	WESTON, 2001	15	Professional judgment
Recreational Canoeist				
Older child	12	Calculated	12	Calculated
Adult	40	WESTON, 2001	20	Professional judgment
Angler				
Older child	12	Calculated	12	Calculated
Adult	38	MDPH, 2001	11	MDPH, 2001
Waterfowl Hunter				
Older child	6	MassWildlife, 2001	6	MassWildlife, 2001
Adult	38	MDPH, 2001	25	MDPH, 2001
Sediment Exposure				
Older child	12	Calculated	12	Calculated
Adult	52	MDPH, 2001	19	MDPH, 2001
Farmer				
Adult	64	MDPH, 2001	29	Professional judgment
Groundskeeper	25	EPA, 1991	12	Professional judgment
Utility Worker	25	EPA, 1991	12	Professional judgment

Table 4-24

Summary of Ingestion Rates

Exposure Scenario	Ingestion Rate (mg/day)		
	RME	CTE	Source
Residential			
Young child	200	100	EPA, 1991, 1997a
Adult	100	50	EPA, 1991, 1997a
General Recreation			
Young child	200	100	EPA, 1991, 1997a
Older child	100	50	EPA, 1991, 1997a
Adult	100	50	EPA, 1991, 1997a
ATV/Dirt and Mountain Biking			
Older child	200	100	Stanek, 1997; EPA, 1997a
Marathon Canoeist			
Adult	50	50	EPA, 1997a
Recreational Canoeist			
Older child	100	50	EPA, 1991, 1997a
Adult	100	50	EPA, 1991, 1997a
Angler			
Older child	100	50	EPA, 1991, 1997a
Adult	100	50	EPA, 1991, 1997a
Waterfowl Hunter			
Older child	100	100	EPA, 1991, 1997a
Adult	100	100	EPA, 1991, 1997a
Sediment Exposure			
Older child	100	50	EPA, 1991, 1997a
Adult	100	50	EPA, 1991, 1997a
Farmer			
Adult	200	100	Stanek, 1997; EPA, 1997a
Groundskeeper	100	50	EPA, 1991, 1997a
Utility Worker	330	100	Stanek, 1997; EPA, 1997a

Table 4-25

Summary of the Exposed Body Parts[a,b]

Scenario	Exposed Body Parts	
	SA_1	SA_2
Residential		
Young child	Hands, forearms, lower legs, feet, and head	Hands and face
Adult	Hands, forearms, lower legs, and head	Hands and face
General Recreation		
Young child	Hands, forearms, lower legs, feet, and head	Hands and face
Older child	Hands, forearms, lower legs, and head	Hands and face
Adult	Hands, forearms, lower legs, and head	Hands and face
ATV/Dirt and Mountain Biker		
Older child	Hands, forearms, lower legs, and face	Hands and face
Marathon Canoeist		
Adult	Hands, forearms, lower legs, and feet	Hands
Recreational Canoeist		
Older child	Hands, forearms, lower legs, feet, and face	Hands and face
Adult	Hands, forearms, lower legs, feet, and face	Hands and face
Angler		
Older child	Hands, forearms, lower legs, feet, and face	Hands and face
Adult	Hands, forearms, lower legs, feet, and face	Hands and face
Waterfowl Hunter[c]		
Older child	Hands and face	NA
Adult	Hands and face	NA
Sediment Exposure[d]		
Older child	Hands, forearms, lower legs, feet, and face	NA
Adult	Hands, forearms, lower legs, feet, and face	NA
Farmer[e]		
Adult	Hands, forearms, and head	NA
Groundskeeper[e]	Hands, forearms, and face	NA
Utility Worker[e]	Hands, forearms, and head	NA

SA_1 = represents the exposed skin surface area during the warmer months.
SA_2 = represents the exposed skin surface area during the cooler months.
[a] The values presented were applied to both the RME and CTE evaluations.
[b] Table 4-7 presents the surface area values for the various body parts.
[c] A single set of clothing assumptions were made for the waterfowl hunter scenario, given the time of year and nature of the activity.
[d] Dermal exposure to sediment was assumed to occur during the 3 summer months (June through August): therefore, a single set of clothing assumptions were made for this scenario.
[e] A single set of clothing assumptions were made for this scenario, given the nature of the activity.

Table 4-26

Summary of the Exposed Skin Surface Area Estimates and the Surface Area Weighted Adherence Factors[a]

	Exposed Skin Surface Area [b] (cm^2/day)		Weighted Soil Adherence Factor (mg/cm^2) [c,d]		
Scenario	**SA_1**	**SA_2**	**AF_1**	**AF_2**	**Soil Contact Activity**
Residential					
Young child	2,800	684	0.2	0.35	Children playing in wet soil
Adult	5,700	1,306	0.07	0.15	Gardeners
General Recreation					
Young child	2,800	684	0.2	0.35	Children playing in wet soil
Older child	4,400	1,125	0.07	0.14	Gardeners
Adult	5,700	1,306	0.07	0.15	Gardeners
ATV/Dirt and Mountain Biker					
Older child	3,522	1,125	0.14	0.24	Heavy equipment operators [e]
Marathon Canoeist					
Adult	5,672	904	0.32	0.658	Reed gatherers
Recreational Canoeist					
Older child	4,471	1,125	0.31	0.43	Reed gatherers [f]
Adult	6,074	1,306	0.3	0.47	Reed gatherers [f]
Angler					
Older child	4,471	1,125	0.31	0.43	Reed gatherers [f]
Adult	6,074	1,306	0.3	0.47	Reed gatherers [f]
Waterfowl Hunter					
Older child	--	1,125	--	0.43	Reed gatherers (hands); gardeners (face)
Adult	--	1,306	--	0.47	Reed gatherers (hands); gardeners (face)
Sediment Exposure					
Older child	4,471	--	0.31	--	Reed gatherers [f]
Adult	6,074	--	0.3	--	Reed gatherers [f]
Farmer					
Adult	3,300	--	0.21	--	Farmers
Groundskeeper	2,479	--	0.1	--	Gardeners
Utility Worker	3,300	--	0.2	--	Utility workers

SA_1 = represents the exposed skin surface area during the warmer months.
SA_2 = represents the exposed skin surface area during the cooler months.
AF_1 = represents the weighted skin adherence factor for the warmer months.
AF_2 = represents the weighted skin adherence factor for the cooler months.
[a] The values presented were applied to both the RME and CTE evaluations.
[b] The SA estimates were based on the exposed body parts presented in Table 4-25.
[c] The surface area-weighted AF values were calculated based on the equation presented in Section 4.5.2.4.2 and the exposed body parts and AF values in presented in Section 4.5.3.
[d] Taken from Exhibit 3-3 of EPA *Risk Assessment Guidance for Superfund* (RAGS), Part E (EPA, 2001).
[e] Lower legs were based on the construction workers value.
[f] Face was based on the gardener's value.

5. POINT ESTIMATE RISK CHARACTERIZATION

5.1 INTRODUCTION

The objective of the risk characterization is to integrate the information developed in the exposure assessment and the toxicity assessment into an evaluation of the potential health risks from direct contact exposure for each exposure scenario in each exposure area (EA). Both cancer risks and noncancer health effects were evaluated for the RME and CTE scenarios for current land use and reasonably anticipated future land use.

A total of 90 EAs were included in the evaluation of soil exposure in this risk assessment. In Reaches 5 and 6, 66 EAs were evaluated and, in Reach 7, 24 EAs were evaluated. At least one risk assessment was completed for each EA based on the exposure scenario and receptor that would result in the greatest risk. Multiple risk assessments were completed for an EA if subareas within that EA were identified as having a separate exposure potential. A total of 140 site-specific risk assessments were performed for exposure to soil in the 90 EAs. A total of eight EAs were included in the evaluation of sediment exposure in this risk assessment. In Reaches 5 and 6, three sediment areas were evaluated and, in Reach 7, five sediment areas were evaluated that were located directly upstream of impoundment areas. Figures 5-1A and 5-1B present the locations of the EAs and subareas in Reaches 5 and 6, and Reach 7, respectively, that were evaluated as part of the risk assessment. Figure 5-1C presents the locations of the sediment areas that were evaluated as part of the risk assessment.

As discussed in Section 2 (Hazard Identification), the COPCs that were quantitatively evaluated in this risk assessment were total PCBs (tPCBs) and dioxins, furans, and dioxin-like PCB congeners. However, the exposure point concentrations (EPCs), doses, cancer risks, and noncancer hazard indices that are the primary focus of this section, including the text, tables, and figures, were based on tPCBs only. This approach was taken because of the higher density of sampling for tPCBs, including multiple samples in each exposure area and subarea, than for PCB congeners, dioxins, and furans.

Dioxin, furan, and dioxin-like PCB congener concentrations were estimated using a regression analysis that was based on the congener data and the corresponding tPCB (measured as Aroclors) concentration at the same sampling location. The description and results of the regression analysis are presented in Attachment 2 of the HHRA. Section 7 (Uncertainty Analysis) presents a discussion of the PCB-only and the PCB plus dioxin, furan, and dioxin-like PCB congener risk, evaluated as 2,3,7,8–tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) toxic equivalence (TEQ).

Certain metals and PAHs that were not eliminated in Section 2 (Hazard Identification) are evaluated qualitatively in Section 5.4.

5.2 CANCER RISK

Potential cancer risks were calculated by multiplying the estimated lifetime average daily dose (LADD) calculated for a contaminant through an exposure route by the CSF, as follows:

Risk = LADD * CSF

Where:

LADD = Lifetime average daily dose; intake averaged over a 70-year lifetime as mg contaminant/kg-body weight per day.

CSF = Contaminant- and route-specific cancer slope factor $(mg/kg\text{-}day)^{-1}$.

Cancer risks were summed across the incidental ingestion and dermal contact pathways for a given receptor and exposure scenario to derive a cumulative lifetime risk. Results of the EA-specific cancer risk evaluation are presented in Section 5.5. The EPA cancer risk range is the increased risk of developing cancer due to exposure to COPCs based on a plausible upper bound of approximately 1 in 10,000 (1E-04) to 1 in 1,000,000 (1E-06).

5.3 NONCANCER HEALTH EFFECTS

The hazard index (HI) was calculated for each pathway to characterize the potential for noncancer health effects by summing the hazard quotients (HQ) for PCBs for both ingestion and dermal contact. A hazard quotient is calculated by dividing the exposure dose by the contaminant-specific reference dose (RfD) (discussed in Section 3). An HQ is the ratio of the exposure duration-averaged daily dose (ADD) to the contaminant-specific RfD. The HQ-RfD relationship is illustrated by the following equation:

$$HQ = ADD/RfD$$

Where:

HQ = Hazard quotient.

ADD = Average daily dose; estimated daily intake averaged over the exposure period (mg/kg-day).

RfD = Reference dose (mg/kg-day).

HQs were summed to calculate HIs for each scenario. HQs were calculated for each exposure route (incidental ingestion and dermal contact), and a total HI was calculated based on exposure to PCBs from both exposure routes for each receptor (age group). Results of the EA-specific noncancer hazard quotient evaluation are presented in Section 5.5. HIs of less than 1 indicate that adverse health effects associated with the exposure scenario are unlikely to occur.

5.4 QUALITATIVE EVALUATION OF RISK FROM OTHER COMPOUNDS

Several metals and PAHs were retained in Section 2 (Hazard Identification) because their maximum concentrations were greater than the preliminary remediation goals (PRGs) or greater than background concentrations. These compounds were not evaluated quantitatively for individual EAs because they are not present at elevated concentrations throughout the site, the concentrations are only marginally greater than the PRGs and/or background concentrations, and the contaminants are not known to be site-related. The following subsections provide a qualitative evaluation of these other compounds by media.

5.4.1 Soil

Three inorganic compounds and five PAHs were retained for consideration as COPCs. As discussed in Section 2.5.2.2.3 and shown in Tables 2-6 and 2-7, the concentrations of the inorganic compounds, arsenic, chromium, and thallium are consistent with background concentrations. Comparisons with both site-specific and MDEP background concentrations indicate that these metals range from slightly below to slightly above background depending on the concentration compared (maximum or average) and the background level (site-specific or MDEP).

In addition to the comparison to background concentrations, an evaluation of worst-case risk was also performed. The maximum detected arsenic concentration in soil exceeds its cancer-based PRG for residential soil exposure by a factor of approximately 34, while the average concentration exceeds the PRG by a factor of 12. In a residential setting, the risk based on the maximum arsenic concentration and the conservative exposure assumptions used to calculate the PRG would be approximately 3E-05, while the risk from the average concentration would be approximately 1E-05. Because the exposure assumptions used to derive the residential soil PRGs are more conservative than the actual exposure expected to occur in the Rest of River area, the risks associated with site-specific exposure assumptions would be less than 3E-05, regardless of the exposure scenario.

Chromium and thallium were evaluated using their respective noncancer-based PRGs for residential soil that were reduced by a factor of 10 for screening purposes. If the PRGs were not adjusted to be more conservative by a factor of 10, the maximum detected chromium concentration would not exceed its PRG and the maximum thallium concentration would marginally exceed its PRG. This would indicate that the HQs associated with site concentrations would be less than or slightly greater than 1.0. Because the exposure assumptions used to derive the residential soil PRGs are more conservative than the actual exposure expected to occur in the Rest of River area, the hazard quotients associated with site-specific exposure assumptions would be below 1.0, regardless of the exposure scenario.

Comparisons with both site-specific and MDEP background concentrations indicate that the five PAHs retained for consideration in Section 2 range from slightly below to slightly above background depending on the concentration compared (maximum or average) and the background level (site-specific or MDEP).

In addition to the comparison to background concentrations, a worst-case evaluation of risk was also performed. Of the five PAHs that were not eliminated from consideration, benzo(a)pyrene and dibenzo(a,h)anthracene are considered the most potent carcinogens based on the CSFs. Because benzo(a)pyrene had one of the highest maximum detected concentrations of the PAHs detected, exposure and resulting risks were estimated. The maximum detected benzo(a)pyrene concentration in soil exceeds its cancer-based PRG for residential soil exposure by a factor of approximately 177, while the average concentration exceeds the PRG by a factor of 12. In a residential setting, the risk based on the maximum benzo(a)pyrene concentration and the conservative exposure assumptions used to calculate the PRG would be approximately 2E-04, while the risk from the average concentration would be approximately 1E-05. Because the exposure assumptions used to derive the residential PRGs are more conservative than the actual exposure expected to occur in the Rest of River area, the risks associated with site-specific exposure assumptions would be well below 2E-04, regardless of the exposure scenario. All of the other PAHs are less toxic and/or had lower maximum concentrations than benzo(a)pyrene and would have risks that are significantly less than 2E-04.

5.4.2 Sediment

Four inorganic compounds and six PAHs were retained for consideration as COPCs. As discussed in Section 2.5.3.2.3, and shown in Tables 2-12 and 2-13, the concentrations of the inorganic compounds, arsenic, cadmium, chromium, and thallium, appear to be consistent with background concentrations. Comparisons with both site-specific and MDEP background concentrations indicate that these metals range from slightly below to slightly above background depending on the concentration used in the comparison (maximum or average) and the background level (site-specific or MDEP).

In addition to the comparison to background concentrations, a worst-case evaluation of risk was also performed. The maximum detected arsenic concentration in sediment exceeds its cancer-based PRG for residential soil exposure by a factor of approximately 37, while the average concentration exceeds the PRG by a factor of 11. In a residential setting, the risk based on the maximum arsenic concentration and the conservative exposure assumptions used to calculate the PRG would be approximately 4E-05, while the risk from the average concentration would be approximately 1E-05. Because the exposure assumptions used to derive the residential soil PRGs are far more conservative than the actual sediment exposure expected to occur in the Rest of River area, the risks associated with site-specific exposure assumptions would be significantly less than 4E-05.

Cadmium, chromium, and thallium were evaluated using their respective noncancer-based PRGs for residential soil, which were reduced by a factor of 10 for screening purposes. If the PRGs were not adjusted, the maximum detected cadmium concentration would not exceed the PRG and the maximum chromium and thallium concentrations would marginally exceed the PRGs. The HQs associated with site concentrations would be less than or slightly greater than 1.0. Because the exposure assumptions used to derive the residential soil PRGs are far more conservative than the actual sediment exposure expected to occur in the Rest of River area, the hazard quotients associated with site-specific exposure assumptions would be less than 1.0.

Comparisons with both site-specific and MDEP background concentrations indicate that the six PAHs not eliminated in Section 2 range from slightly below to slightly above background depending on the concentration compared (maximum or average) and the background level (site-specific or MDEP).

In addition to the comparison to background concentrations, an evaluation of worst-case risk was also performed. Of the six PAHs that were retained for consideration, five are classified as carcinogens. Benzo(a)pyrene and dibenzo(a,h)anthracene are considered the most potent carcinogens based on their CSFs. Because benzo(a)pyrene had one of the highest maximum detected concentrations of the PAHs, risks for this contaminant were estimated. The maximum detected benzo(a)pyrene concentration in sediment exceeds its cancer-based PRG for residential soil exposure by a factor of approximately 240 while the average concentration exceeds the PRG by a factor of 16. In a residential setting, the risk based on the maximum benzo(a)pyrene concentration and the conservative exposure assumptions used to calculate the PRG would be approximately 2E-04, while the risk from the average concentration would be approximately 1E-05. Because the exposure assumptions used to derive the residential soil PRGs are far more conservative than the actual sediment exposure expected to occur in the Rest of River area, the risks associated with site-specific exposure assumptions would be significantly less than 2E-04. All of the other carcinogenic PAHs would have risks that are significantly less than 2E-04 because they lacked the carcinogenic potency and, in general, had lower concentrations.

Site concentrations of phenanthrene were evaluated using the noncancer-based PRGs for residential soil for naphthalene, which was reduced by a factor of 10 for screening purposes. If the PRG were not adjusted, the maximum detected phenanthrene concentration would not exceed the PRG. This would indicate that the HQs associated with site concentrations would be less than 1.0. Because the exposure assumptions used to derive the residential soil PRGs are far more conservative than the actual sediment exposure expected to occur in the Rest of River area, the hazard quotients associated with site-specific exposure assumptions would be significantly less than 1.0.

5.5 EXPOSURE AREA-SPECIFIC RISK ASSESSMENTS

The following sections present the risk assessments for all of the EAs evaluated as part of the direct contact risk assessment. Each risk assessment contains the following:

- A brief site description.
- A description of the current land use of the EA.
- A description of the reasonably anticipated future land use of the EA.
- A figure illustrating the specific EA and any subarea(s), if applicable.
- The exposure scenario(s) being evaluated with a brief summary of key assumptions.
- A summary of the data.
- The EPC.
- Summary tables presenting the cancer and noncancer doses and risks for both the current and reasonably anticipated future land uses.

A description of the EA and subarea-specific exposure frequencies are also presented in the EA-specific risk assessment. As noted in Section 4, this is the one exposure parameter that is based on the EA, and as such, a specific discussion of this parameter is included in each EA description. Table 4-22 presents the exposure frequencies for each exposure scenario.

Because of the large number of EAs and the size of the interpolated (spatially weighted) data sets, the raw data were not presented in tabular format. Rather, the data were written to a compact disc and included as an attachment to this report (see Attachment B.1).

The EA-specific risk assessments for Reaches 5 and 6 are presented in Section 5.5.1. Section 5.5.2 presents the risk assessments for the EAs in Reach 7. The risk assessments for sediment exposure are presented in Section 5.5.3. Figures 5-1A and 5-1B present the locations of the EAs and subareas in Reaches 5 and 6, and Reach 7, respectively, that were evaluated as part of the risk assessment. Figure 5-1C presents the locations of the sediment areas that were evaluated as part of the risk assessment

5.5.1 Reach 5 and 6 Exposure Area-Specific Risk Assessments

The following sections include a description of each of the EAs and subareas, a table(s) showing the cancer risks and hazard indices for each EA and subarea, and a figure with the following information:

- The river hydrography.
- The EA boundary and the subarea boundary (if applicable).
- The tax parcel identification number.
- The 1-ppm tPCB isopleth.
- The interpolated surface of PCB concentrations, including the areas designated wadable, difficult to access, and boatable. It should be noted that the use-weighting factors have not been applied to the interpolated PCB concentrations at the wadable, difficult to access, and boatable areas presented in the figures. The use-weighting factors were applied prior to the calculation of the EPC.
- The sampling locations.
- A table listing the activities that occur at the EA.
- A table presenting the exposure scenario(s) evaluated, the EPC(s), and summary statistics for the EA and each subarea (if applicable).
- Trails or easements.
- Delineation of areas with tPCB concentrations greater than or equal to 50 mg/kg, to indicate areas where, if exposure was not random, risks would likely be higher than those calculated with the areawide EPC. This concentration is the not-to-exceed threshold for removal actions in areas of the floodplain with recreational uses outside of Rest of River.

Table 5-1 summarizes the cancer and noncancer risks for all of the EAs and subareas in Reaches 5 and 6. The EA number, the exposure scenario(s) evaluated, the receptor(s), the land use for which the exposure scenario(s) apply, the EPC, the cancer risks, and noncancer hazard indices are presented. Figure 5-1A presents the locations of the EAs and subareas in Reaches 5 and 6 that were evaluated as part of the risk assessment.

5.5.1.1 Exposure Area 1

Exposure Area 1 consists of portions of tax parcel H6-4-5 as shown in Figure 5-2 and is approximately 14.8 acres. Tax parcel H6-4-5 is owned by the Massachusetts Division of Fisheries and Wildlife and is located just off Route 20 in Pittsfield. EA 1 is adjacent to the Confluence of the East and West Branches. There are about 10 homes located to the west less than ¼ of a mile away. There is a parking lot located to the west that provides access to the area. As shown in Figure 5-2, a utility easement runs across the northern portion of EA 1. In addition to being used by utility workers, the easement is used by individuals for recreational purposes. A significant portion of the area within the 1-ppm tPCB isopleth is in the wadable, difficult-to-access, and/or boatable accessibility classes. A smaller portion is characterized as walkable. There is little area within the 1-ppm tPCB isopleth at the southern portion of EA 1 because of a hill along the river.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include playing paintball, camping, walking, running, biking, and hiking. In addition, GE personnel observed individuals riding ATVs and dirt bikes. These activities meet the criteria for the general recreation and ATV/dirt- and mountain-bike-riding scenarios. Because the general recreation scenario would result in the higher exposure, it was evaluated for the older child and adult receptors. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 1 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 1 is considered a medium-use area. A significant portion of the area is wadable, difficult-to-access, or boatable and there is a steep bank to the river in the southern portion. There are, however, homes nearby, some trails in the area, and evidence that the area has been used for recreational activities was observed by EPA field personnel. Thus, exposure frequency (EF) values of 60 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-2. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 15 mg/kg.

Tables 5-2 and 5-3 present the cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 2E-06 and 8E-06, respectively. The total CTE cancer risk for both the older child and adult is 2E-07.

Tables 5-4 and 5-5 present the HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.38 and 0.26, respectively. The total CTE HIs for the older child and adult are 0.086 and 0.064, respectively. These cancer risks and HIs apply to both the current and future uses of EA 1.

5.5.1.2 Exposure Area 2

Exposure Area 2 consists of portions of tax parcels I6-1-41 and I6-1-27 as shown in Figure 5-3 and is approximately 31.2 acres. Tax parcels I6-1-41 and I6-1-27 are owned by the Massachusetts Division of Fisheries and Wildlife. EA 2 is adjacent to the Confluence of the East and West Branches in Pittsfield and is within ¼ of a mile of over 50 residences located to the east/northeast (several homes directly abut EA 2). There are a number of trails on this area including two maintained utility easements, as shown in Figure 5-3. In addition to being used by utility workers, the easements are used by individuals for recreational purposes. Four streets, which dead-end at EA 2, provide access to the area. The majority of EA 2 is characterized as walkable. There are portions of EA 2 that are wet for some part of the year and other portions that are difficult to access because of dense vegetation.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include hiking, walking, running, wild crop (i.e., fiddlehead fern) gathering, biking, and bird watching. EPA field personnel have also observed evidence of camping (e.g., fire pits). These activities can occur both on and off the trails and meet the criteria for the general recreation exposure scenario.

Two subareas were identified in EA 2 where activities appear to be more focused. Risks were calculated for each subarea, in addition to the entire EA. Subarea 2A is located in the northwest portion of EA 2 and is used by older children for parties, as evidenced by debris and other signs of use (e.g., fire pits). Subarea 2B is an area located near residences and trails that may be used by older children for play. The locations of these subareas are shown in Figure 5-3. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Portions of the two utility easements on EA 2 were combined and evaluated separately as EA 4 because they can readily be accessed for recreational purposes and are frequently used trails. Section 5.5.1.4 presents the risk assessment for EA 4. One of the two utility easements on EA 2 was also evaluated separately as EA 61 for worker exposure that would occur during the installation and maintenance of equipment. Section 5.5.1.61 presents the risk assessment for EA 61.

Future Use

EA 2 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses. There is the possibility that additional trails could be developed at some point in the future; however, the activities that could occur on the additional trails are not expected to differ significantly from those currently occurring at EA 2. No change is expected to the activities that currently occur within the utility easements.

5.5.1.2.1 Exposure Area 2 – Entire Area

The general recreation scenario was applied to the entire area and included the older child and adult receptors. Currently, EA 2 is considered a high-use area, based on ease of access and the observed activity. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively, for the current and future use evaluations.

The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-3. The EPC for the entire area for both the current and future uses, based on the spatially and use-weighted data, is 24 mg/kg.

Results

Table 5-6 presents the older child cancer risk estimates for the entire area. The total RME cancer risk is 2E-06. The total CTE cancer risk is 2E-07. Table 5-7 presents the adult cancer risk estimates for the entire area. The total RME cancer risk is 6E-06. The total CTE cancer risk is 2E-07. Table 5-8 presents the older child HQs and HIs for the entire area. The total RME HI is

0.31. The total CTE HI is 0.069. Table 5-9 presents the adult HQs and HIs for the entire area. The total RME HI is 0.21. The total CTE HI is 0.052.

5.5.1.2.2 Subarea 2A

The general recreation scenario was applied to subarea 2A for the older child receptor. Subarea 2A is considered a low-use subarea because it is not readily accessible because of boatable habitat that surrounds the area which reduces access. Thus, EF values of 30 and 15 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 2A were used to calculate the EPC. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-3. The EPC for subarea 2A for both the current and future uses, based on the spatially and use-weighted data, is 24 mg/kg.

Results

Table 5-10 presents the older child cancer risk estimates for subarea 2A. The total RME cancer risk is 2E-06. The total CTE cancer risk is 2E-07. Table 5-11 presents the older child HQs and HIs for subarea 2A. The total RME HI is 0.30. The total CTE HI was 0.069. These cancer risks and HIs apply to both the current and future uses of subarea 2A.

5.5.1.2.3 Subarea 2B

The general recreation scenario was applied to subarea 2B for the older child receptor. Subarea 2B is considered a high-use subarea because it is situated between walking trails that provide access to the area and it is located within close proximity of numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 2B were used to calculate the EPC. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-3. The EPC for subarea 2B for both the current and future uses, based on the spatially and use-weighted data, is 26 mg/kg.

Results

Table 5-12 presents the older child cancer risk estimates for subarea 2B. The total RME cancer risk was 7E-06. The total CTE cancer risk was 5E-07. Table 5-13 presents the older child HQs and HIs for subarea 2B. The total RME HI was 0.97. The total CTE HI was 0.15. These cancer risks and HIs apply to both the current and future uses of subarea 2B.

5.5.1.3 Exposure Area 3

Exposure Area 3 consists of a portion of tax parcel I6-1-42, as shown in Figure 5-4, and is approximately 0.4 acre. Tax parcel I6-1-42 is privately owned residential land that is located within a residential neighborhood at the end of Kenilworth Street in Pittsfield. In addition to the homes adjacent to EA 3, there are over 50 residences located within ¼ of a mile. As shown in Figure 5-4, a trail on EA 2 runs along the eastern and southern border of the area. Access to EA 3 can be gained from the trail and from Kenilworth Street. All of EA 3 is characterized as walkable.

Current Use

Although EA 3 is a portion of a privately owned residential tax parcel, it is currently used for recreational purposes. Therefore, EA 3 was evaluated using the general recreation exposure scenario for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 3 is considered to be unsuitable for future development because the majority of tax parcel I6-1-42 lies within the 10-year floodplain (approximately equivalent to the 1-ppm tPCB isopleth), making future development unlikely. Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 3 is considered a high-use area because it is located within close proximity of numerous residences, can be accessed from the trail that runs adjacent to the area, and is readily accessible from Kenilworth Street. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-4. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 8 mg/kg.

Table 5-14 presents the cancer risk estimates for the adult. The total RME cancer risk is 6E-06. The total CTE cancer risk is 1E-07. Table 5-15 presents the HQs and the total HIs for the adult. The total RME HI is 0.21. The total CTE HI is 0.034. These cancer risks and HIs apply to both the current and future uses of EA 3.

5.5.1.4 Exposure Area 4

Exposure Area 4 consists of a maintained utility easement located in Pittsfield. It runs across portions of EAs 2 (tax parcel I6-1-41), 5 (tax parcels I6-1-1 and I6-2-1), and 7 (residential tax parcels I6-3-13 and I6-3-1) as shown in Figure 5-5. It is approximately 3.2 acres in area. Both utility worker and recreational exposure occur at this area; recreational exposure is evaluated in this section and utility worker exposure is evaluated in Section 5.5.1.61. EA 4 is located within ¼ of a mile of over 50 residences. There are a number of potential access points to EA 4 including the paths from the streets that dead-end at EA 2, paths from the residential properties (tax parcels I6-3-13 and I6-3-1) that are transected by EA 4, and a path from Pomeroy Avenue located at the eastern end of the area. All of EA 4 is characterized as walkable.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include riding dirt bikes, riding ATVs, hiking, walking, dog walking, and wild crop gathering. These activities meet the criteria for the general recreation and ATV/dirt- and mountain bike-riding scenarios. Because the general recreation scenario would result in the higher exposure, it was evaluated for the young child, older child, and adult receptors. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

It is assumed that the utility easements will remain in their current locations and that the recreational use of the easements will not change in the future. Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 4 is considered a high-use area because it is a readily accessible, frequently used trail that is located within close proximity of numerous homes. Thus, for the older child and adult, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. Although young children have been observed using the trail (TER, 2003), they are not expected to use the area at the same frequency as older children and adults. The EF for the young child is 15 days/year for both the RME and CTE and applies for both the current and future uses. The data from the utility easement were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-5. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 40 mg/kg.

Tables 5-16, 5-17, and 5-18 present the cancer risk estimates for the young child, older child, and adult, respectively. The total RME cancer risks for the young child, older child, and adult were 5E-06, 1E-05, and 3E-05, respectively. The total CTE cancer risks for the young child, older child, and adult were 1E-06, 8E-07, and 6E-07, respectively.

Tables 5-19, 5-20, and 5-21 present the HQs and the total HIs for the young child, older child, and adult, respectively. The total RME HIs for the young child, older child, and adult were 1.5, 1.5, and 1.0, respectively. The total CTE HIs for the young child, older child, and adult were 0.63, 0.23, and 0.17, respectively. These cancer risks and HIs apply to both the current and future uses of the site.

5.5.1.5 Exposure Area 5

Exposure Area 5 includes portions of tax parcels I6-1-1 and I6-2-1, as shown in Figure 5-6, and is approximately 2.5 acres. Tax parcels I6-1-1 and I6-2-1 are both owned by the City of Pittsfield and are located within a residential neighborhood at the end of Noblehurst Avenue in Pittsfield. In addition to the homes that are adjacent to EA 5, there are over 50 residences located within ¼ of a mile. As shown in Figure 5-6, a maintained utility easement, the entire length of which was evaluated as EA 4, transects EA 5. Access to EA 5 can be gained from the easement and from Noblehurst Avenue. The majority of EA 5 is characterized as walkable. A small portion falls into the wadable and/or difficult-to-access accessibility classes.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include hiking, biking, bird watching, running, and dog walking. These activities can occur both on and off the trails and meet the criteria for the general recreation exposure scenario. This scenario was evaluated for the older child and adult receptors. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

A discussion with the City of Pittsfield planner indicated that there is no intention to develop or change the land use of the city-owned parcels. Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 5 is considered a high-use area because it is readily accessible from the easement that transects the area and from Noblehurst Avenue. In addition, it is located within close proximity of numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-6. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 22 mg/kg.

Tables 5-22 and 5-23 present the cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 6E-06 and 2E-05, respectively. The total CTE cancer risk the older child and adult are 4E-07 and 3E-07, respectively.

Tables 5-24 and 5-25 present the HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.83 and 0.57, respectively. The total CTE HIs for the older child and adult are 0.12 and 0.094, respectively. These cancer risks and HIs apply to both the current and future uses of EA 5.

5.5.1.6 Exposure Area 6

Exposure Area 6 consists of a small portion of tax parcel I5-1-1 as shown in Figure 5-7 and is approximately 3.8 acres. Miss Hall's School is located on tax parcel I5-1-1, which is situated along Holmes Road in Pittsfield. As shown in Figure 5-7, there is little area within the 1-ppm tPCB isopleth. This is because of a hill along the river. The majority of EA 6 is characterized as walkable. A small portion is characterized as having dense vegetation and/or inundated wetlands for some part of the year.

Current Use

Currently, EA 6 is used by Miss Hall's School for educational field trips. Groundskeepers also use a portion of the area as a dumping ground for grass clipping, leaves, and other waste material that results from the routine maintenance of the grounds. These activities meet the criteria for the general recreation and groundskeeper exposure scenarios. Because the general recreation scenario would result in the higher exposure, it was used for the risk assessment. The receptor is the adult who would lead the field trips, and as the leader, is anticipated to have the highest frequency and longest duration of exposure. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

It is reasonably anticipated that this parcel could be residentially developed in the future. Thus, the future residential scenario was evaluated for the young child and adult. A summary of the exposure assumptions for the future residential scenario is presented in Tables 4-9 through 4-11.

5.5.1.6.1 General Recreation Scenario

Currently, EA 6 is a low-use area because the field trips are assumed to occur infrequently. Thus, EF values of 30 and 15 days/year were used to calculate the exposure doses and risks for the general recreation exposure scenario for the RME and CTE scenarios, respectively. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-7. The EPC for the current use, based on the spatially and use-weighted data, is 32 mg/kg.

Results

Table 5-26 presents the cancer risk estimates for the general recreation scenario. The total RME cancer risk for the adult is 7E-06. The total CTE cancer risk for the adult is 3E-07. Table 5-27 presents the HQs and the total HIs for the general recreation scenario. The total RME HI for the adult is 0.28. The total CTE HI for the adult is 0.068. These cancer risks and HIs apply to the current uses of EA 6.

5.5.1.6.2 Future Residential Scenario

It was assumed the parcel has the potential for future residential development. The majority of the area within the 1-ppm isopleth has steep bank slopes and inundated wetlands, which would preclude future residential lawn areas. Therefore, the EF values used to calculate the exposure doses and risks for the future residential exposure scenario were 90 and 30 days/year for the RME and CTE evaluations, respectively. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-7. The EPC for the future use, based on the spatially and use-weighted data, is 32 mg/kg.

Results

Table 5-28 presents the cancer risk estimates for the future residential scenario. The total RME cancer risk is 4E-05. The total CTE cancer risk is 3E-06. Tables 5-29 and 5-30 present the HQs and the total HIs from the future residential scenario for the young child and adult, respectively. The total RME HIs for the young child and adult are 7.0 and 0.83, respectively. The total CTE HIs for the young child and adult are 1.5 and 0.18, respectively. These cancer risks and HIs apply to the future uses of EA 6.

5.5.1.7 Exposure Area 7

Exposure Area 7 consists of portions of tax parcels I6-3-13 and I6-3-1, as shown in Figure 5-8, and is approximately 5.9 acres. Tax parcels I6-3-13 and I6-3-1 are privately owned residential parcels that are located within a residential neighborhood at the end of Revilla Terrace in Pittsfield. There is a home located on tax parcel I6-3-13. In addition to the homes adjacent to EA 7, there are over 50 residences located within ¼ of a mile. As presented in Figure 5-8, a maintained utility easement, the entire length of which was evaluated as EA 4, transects EA 7. There are a number of potential access points to EA 7, including a path from tax parcel I6-3-13, the utility easement that transects the area, and a path from Pomeroy Avenue located at the eastern end of the area. The majority of EA 7 is characterized as walkable. A small portion falls into the wadable or difficult-to-access accessibility classes.

Current Use

Although EA 7 consists of privately owned residential tax parcels, it is currently used for recreational purposes. Activities observed in this area by EPA and GE personnel or consultants include hiking, walking, biking, bird watching, and other recreational activities. These activities meet the criteria for the general recreation and ATV/dirt- and mountain bike-riding scenarios and can occur both on and off the trail. Because the general recreation scenario would result in the higher exposure, it was evaluated for the older child and adult receptors. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

Future development is considered unlikely at EA 7 because a significant portion of the area is wetland. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 7 is considered a high-use area because it is readily accessible from the easement that transects the area, via a path from tax parcel I6-3-13, and from Pomeroy Avenue, and because it is located within close proximity of numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-8. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 24 mg/kg.

Tables 5-31 and 5-32 present the cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 6E-06 and 2E-05, respectively. The total CTE cancer risks for the older child and adult are 5E-07 and 4E-07, respectively.

Tables 5-33 and 5-34 present the HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.89 and 0.62, respectively. The total CTE HIs for the older child and adult are 0.13 and 0.10, respectively. These cancer risks and HIs apply to both current and future uses of EA 7.

5.5.1.8 Exposure Area 8

Exposure Area 8 consists of a portion of tax parcel J6-3-2, as shown in Figure 5-9, and is 0.60 acre. Tax parcel J6-3-2 is owned by the Massachusetts Audubon Society. It is bounded by Holmes Road in Pittsfield to the southeast and by a residential property to the west. In addition to the home adjacent to EA 8, there are numerous residences located within ¼ of a mile. All of EA 8 is characterized as walkable.

Current Use

Activities observed in this area by EPA personnel or consultants include general recreation and camping. In addition, EA 8 has been identified as a canoe/boat launch area. These activities meet the criteria for the general recreation and recreational canoeist/boater scenarios. Because the recreational canoeist/boater scenario would result in the higher exposure, it was evaluated for the older child and adult receptors. A summary of the exposure assumptions for this scenario is presented in Table 4-15.

Future Use

Because tax parcel J6-3-2 is owned by the Audubon Society, it is expected that the use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

Results

As noted in Section 4.3.5.2.4, it is assumed that older children and adults are the most likely receptors to engage in recreational canoeing/boating. As presented in Table 4-15, the EFs for the older child are 30 and 15 days/year for the RME and CTE cases, respectively. The EFs for the adult are 60 and 30 days/year for the RME and CTE cases, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-9. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 23 mg/kg.

Tables 5-35 and 5-36 present the cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 4E-06 and 2E-05, respectively. The total CTE cancer risks for the older child and adult are 7E-07 and 2E-06, respectively.

Tables 5-37 and 5-38 present the HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.54 and 0.83, respectively. The total CTE HIs for the older child and adult are 0.19 and 0.31, respectively. These cancer risks and HIs apply to both the current and future uses of EA 8.

5.5.1.9 Exposure Area 9

Exposure Area 9 consists of a small portion of tax parcel J6-2-3, as shown in Figure 5-10, and is approximately 0.04 acre. Tax parcel J6-2-3 is a privately owned residential parcel that is located in a residential neighborhood along Holmes Road in Pittsfield. There is a home located on this parcel and there are numerous residences located within ¼ of a mile. The parking lot and entrance to the Canoe Meadows Wildlife Sanctuary are located on the opposite side of Holmes. This area was characterized as having a steep slope to the river composed of cobble and rocks.

Current Use

Although EA 9 is a portion of a privately owned residential tax parcel, it is currently used for recreational purposes. It is assumed that the riverbank can be used by older children for play. Therefore, EA 9 was evaluated using the general recreation exposure scenario for the older child receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 9 is considered to be unsuitable for future development because it consists of a small portion of tax parcel J6-2-3 that is characterized as having a steep slope. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 9 is considered a low-use area because it is composed solely of a small, narrow strip of land with a steep slope (or erosional bank) and the presence of a well-known recreational area nearby (i.e., Canoe Meadows). Thus, EF values of 30 and 15 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-10. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 15 mg/kg.

Table 5-39 presents the cancer risk estimates for the older child. The total RME cancer risk is 1E-06. The total CTE cancer risk is 1E-07. Table 5-40 presents the HQs and the total HIs for the older child. The total RME HI is 0.19. The total CTE HI is 0.043. These cancer risks and HIs apply to both the current and future uses of EA 9.

5.5.1.10 Exposure Area 10

Exposure Area 10 consists of a portion of tax parcel J6-4-2, as shown in Figure 5-11, and is approximately 67.0 acres. Tax parcel J6-4-2 is the location of the Canoe Meadows Wildlife Sanctuary, a well-known recreational area located along Holmes Road in Pittsfield, that is owned by the Massachusetts Audubon Society. There are numerous residences within close proximity. Approximately 3 miles of trails currently wind through the woods, fields, and wetlands, and along the edge of the Housatonic River. There is a parking lot at the entrance to the sanctuary that provides parking for several vehicles. The majority of EA 10 is characterized as walkable. Smaller portions are in the wadable, difficult-to-access, and boatable accessibility classes.

Current Use

Activities observed in this area by EPA personnel or consultants include hiking, bird watching, biking, and cross-country skiing. These activities meet the criteria for the general recreation and ATV/dirt- and mountain bike-riding scenarios. Because the general recreation scenario would result in the higher exposure, it was evaluated for EA 10. A subarea was identified in EA 10 where activities appear to be more intensive. Subarea 10A, shown in Figure 5-11, consists of the trail network. Risks were calculated for the subarea, in addition to the entire EA. Because Canoe Meadows is a well-known and frequently used recreational area, the young child and adult receptors were evaluated. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

Because tax parcel J6-4-2 is owned by the Audubon Society, it is expected that the use will not change in the future (i.e., it will remain recreational). There is the possibility that additional trails could be developed at some point in the future; however, the activities that could occur on the additional trails are not expected to differ significantly from those currently occurring at Canoe Meadows.

5.5.1.10.1 Exposure Area 10 – Entire Area

EA 10 is considered a high-use area because it is a well-known, frequently used recreational area with an extensive trail network that is adjacent to several residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-11. The EPC for the entire area for both the current and future uses, based on the spatially and use-weighted data, is 14 mg/kg.

Results

Table 5-41 presents the young child cancer risk estimates for the entire area. The total RME cancer risk is 1E-05. The total CTE cancer risk is 8E-07. Table 5-42 presents the adult cancer risk estimates for the entire area. The total RME cancer risk is 1E-05. The total CTE cancer risk is 2E-07. Table 5-43 presents the young child HQs and HIs for the entire area. The total RME HI is 3.1. The total CTE HI is 0.45. Table 5-44 presents the adult HQs and HIs for the entire area. The total RME HI is 0.37. The total CTE HI is 0.061. These cancer risks and HIs apply to both the current and future uses of EA 10.

5.5.1.10.2 Subarea 10A

Subarea 10A is considered a high-use area because it consists of readily accessible trails that are frequently used and because of the popularity of Canoe Meadows as a recreational venue. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 10A were used to calculate the EPC. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-11. The EPC for subarea 10A for both the current and future uses, based on the spatially and use-weighted data, is 53.1 mg/kg.

Results

Table 5-45 presents the young child cancer risk estimates for subarea 10A. The total RME cancer risk is 4E-05. The total CTE cancer risk is 3E-06. Table 5-46 presents the adult cancer risk estimates for subarea 10A. The total RME cancer risk is 4E-05. The total CTE cancer risk is 8E-07. Table 5-47 presents the young child HQs and HIs for subarea 10A. The total RME HI is 12. The total CTE HI is 1.7. Table 5-48 presents the adult HQs and HIs for subarea 10A. The total RME HI is 1.4. The total CTE HI is 0.23. These cancer risks and HIs apply to both the current and future uses of subarea 10A.

5.5.1.11 Exposure Area 11

Exposure Area 11 consists of a portion of tax parcel J5-2-110, as shown in Figure 5-12, and is approximately 2.5 acres. Tax parcel J5-2-110 is owned by the Massachusetts Division of Fisheries and Wildlife. It is located along Holmes Road in Pittsfield and is adjacent to some, and within ¼ mile of numerous other, residences situated to the west. A portion of EA 11 consists of a maintained utility easement that can be readily accessed from Holmes Road at the northern end of the area. In addition to being used by utility workers, the easement is used by individuals for recreational purposes. All of EA 11 is characterized as walkable.

Current Use

Activities observed in this area by EPA personnel or consultants include hiking, bird watching, dog walking, and biking. These activities meet the criteria for the general recreation and ATV/dirt- and mountain bike-riding scenarios. Because the general recreation scenario would result in the higher exposure, it was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

The portion of the utility easement on EA 11 was evaluated separately as EA 12 because it can be readily accessed for recreational purposes and is a frequently used trail. Section 5.5.1.12 presents the risk assessment for EA 12.

Future Use

EA 11 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 11 is considered a high-use area because it is readily accessible from the easement that runs through the area, from Holmes Road, and from the nearby residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-12. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 21 mg/kg.

Table 5-49 presents the cancer risk estimates for the adult. The total RME cancer risk is 1E-05. The total CTE cancer risk is 3E-07. Table 5-50 presents the HQs and the total HIs for the adult. The total RME HI is 0.55. The total CTE HI is 0.090. These cancer risks and HIs apply to both the current and future uses of EA 11.

5.5.1.12 Exposure Area 12

Exposure Area 12 consists of two maintained utility easements located in Pittsfield that begin at Holmes Road and extend downstream to the Pittsfield wastewater treatment plant (WWTP), a distance of about 1½ miles. Both easements include underground pipes. The first easement runs north/south and crosses portions of numerous state-owned and privately owned areas including EAs 11, 13, 16, 17, 19, 23, 24, and 26 as shown in Figure 5-13. The second easement extends east/west and crosses EA 20, a state-owned area. Both utility worker and recreational exposure occur at this area; recreational exposure is evaluated in this EA because it would result in the higher exposure. Utility worker exposure on the second easement is evaluated in Section 5.5.1.63; the concentrations on the first easement are below levels of concern for the worker; therefore, this easement was not evaluated quantitatively for worker exposure. EA 12 is located within ¼ of a mile of numerous residences. There are a number of potential access points to EA 12, including the entrance from Holmes Road, the paths from the residential properties that are transected by EA 12, and the paths by the WWTP at the southern end of the easement. All of EA 12 is characterized as walkable.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include riding dirt bikes, riding ATVs, walking, hiking, biking, dog walking, and wild crop gathering. These activities meet the criteria for the general recreation and ATV/dirt- and mountain bike-riding scenarios. Because the general recreation scenario would result in the higher exposure, it was evaluated for the young child, older child, and adult receptors. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

It is assumed that the utility easements will remain in their current locations and that the recreational use of the easements will not change in the future. Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 12 is considered a high-use area because it is a readily accessible, frequently used trail that is located within close proximity of numerous residences. Thus, for the older child and adult, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. Although young children have been observed using the trail (TER, 2003), they are not expected to use the area at the same frequency as the older child and adult. The EF for the young child is 15 days/year for both the RME and CTE and applies for both the current and future uses. The data from within the utility easements were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-13. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 9 mg/kg.

Tables 5-51, 5-52, and 5-53 present the cancer risk estimates for the young child, older child, and adult, respectively. The total RME cancer risks for the young child, older child, and adult are 1E-06, 2E-06, and 6E-06, respectively. The total CTE cancer risks for the young child, older child, and adult are 2E-07, 2E-07, and 1E-07, respectively.

Tables 5-54, 5-55, and 5-56 present the HQs and the total HIs for the young child, older child, and adult, respectively. The total RME HIs for the young child, older child, and adult are 0.31, 0.32, and 0.22, respectively. The total CTE HIs for the young child, older child, and adult are 0.14, 0.049, and 0.037, respectively. These cancer risks and HIs apply to both the current and future uses of EA 12.

5.5.1.13 Exposure Area 13

Exposure Area 13 consists of a portion of tax parcel J5-2-105, as shown in Figure 5-14, and is approximately 6.0 acres. Tax parcel J5-2-105 is owned by the Massachusetts Division of Fisheries and Wildlife. It is located off Holmes Road in Pittsfield and is within ¼ mile of numerous residences situated to the west (two homes directly abut EA 13). As presented in Figure 5-14, a portion of EA 13 consists of a maintained utility easement that is readily accessible from Holmes Road at the northern end of the area. In addition to being used by utility workers, the easement is used by individuals for recreational purposes. Approximately half of EA 13 is characterized as walkable. The remaining portion is considered wadable and/or difficult-to-access.

Current Use

Activities observed in this area by EPA personnel or consultants include hiking, bird watching, dog walking, and biking. These activities meet the criteria for the general recreation and ATV/dirt- and mountain bike-riding scenarios. Because the general recreation scenario would result in the higher exposure, it was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

The portion of the utility easement on EA 13 was evaluated separately as EA 12 because it can be readily accessed for recreational purposes and is used frequently. Section 5.5.1.12 presents the risk assessment for EA 12.

Future Use

EA 13 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 13 is considered a high-use area because it is readily accessible from the easement that runs through the area, from Holmes Road, and from the nearby residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-14. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 18 mg/kg.

Table 5-57 presents the cancer risk estimates for the adult. The total RME cancer risk is 1E-05. The total CTE cancer risk is 3E-07. Table 5-58 presents the HQs and the total HIs for the adult. The total RME HI is 0.47. The total CTE HI is 0.077. These cancer risks and HIs apply to both the current and future uses of EA 13.

5.5.1.14 Exposure Area 14

Exposure Area 14 consists of a portion of tax parcel J5-2-5, as shown in Figure 5-15, and is approximately 4.1 acres. Tax parcel J5-2-5 is a privately owned residential parcel that is located within a residential neighborhood along Holmes Road in Pittsfield. There is a home located on this tax parcel, and there are numerous residences located within ¼ of a mile. Access to EA 14 can be gained from Holmes Road and from the nearby residences. The majority of EA 14 falls into the wadable and/or difficult-to-access accessibility classes. A small area is characterized as walkable.

Current Use

Although EA 14 is a portion of a privately owned residential tax parcel, general recreation-related activities currently occur at this area. Thus, EA 14 was evaluated using the general recreation exposure scenario for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

This area is assumed to be undevelopable because much of EA 14 consists of inundated wetlands, which would make future development unlikely. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 14 is considered a high-use area because there is a home present on the tax parcel and because it is readily accessible from Holmes Road and the nearby residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-15. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 5 mg/kg.

Table 5-59 presents the cancer risk estimates for the adult. The total RME cancer risk is 3E-06. The total CTE cancer risk is 8E-08. Table 5-60 presents the HQs and the total HIs for the adult. The total RME HI is 0.13. The total CTE HI is 0.021. These cancer risks and HIs apply to both the current and future uses of EA 14.

5.5.1.15 Exposure Area 15

Exposure Area 15 consists of tax parcel J5-2-6, as shown in Figure 5-16, and is approximately 0.9 acre. Tax parcel J5-2-6 is owned by the Massachusetts Division of Fisheries and Wildlife and is located along Holmes Road in Pittsfield within ¼ mile of numerous residences (a home directly abuts EA 15). Access to EA 15 can be gained from Holmes Road and nearby residences. The majority of EA 15 falls into the wadable and/or difficult-to-access accessibility classes. A small portion is considered walkable.

Current Use

General recreation-related activities currently occur at this area. Thus, EA 15 was evaluated using the general recreation exposure scenario for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 15 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 15 is considered a high-use area because it is readily accessible from Holmes Road and the nearby residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-16. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 6.9 mg/kg.

Table 5-61 presents the cancer risk estimates for the adult. The total RME cancer risk is 5E-06. The total CTE cancer risk is 1E-07. Table 5-62 presents the HQs and the total HIs for the adult. The total RME HI is 0.18. The total CTE HI is 0.030. These cancer risks and HIs apply to both the current and future uses of EA 15.

5.5.1.16 Exposure Area 16

Exposure Area 16 consists of a portion of tax parcel J5-2-11, as shown in Figure 5-17, and is approximately 2.5 acres. Tax parcel J5-2-11 is a privately owned residential parcel that is located along Holmes Road in Pittsfield within a residential neighborhood (several homes abut this area). There is a home located on tax parcel J5-2-11 and there are numerous residences located within ¼ of a mile. As presented in Figure 5-17, a maintained utility easement marks the northwestern border of EA 16. Access to EA 16 can be gained from the utility easement and the nearby homes.

Current Use

Although EA 16 is a portion of a privately owned residential tax parcel, general recreation-related activities currently occur at this area. Thus, EA 16 was evaluated using the general recreation exposure scenario for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 16 was assumed to be unsuitable for development because much of the area consists of seasonally inundated wetlands. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 16 is considered a high-use area because it is readily accessible from the utility easement and nearby residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-17. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 48 mg/kg.

Table 5-63 presents the cancer risk estimates for the adult. The total RME cancer risk is 3E-05. The total CTE cancer risk is 8E-07. Table 5-64 presents the HQs and the total HIs for the adult. The total RME HI is 1.2. The total CTE HI is 0.21. These cancer risks and HIs apply to both the current and future uses of EA 16.

5.5.1.17 Exposure Area 17

Exposure Area 17 consists of a portion of tax parcel J5-2-4, as shown in Figure 5-18, and is approximately 8.5 acres. Tax parcel J5-2-4 is a privately owned residential parcel that is located within a residential neighborhood along Holmes Road in Pittsfield. There is a home located on tax parcel J5-2-4, and there are numerous residences situated to the west within ¼ of a mile. The western portion of EA 17 consists of a maintained utility easement. In addition to being used by utility workers, the easement is used by individuals for recreational purposes. Access to EA 17 can be gained from the utility easement and the nearby homes.

Current Use

Although EA 17 is a portion of a privately owned residential tax parcel, it is assumed that general recreation-related activities currently occur at this area. Thus, EA 17 was evaluated using the general recreation exposure scenario for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

The portion of the utility easement on EA 17 was evaluated separately as EA 12 because it can be readily accessed for recreational purposes and is frequently used. Section 5.5.1.12 presents the risk assessment for EA 12.

Future Use

EA 17 was assumed to be unsuitable for development because much of this area consists of seasonally inundated wetlands. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 17 is considered a high-use area because it is readily accessible from the easement and nearby residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-18. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 26 mg/kg.

Table 5-65 presents the cancer risk estimates for the adult. The total RME cancer risk is 2E-05. The total CTE cancer risk is 4E-07. Table 5-66 presents the HQs and the total HIs for the adult. The total RME HI is 0.68. The total CTE HI is 0.11. These cancer risks and HIs apply to both the current and future uses of EA 17.

5.5.1.18 Exposure Area 18

Exposure Area 18 consists of a portion of tax parcel K4-6-28, as shown in Figure 5-19, and is approximately 17.2 acres. Tax parcel K4-6-28 is privately owned and is located along East New Lenox Road in Pittsfield. There are numerous homes within ½ of a mile to the south. The eastern half of EA 18 is characterized as walkable. Much of the western half falls into the wadable, difficult-to-access, and/or boatable accessibility classes.

Current Use

Currently, tax parcel K4-6-28 is used for agricultural and general recreation-related activities. Much of the agricultural activity occurs outside of the 1-ppm isopleth. Because of this, EA 18 was evaluated using the general recreation scenario for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

It is reasonably anticipated that this parcel can be developed residentially in the future. Thus, the future residential scenario was evaluated for the young child and adult. A summary of the exposure assumptions for the future residential scenario is presented in Tables 4-9 through 4-11.

5.5.1.18.1 General Recreation

Currently, EA 18 is considered a medium-use area because a portion of EA 18 is accessible from a trail that runs through the eastern portion of the area; however, an active farm is located between EA 18 and the residential area. Thus, EF values of 60 and 30 days/year were used to calculate the exposure doses and risk for the general recreation exposure for the RME and CTE evaluations, respectively. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-19. The EPC for the current uses, based on the spatially and use-weighted data, is 43 mg/kg.

Results

Table 5-67 presents the cancer risk estimates for the adult based on the general recreation scenario. The total RME cancer risk is 2E-05. The total CTE cancer risk is 7E-07. Table 5-68 presents the HQs and the total HIs for the adult based on the general recreation scenario. The total RME HI is 0.75. The total CTE HI is 0.18. These cancer risks and HIs apply to the current uses of EA 18.

5.5.1.18.2 Future Residential

It was assumed the parcel had the potential for future residential development. Therefore, the EF values used to calculate the exposure doses and risks for the future residential exposure scenario were 150 days/year for both the RME and CTE evaluations. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-19. The EPC for the future uses, based on the spatially and use-weighted data, 43 mg/kg, is the same as for current uses.

Results

Table 5-69 presents the cancer risk estimates from the future residential scenario. The total RME cancer risk is 1E-04. The total CTE cancer risk is 2E-05. Tables 5-70 and 5-71 present the HQs and the total HIs from the future residential scenario for the young child and adult, respectively. The total RME HIs for the young child and adult are 15.9 and 1.8, respectively. The total CTE HIs for the young child and adult are 10.0 and 1.25, respectively. These cancer risks and HIs apply to the future uses of EA 18.

5.5.1.19 Exposure Area 19

Exposure Area 19 consists of tax parcel J4-3-13, as shown in Figure 5-20, and is approximately 35.7 acres. Tax parcel J4-3-13 is located off Holmes Road in Pittsfield and is owned by the Massachusetts Division of Fisheries and Wildlife. EA 19 is bounded by residential properties to the north, west, and southwest. As presented in Figure 5-20, two utility easements run across the area. The first, a maintained easement, extends north/south and marks the western boundary of the area. The second extends east and west across the area. The majority of EA 19 is characterized as walkable. A smaller portion falls into the wadable, difficult-to-access, and boatable accessibility classes.

Current Use

Activities observed in this area by EPA personnel or consultants include general recreation-related activities. Thus, the general recreation scenario was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

As noted in Figure 5-20, two utility easements are located on EA 19. The portion of the easement along the western boundary was evaluated separately as EA 12 because it can be readily accessed for recreational purposes and is a frequently used trail. Section 5.5.1.12 presents the risk assessment for EA 12. Utility worker exposure could occur along the easement that extends east and west, which is identified as EA 62. Section 5.5.1.62 presents the risk assessment for EA 62.

Future Use

EA 19 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 19 is considered a high-use area because it is readily accessible from the easements that run through the area and by its proximity to residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-20. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 76 mg/kg.

Table 5-72 presents the cancer risk estimates for the adult. The total RME cancer risk is 5E-05. The total CTE cancer risk is 1E-06. Table 5-73 presents the HQs and the total HIs for the adult.

The total RME HI is 2.0. The total CTE HI is 0.32. These cancer risks and HIs apply to the current and future uses of EA 19.

5.5.1.20 Exposure Area 20

Exposure Area 20 consists of tax parcel J4-3-12, as shown in Figure 5-21, and is approximately 9.1 acres. Tax parcel J4-3-12 is located off Holmes Road in Pittsfield and is owned by the Massachusetts Division of Fisheries and Wildlife. It is bounded by a state-owned property to the north and numerous residential properties to the west, several of which directly abut EA 20. As presented in Figure 5-21, two maintained utility easements cross the area. The first extends north and south and marks the western boundary of the area. The second extends east and west and marks the northern border of the area. Approximately half of EA 20 is characterized as walkable. The remaining area is wadable, difficult-to-access, and/or boatable.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include walking, hiking, running and other general recreation-related activities. Thus, the general recreation scenario was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

The portion of the easements on EA 20 was evaluated separately as EA 12 because it can be readily accessed for recreational purposes and is a frequently used trail. Section 5.5.1.12 presents the risk assessment for EA 12. In addition to the recreational activities, utility worker exposure would occur during the installation and maintenance of equipment on the utility easements. Section 5.5.1.63 presents the risk assessment for the utility worker exposure at this location.

Future Use

EA 20 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 20 is considered a high-use area because it is readily accessible from the easements that run through the area and by the proximity of residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-21. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 28 mg/kg.

Table 5-74 presents the cancer risk estimates for the adult. The total RME cancer risk is 2E-05. The total CTE cancer risk is 4E-07. Table 5-75 presents the HQs and the total HIs for the adult. The total RME HI is 0.73. The total CTE HI is 0.12. These cancer risks and HIs apply to the current and future uses of EA 20.

5.5.1.21 Exposure Area 21

Exposure Area 21 consists of the agricultural portion of tax parcel J3-2-1, as shown in Figure 5-22. Tax parcel J3-2-1 is located off East New Lenox Road in Pittsfield and is privately owned. There are numerous residences located to the east (several directly abut parcel J3-2-1). All of EA 21 is considered to be walkable.

Current Use

There are two types of use currently occurring on tax parcel J3-2-1: agricultural and recreational. The portion currently being used for agricultural was delineated and identified as EA 21. The farmer scenario was applied to this area. The remaining area that is not used for agricultural purposes was identified as EA 22 and is used for recreational purposes. The risk assessment for

EA 22 is presented in Section 5.5.1.22. Figure 5-22 shows both of these exposure areas. A summary of the exposure assumptions for the farmer scenario is presented in Table 4-19.

Future Use

Potential future residential development was considered possible on tax parcel J3-2-1, which includes EAs 21 and 22. Thus, these EAs were combined and the future residential scenario was evaluated for the young child and adult receptors. A summary of the exposure assumptions for the future residential scenario is presented in Tables 4-9 through 4-11.

5.5.1.21.1 Farmer Scenario

As presented in Table 4-19, the EFs for the farmer scenario are 40 and 10 days/year for the RME and CTE scenarios, respectively. The data from the cultivated area were used to calculate the EPC for the farmer exposure. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-22. The EPC for the current use, based on the spatially and use-weighted data, is 4 mg/kg.

Results

Table 5-76 presents the cancer risk estimates for the farmer. The total RME cancer risk is 3E-06. The total CTE cancer risk is 1E-07. Table 5-77 presents the HQs and the total HIs for the farmer. The total RME HI is 0.094. The total CTE HI is 0.012. These cancer risks and HIs apply to the current uses of EA 21.

5.5.1.21.2 Future Residential Scenario

It was assumed that tax parcel J3-2-1 (EAs 21 and 22 combined) had the potential for future residential development, including future residential lawn areas. Therefore, the EF value used to calculate the exposure doses and risks for the future residential exposure scenario was 150 days/year for both the RME and CTE evaluations. The data from the entire tax parcel were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-22. The EPC for the future use, based on the spatially and use-weighted data, is 25 mg/kg.

Results

Table 5-78 presents the cancer risk estimates from the future residential scenario. The total RME cancer risk is 6E-05. The total CTE cancer risk is 1E-05. Tables 5-79 and 5-80 present the HQs and the total HIs from the future residential scenario for the young child and adult, respectively. The total RME HIs for the young child and adult are 9.1 and 1.1, respectively. The total CTE HIs for the young child and adult are 5.7 and 0.72, respectively. These cancer risks and HIs apply to the future uses of tax parcel J3-2-1.

5.5.1.22 Exposure Area 22

Exposure Area 22 consists of the non-agricultural portion of tax parcel J3-2-1, as shown in Figure 5-22. Tax parcel J3-2-1 is located off East New Lenox Road in Pittsfield and is privately owned. There are a number of residences situated within ¼ mile to the east, several of which directly abut tax parcel J3-2-1. As presented in Figure 5-22, dirt-bike riding trails are located in the northern portion of EA 22. Approximately half of EA 22 is characterized as walkable. The remaining portions are characterized as wadable and/or difficult-to-access.

Current Use

There are two types of uses currently occurring on tax parcel J3-2-1: agricultural and recreational. The farmer scenario evaluated the portion of tax parcel J3-2-1 that is currently used for agricultural purposes and is presented in Section 5.5.1.21. The remaining area that is not used for agricultural purposes is used for recreational purposes. Activities observed in this area by EPA personnel or consultants include hunting (nonwaterfowl), walking, riding dirt bikes, and riding ATVs. These activities meet the criteria for the general recreation and ATV/dirt- and mountain bike-riding scenarios. The general recreation scenario was evaluated for the entire area for the older child and adult receptors. The ATV/dirt- and mountain bike-riding scenario was applied to the dirt bike and ATV trails, which were designated as subarea 22A. A summary of the exposure assumptions for the general recreation and ATV/dirt- and mountain bike-riding scenarios are presented in Tables 4-12 and 4-13, respectively.

Future Use

Potential future residential development was considered possible at tax parcel J3-2-1, which includes EAs 21 and 22. The future residential scenario is evaluated in Section 5.5.1.21.

5.5.1.22.1 Exposure Area 22 – Entire Area

Currently, EA 22 is considered a high-use area because it is readily accessible from the trails that run through the northern portion of the area and is located within close proximity of numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-22. The EPC for the current uses, based on the spatially and use-weighted data, is 29 mg/kg.

Results

Tables 5-81 and 5-82 present the general recreation cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 7E-06 and 2E-05, respectively. The total CTE cancer risks for the older child and adult are 6E-07 and 5E-07, respectively.

Tables 5-83 and 5-84 present the general recreation HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 1.1 and 0.75, respectively. The total CTE HIs for the older child and adult are 0.16 and 0.12, respectively. These cancer risks and HIs apply to the current uses of EA 22.

5.5.1.22.2 Subarea 22A

As presented in Table 4-13, the EFs for the ATV/dirt- and mountain bike-riding scenario are 90 and 30 days/year for the RME and CTE scenarios, respectively. The data from subarea 22A were used to calculate the EPC for the ATV/dirt- and mountain bike-riding exposure scenario. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-22. The EPC for the current uses, based on the spatially and use-weighted data, is 61 mg/kg.

Results

Table 5-85 presents the cancer risk estimates for the dirt bike rider. The total RME cancer risk is 3E-05. The total CTE cancer risk is 2E-06. Table 5-86 presents the HQs and the total HIs for the dirt bike rider. The total RME HI is 4.3. The total CTE HI is 0.61. These cancer risks and HIs apply to the current uses of subarea 22A.

5.5.1.23 Exposure Area 23

Exposure Area 23 consists of small portions of tax parcels J3-1-11, J3-1-12, J3-1-13, and J3-1-14 as shown in Figure 5-23 and is approximately 0.28 acre. These tax parcels are privately owned residential parcels that are located in a residential neighborhood along Palomino Drive in Pittsfield. There are residences located on each of these tax parcels. As presented in Figure 5-23, a maintained utility easement runs north/south along this area outside of the 1-ppm tPCB isopleth. This area is narrow, with a steep slope to the river as evidenced by the lack of area within the 1-ppm tPCB isopleth.

Current Use

Although EA 23 is a portion of privately owned residential tax parcels, it is currently used for recreational purposes. It is assumed that the riverbank can be used by older children for play. Therefore, EA 23 was evaluated using the general recreation exposure scenario for the older child receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 23 is considered to be unsuitable for future development because it consists of small portions of tax parcels J3-1-11, J3-1-12, J3-1-13, and J3-1-14 that are characterized as having a steep slope to the river. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 23 is considered a medium-use area because of the steep slope to the river and the narrow area in the floodplain. Thus, EF values of 60 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-23. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 12 mg/kg.

Table 5-87 presents the cancer risk estimates for the older child. The total RME cancer risk is 2E-06. The total CTE cancer risk is 2E-07. Table 5-88 presents the HQs and the total HIs for the older child. The total RME HI is 0.30. The total CTE HI is 0.068. These cancer risks and HIs apply to both the current and future uses of EA 23.

5.5.1.24 Exposure Area 24

Exposure Area 24 consists of a portion of tax parcels J3-1-6 and J3-1-7, as shown in Figure 5-24, and is approximately 10.3 acres. Tax parcels J3-1-6 and J3-1-7 are located off Palomino Drive in Pittsfield and are owned by the Massachusetts Division of Fisheries and Wildlife. There are a number of residences situated to the northwest within ¼ of a mile, several of which directly abut tax parcel J3-1-7. As presented in Figure 5-24, a maintained utility easement marks the western portion of this area. Access to EA 24 can be gained from the utility easement. More than half of EA 24 is characterized as walkable. The remaining area is wadable and/or difficult-to-access.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include hunting (nonwaterfowl) and general recreation-related activities. These activities can occur both on and off trails. Thus, the general recreation exposure scenario was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

The portion of the utility easement on EA 24 was evaluated separately as EA 12 because it can be readily accessed for recreational purposes and is frequently used. Section 5.5.1.12 presents the risk assessment for EA 12.

Future Use

EA 24 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 24 is considered a high-use area because it is readily accessible from the utility easement and it is within close proximity of numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-24. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 29 mg/kg.

Table 5-89 presents the cancer risk estimates for the adult. The total RME cancer risk is 2E-05. The total CTE cancer risk is 5E-07. Table 5-90 presents the HQs and the total HIs for the adult. The total RME HI is 0.75. The total CTE HI is 0.12. These cancer risks and HIs apply to both the current and future uses of EA 24.

5.5.1.25 Exposure Area 25

Exposure Area 25 consists of a small portion of tax parcels J3-2-2, J3-2-3, J3-2-4, J3-2-5, and J3-2-6, as shown in Figure 5-25, and is approximately 0.51 acre. These tax parcels are privately owned residential parcels that are located in a heavily developed residential neighborhood along Joseph Drive in Pittsfield. There are residences located on each of these tax parcels. A portion of this area has a steep slope to the river as evidenced by the lack of area within the 1-ppm tPCB isopleth. All of EA 25 is characterized as walkable.

Current Use

Although EA 25 is a portion of privately owned residential tax parcels, it is currently used for recreational purposes. It is assumed that the riverbank can be used by older children for play and other general recreation activities. Therefore, EA 25 was evaluated using the general recreation exposure scenario for the older child receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 25 is considered to be unsuitable for future development because it consists of a small portion of tax parcels J3-2-2, J3-2-3, J3-2-4, J3-2-5, and J3-2-6 that is characterized as having steep slopes. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 25 is considered a high-use area because it is readily accessible from several nearby residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-25. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 44 mg/kg.

Table 5-91 presents the cancer risk estimates for the older child. The total RME cancer risk is 1E-05. The total CTE cancer risk is 9E-07. Table 5-92 presents the HQs and the total HIs for the older child. The total RME HI is 1.7. The total CTE HI is 0.25. These cancer risks and HIs apply to both the current and future uses of EA 25.

5.5.1.26 Exposure Area 26

Exposure Area 26 consists of a portion of tax parcel J2-2-2, as shown in Figure 5-26, and is approximately 63.0 acres. Tax parcel J2-2-2 is owned by the Commonwealth of Massachusetts Division of Fisheries and Wildlife and is located just north of the City of Pittsfield WWTP. There are residences located within ½ of a mile to the north/northwest. As shown in Figure 5-26, a maintained utility easement runs across the western portion of this area. In addition, a network of trails, most of which are outside of the 1-ppm tPCB isopleth, is located on tax parcel J2-2-2. The majority of the area is classified as walkable but there are areas that are characterized as wadable, difficult-to-access, and boatable.

Current Use

Currently, tax parcel J2-2-2 is used for agricultural and recreational purposes. Activities observed in this area by EPA and GE personnel or consultants include hunting (nonwaterfowl), walking, hiking, running, riding ATVs and dirt bikes, and farming. In addition, GE personnel or consultants have observed individuals playing paintball and horseback riding. These activities meet the criteria for the general recreation, ATV/dirt- and mountain bike-riding, and farming scenarios.

This EA was divided into two subareas based on the different activities that occur in each area. The first, designated as subarea 26A, consists of the area that is used for recreational activities. Because the general recreation scenario would result in the higher exposure, it was applied to Subarea 26A for the older child and adult receptors. The second subarea, designated as subarea 26B, consists of the portion of EA 26 that is currently used for agricultural purposes. The farmer scenario was used to evaluate this area. Figure 5-26 presents the location of subareas 26A and 26B. A summary of the exposure assumptions for the general recreation and the farmer scenarios are presented in Tables 4-12 and 4-19, respectively.

Future Use

EA 26 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and

Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.26.1 Subarea 26A (General Recreation Scenario)

Currently, subarea 26A is considered a high-use area because it is readily accessible from easements and trails that run through the area, and it is located within close proximity of residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The data from subarea 26A were used to calculate the EPC. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-26. The EPC for the current use, based on the spatially and use-weighted data, is 6 mg/kg.

Results

Tables 5-93 and 5-94 present the general recreation cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 2E-06 and 4E-06, respectively. The total CTE cancer risks for the older child and adult are 1E-07 and 9E-08, respectively.

Tables 5-95 and 5-96 present the general recreation HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.23 and 0.16, respectively. The total CTE HIs for the older child and adult are 0.034 and 0.026, respectively. These cancer risks and HIs apply to the current use of subarea 26A.

5.5.1.26.2 Subarea 26B (Farmer Scenario)

As shown in Table 4-19, the EFs for the farmer scenario are 40 and 10 days/year for the RME and CTE scenarios, respectively. The data from subarea 26B were used to calculate the EPC for the farmer exposure. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-26. The EPC for the current use, based on the spatially and use-weighted data, is 2 mg/kg.

Results

Table 5-97 presents the cancer risk estimates for the farmer. The total RME cancer risk is 2E-06. The total CTE cancer risk is 5E-08. Table 5-98 presents the HQs and the total HIs for the farmer. The total RME HI is 0.047. The total CTE HI is 0.0058. These cancer risks and HIs apply to the current use of subarea 26B.

5.5.1.26.3 Exposure Area 26 – Entire Area

In the future, EA 26 is assumed to be a high-use area because it is readily accessible from easements and trails the run through the area and it is located within close proximity of residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The data from the EA were used to calculate the EPC. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-26. The EPC for the future uses, based on the spatially and use-weighted data, is 5 mg/kg.

Results

Tables 5-99 and 5-100 present the general recreation cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 1E-06 and 4E-06, respectively. The total CTE cancer risks for the older child and adult are 1E-07 and 8E-08, respectively.

Tables 5-101 and 5-102 present the general recreation HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.20 and 0.14, respectively. The total CTE HIs for the older child and adult are 0.030 and 0.022, respectively. These cancer risks and HIs apply to the future use of EA 26.

5.5.1.27 Exposure Area 27

Exposure Area 27 consists of a portion of tax parcel K3-1-19, as shown in Figure 5-27, and is approximately 6.7 acres. Tax parcel K3-1-19 is located off Joseph Drive in Pittsfield and is owned by the City of Pittsfield. It is bounded by numerous residences to the north and east.

There is a maintained trail from Joseph Drive that provides access to the area. The majority of EA 27 is classified as walkable with a smaller portion characterized as wadable and/or difficult-to-access.

Current Use

Activities observed in this area by EPA personnel or consultants include hiking and riding dirt bikes. EPA field personnel have also observed evidence of campfires (e.g., fire pits). These activities meet the criteria for the general recreation and ATV/dirt- and mountain bike-riding exposure scenarios. The general recreation scenario was evaluated for the entire area for the older child and adult receptors. The ATV/dirt- and mountain bike-riding scenario was evaluated for the dirt bike and ATV trails, which were designated as subarea 27A. Summaries of the exposure assumptions for the general recreation and ATV/dirt- and mountain bike-riding scenarios are presented in Tables 4-12 and 4-13, respectively.

Future Use

A discussion with the City of Pittsfield planner indicated that the use of tax parcel K3-1-19 will not change in the future (i.e., it will remain recreational). Thus, the exposure scenarios identified above also reflect the likely future uses.

5.5.1.27.1 Exposure Area 27 – Entire Area

EA 27 is considered a high-use area because it is readily accessible from a trail that runs through the area and it is located within close proximity of numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-27. The EPC for both the current and future use, based on the spatially and use-weighted data, is 6 mg/kg.

Results

Tables 5-103 and 5-104 present the general recreation scenario cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 2E-06 and 4E-06, respectively. The total CTE cancer risks for both the older child and adult are 1E-07.

Tables 5-105 and 5-106 present the general recreation scenario HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.23 and 0.16, respectively. The total CTE HIs for the older child and adult are 0.034 and 0.026, respectively. These cancer risks and HIs apply to both the current and future uses of EA 27.

5.5.1.27.2 Subarea 27A

As shown in Table 4-13, the EFs for the ATV/dirt- and mountain bike-riding scenario are 90 and 30 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 27A were used to calculate the EPC for the ATV/dirt- and mountain bike-riding exposure. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-27. The EPC for both the current and future use, based on the spatially and use-weighted data, is 8 mg/kg.

Results

Table 5-107 presents the cancer risk estimates for the dirt bike rider. The total RME cancer risk is 4E-06. The total CTE cancer risk is 3E-07. Table 5-108 presents the HQs and the total HIs for the dirt bike rider. The total RME HI is 0.57. The total CTE HI is 0.081. These cancer risks and HIs apply to both the current and future uses of subarea 27A.

5.5.1.28 Exposure Area 28

Exposure Area 28 consists of a portion of tax parcel K3-1-2 as shown in Figure 5-28 and is approximately 0.28 acre. Tax parcel K3-1-2 is located along East New Lenox Road in Pittsfield and is a privately owned residential parcel. There is a residence located on this tax parcel. It is bounded by city-owned land and residences to the north, state-owned land to the south, and numerous residences to the east across East New Lenox Road. As shown in Figure 5-28, two trails run through this area. Access to EA 28 can be gained directly from East New Lenox Road and these trails. All of EA 28 is characterized as walkable.

Current Use

Although EA 28 is a portion of a privately owned residential tax parcel, it is currently used for recreational purposes. Activities observed by EPA and GE personnel or consultants include walking, hiking, and running. In addition, EPA personnel or consultants have seen evidence of dirt biking (e.g., trails). These activities meet the criteria for the general recreation and ATV/dirt- and mountain bike-riding exposure scenarios. The general recreation scenario evaluated the entire area for the young child, older child, and adult receptors. The ATV/dirt- and mountain bike-riding scenario evaluated the dirt bike and ATV trails, which were designated as subarea 28A. A summary of the exposure assumptions for the general recreation and ATV/dirt- and mountain bike-riding scenarios are presented in Tables 4-12 and 4-13, respectively.

Future Use

EA 28 was assumed to be unsuitable for development because much of this area consists of seasonally inundated wetlands, which would make future development unlikely. Thus, the exposure scenarios identified above also reflect the likely future uses.

5.5.1.28.1 Exposure Area 28 – Entire Area

EA 28 is considered a high-use area because it is readily accessible from the trails that run through the area and is located within close proximity of numerous residences. Thus, for the older child and adult, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. Although young children have been observed using this EA (TER, 2003), they are not expected to use the area at the same frequency as the older child and adult. The EF for the young child is 15 days/year for both the RME and CTE and applies for both the current and future uses. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-28. The

EPC for both the current and future uses, based on the spatially and use-weighted data, is 40.4 mg/kg.

Results

Tables 5-109, 5-110, and 5-111 present the cancer risk estimates for the young child, older child, and adult, respectively. The total RME cancer risks for the young child, older child, and adult are 5E-06, 1E-05, and 3E-05, respectively. The total CTE cancer risks for the young child, older child, and adult are 1E-06, 8E-07, and 6E-07, respectively.

Tables 5-112, 5-113, and 5-114 present the HQs and the total HIs for the young child, older child, and adult, respectively. The total RME HIs for the young child, older child, and adult are 1.5, 1.5, and 1.0, respectively. The total CTE HIs for the young child, older child, and adult are 0.64, 0.23, and 0.17, respectively. These cancer risks and HIs apply to both the current and future uses of EA 28.

5.5.1.28.2 Subarea 28A

As shown in Table 4-13, the EFs for the ATV/dirt- and mountain bike-riding scenario are 90 and 30 days/year for the RME and CTE scenarios, respectively. The EFs apply to both the current and future uses of this EA. The data from subarea 28A were used to calculate the EPC for the ATV/dirt- and mountain bike-riding exposure. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-28. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 23 mg/kg.

Results

Table 5-115 presents the cancer risk estimates for the dirt bike rider. The total RME cancer risk is 1E-05. The total CTE cancer risk is 8E-07. Table 5-116 presents the HQs and the total HIs for the dirt bike rider. The total RME HI is 1.6. The total CTE HI is 0.23. These cancer risks and HIs apply to the current and future uses of subarea 28A.

5.5.1.29 Exposure Area 29

Exposure Area 29 consists of a small portion of tax parcel K3-1-1, as shown in Figure 5-29, and is approximately 0.34 acre. Tax parcel K3-1-1 is located along East New Lenox Road in Pittsfield and is owned by the Massachusetts Division of Fisheries and Wildlife. There are numerous residences located to the north, south, and east within ¼ of a mile. There are trails present outside of the 1-ppm tPCB isopleth on tax parcel K3-1-1. The majority of EA 29 has a steep slope to the river as evidenced by the lack of area within the 1-ppm tPCB isopleth, and is characterized as wadable and/or difficult-to-access. The remaining area is walkable.

Current Use

EPA personnel or consultants have observed individuals bird watching in this area. This activity meets the criteria for the general recreation exposure scenario. Thus, this scenario was evaluated for EA 29 for the older child and adult receptors. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 29 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 29 is considered a low-use area because the majority of EA 29 is relatively inaccessible and has a steep slope and there are more desirable trails outside of the floodplain. Thus, EF values of 30 and 15 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-29. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 28 mg/kg.

Tables 5-117 and 5-118 present the cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 2E-06 and 7E-06, respectively. The total CTE cancer risks for the older child and adult are 3E-07 and 2E-07, respectively.

Tables 5-119 and 5-120 present the HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.35 and 0.24, respectively. The total CTE HIs for the older child and adult are 0.079 and 0.060, respectively. These cancer risks and HIs apply to both the current and future uses of EA 29.

5.5.1.30 Exposure Area 30

Exposure Area 30 consists of a small portion of tax parcel K2-1-10, as shown in Figure 5-30, and is approximately 0.19 acre. Tax parcel K2-1-10 is located along East New Lenox Road in Pittsfield and is a privately owned residential parcel. There is a residence located on this parcel. It is bounded by state-owned property to the north and residential properties to the south and east.

Current Use

Although EA 30 is a portion of a privately owned residential tax parcel, it is currently used for recreational purposes. It is assumed that the riverbank can be used by adults for recreational purposes and by older children for play. Therefore, EA 30 was evaluated using the general recreation exposure scenario for the older child and adult receptors. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 30 is considered to be unsuitable for future development because it consists of a small portion of tax parcel K2-1-10 that is characterized as having a steep slope. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 30 is part of a residential tax parcel and, although it slopes steeply to the river, it is considered a high-use area. Therefore, the EF values of 90 and 30 days/year were used to calculate the exposure doses for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-30. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 34.8 mg/kg.

Tables 5-121A and 5-121B present the cancer risk estimates from the general recreational scenario for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 9E-06 and 2E-05, respectively. The total CTE cancer risks for the older child and adult are 7E-07 and 6E-07, respectively. Tables 5-122 and 5-123 present the HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 1.3 and 0.91, respectively. The total CTE HIs for the older child and adult are 0.20 and 0.15, respectively. These cancer risks and HIs apply to both the current and future uses of EA 30.

5.5.1.31 Exposure Area 31

Exposure Area 31 consists of portions of tax parcels K2-1-3, K2-1-4, and K2-1-5, as shown in Figure 5-31, and is approximately 5.0 acres. These tax parcels are located along East New Lenox Road in Pittsfield and are government-owned. Parcels K2-1-3 and K2-1-5 are owned by the Massachusetts Division of Fisheries and Wildlife. Tax parcel K2-1-4 is a maintained utility easement, which makes up the entire parcel, and is owned by the City of Pittsfield. There are a number of residences adjacent to and within close proximity to this area. Both utility worker and recreational exposure occur in this area; recreational exposure is evaluated here and utility worker exposure is evaluated in Section 5.5.1.64. Access to EA 31 can be gained from the nearby residences and from East New Lenox Road via the easement.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include walking, running, hiking, and other general recreation-related activities. EPA field personnel have also observed evidence of campfires (e.g., fire pits). These activities meet the criteria for the general recreation exposure scenario.

A subarea was identified on EA 31 where activities are more intensive. Risks were calculated for the subarea and for the entire EA. The subarea consisted of the easement on EA 31 and was designated as subarea 31A. The location of the subarea is shown in Figure 5-31. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

In addition to the recreational activities, utility worker exposure would occur during the installation and maintenance of equipment on the utility easement. Section 5.5.1.64 presents the risk assessment for the utility worker exposure at this location.

Future Use

Tax parcels K2-1-3 and K2-1-5 are owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). It is assumed that the utility easement will remain in its current location and that the recreational use of the easement will not change in the future. Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.31.1 Exposure Area 31 – Entire Area

The general recreation scenario was applied to the entire area for older child and adult receptors. EA 31 is considered a high-use area because it is readily accessible from the maintained easement that runs through the area and there are residences adjacent to and within close proximity. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the

95% UCL, and the EPC, are presented in Figure 5-31. The EPC for the entire area for both the current and future use, based on the spatially and use-weighted data, is 23 mg/kg.

Results

Table 5-124 presents the older child cancer risk estimates for the entire area. The total RME cancer risk is 6E-06. The total CTE cancer risk is 4E-07. Table 5-125 presents the adult cancer risk estimates for the entire area. The total RME cancer risk is 2E-05. The total CTE cancer risk is 4E-07. Table 5-126 presents the older child HQs and HIs for the entire area. The total RME HI is 0.86. The total CTE HI is 0.13. Table 5-127 presents the adult HQs and HIs for the entire area. The total RME HI is 0.60. The total CTE HI is 0.098. These cancer risks and HIs apply to both the current and future uses of EA 31.

5.5.1.31.2 Subarea 31A

The general recreation scenario evaluated subarea 31A for the older child and adult receptors. Subarea 31A is considered a high-use area because it is a readily accessible, frequently used trail that is located within close proximity of numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data located within subarea 31A were used to calculate the EPC. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-31. The EPC for subarea 31A for both the current and future uses, based on the spatially and use-weighted data, is 37.6 mg/kg.

Results

Table 5-128 presents the older child cancer risk estimates for subarea 31A. The total RME cancer risk is 1E-05. The total CTE cancer risk is 7E-07. Table 5-129 presents the adult cancer risk estimates for subarea 31A. The total RME cancer risk is 3E-05. The total CTE cancer risk is 6E-07. Table 5-130 presents the older child HQs and HIs for subarea 31A. The total RME HI is 1.4. The total CTE HI is 0.21. Table 5-131 presents the adult HQs and HIs for subarea 31A. The total RME HI is 0.98. The total CTE HI is 0.16. These cancer risks and HIs apply to both the current and future uses of subarea 31A.

5.5.1.32 Exposure Area 32

Exposure Area 32 consists of a portion of tax parcel K2-1-1, as shown in Figure 5-32, and is approximately 6.8 acres. Tax parcel K2-1-1 is located along East New Lenox Road in Pittsfield and is owned by the Massachusetts Division of Fisheries and Wildlife. It is bounded by a state-owned property and residences to the north, a privately owned property used for agriculture to the south, and numerous residences to the east across East New Lenox Road. A significant portion of EA 32 is characterized as wadable and difficult-to-access with a smaller portion being walkable.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include walking, running, and hiking. In addition, EPA personnel or consultants have observed individuals hunting (nonwaterfowl). These activities meet the criteria for the general recreation exposure scenario. Thus, the general recreation scenario was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 32 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 32 is considered a high-use area because it is readily accessible from the easement on EA 31 that borders the upper portion of the area and from the parcel to the south and it is located within close proximity of numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risk for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-32. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 23 mg/kg.

Table 5-132 presents the cancer risk estimates for the adult. The total RME cancer risk is 2E-05. The total CTE cancer risk is 4E-07. Table 5-133 presents the HQs and the total HIs for the adult. The total RME HI is 0.60. The total CTE HI is 0.098. These cancer risks and HIs apply to both the current and future uses of EA 32.

5.5.1.33 Exposure Area 33

Exposure Area 33 consists of a portion of tax parcel J2-2-1, as shown in Figure 5-33, and is approximately 29.5 acres. Tax parcel J2-2-1 is owned by the City of Pittsfield and is the site of the Pittsfield WWTP. It is located off Holmes Road in Pittsfield. The various tanks, buildings, and equipment that are used to treat the wastewater are located outside of the 1-ppm tPCB isopleth. There are a number of trails and service roads through the area that are both in and outside of the isopleth. Access to EA 33 can be gained from the trails on EA 26 to the north and from the trails and service roads on tax parcel J2-2-1.

Current Use

Activities known to occur at this EA include the maintenance of site grounds and other related groundskeeping activities. In addition, GE personnel or consultants have observed walking, hiking, running, and other general recreation activities in this area. These activities meet the criteria for the groundskeeper and general recreation exposure scenarios. Because the general recreation scenario would result in the higher exposure, it was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

It is assumed that the location of the WWTP will remain in its current location and that the recreational use of this area will not change in the future. Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 33 is considered a high-use area because it is readily accessible from the easement and service roads that run through the area. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks from the general recreation exposure for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-33. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 33 mg/kg.

Table 5-134 presents the cancer risk estimates for the adult. The total RME cancer risk is 2E-05. The total CTE cancer risk is 5E-07. Table 5-135 presents the HQs and the total HIs for the adult. The total RME HI is 0.86. The total CTE HI is 0.14. These cancer risks and HIs apply to both the current and future uses of EA 33.

5.5.1.34 Exposure Area 34

Exposure Area 34 consists of tax parcel K1-1-10, as shown in Figure 5-34, and is approximately 7.8 acres. Tax parcel K1-1-10 is privately owned and is located along East New Lenox Road in Pittsfield. It is bounded by a state-owned property to the north, an industrial property to the south, and numerous residences to the east less than ¼ mile away. The majority of EA 34 is characterized as walkable. A small portion is wadable and/or difficult-to-access.

Current Use

EA 34 is currently used for agricultural purposes. Thus, the farmer exposure scenario was applied to evaluate EA 34. A summary of the exposure assumptions for the farmer scenario is presented in Table 4-19.

Future Use

It is reasonably anticipated that EA 34 can be residentially developed in the future. Thus, the future residential scenario was evaluated for the young child and adult receptors. A summary of the exposure assumptions for the future residential scenario is presented in Tables 4-9 through 4-11.

5.5.1.34.1 Farmer Scenario

As shown in Table 4-19, the EFs for the farming scenario are 40 and 10 days/year for the RME and CTE scenarios, respectively. The data from EA 34 were used to calculate the EPC for the farmer exposure. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-34. The EPC for the current use, based on the spatially and use-weighted data, is 29 mg/kg.

Results

Table 5-136 presents the cancer risk estimates for the farmer. The total RME cancer risk is 2E-05. The total CTE cancer risk is 7E-07. Table 5-137 presents the HQs and the total HIs for the farmer. The total RME HI is 0.67. The total CTE HI is 0.083. These cancer risks and HIs apply to the current uses of EA 34.

5.5.1.34.2 Future Residential

It was assumed that EA 34 had the potential for future residential development, including future residential lawn areas. Therefore, the EF value used to calculate the exposure doses and risks for the future residential exposure scenario was 150 days/year for both the RME and CTE evaluations. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-34. The EPC for the future use, based on the spatially and use-weighted data, is 29 mg/kg.

Results

Table 5-138 presents the cancer risk estimates from the future residential scenario. The total RME cancer risk is 6E-05. The total CTE cancer risk is 1E-05. Tables 5-139 and 5-140 present the HQs and the total HIs from the future residential scenario for the young child and adult, respectively. The total RME HIs for the young child and adult are 11 and 1.3, respectively. The total CTE HIs for the young child and adult are 6.6 and 0.83, respectively. These cancer risks and HIs apply to the future uses of EA 34.

5.5.1.35 Exposure Area 35

Exposure Area 35 consists of a portion of tax parcel 33-40, as shown in Figure 5-35, and is approximately 25.4 acres. Tax parcel 33-40 is privately owned and is located north of New Lenox Road in Lenox. It is bounded by the Pittsfield WWTP to the north, a state-owned property to the south, and railroad tracks to the west. There are a number of trails in this area, including two maintained utility easements, as shown in Figure 5-35. In addition to being used by utility workers, the easements are used by individuals for recreational purposes. There is an unnamed tributary that runs across the northern portion of the area. Approximately half of EA 35 is characterized as walkable. The remaining area is wadable, difficult-to-access, and/or boatable.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include dog walking, hiking, running, and bird watching. In addition, EPA personnel or consultants have observed hunting (nonwaterfowl), riding ATVs, and horseback riding. These activities can occur both on and off trails and meet the criteria for the general recreation and ATV/dirt- and mountain bike-riding scenarios. Because the general recreation scenario would result in the higher exposure, it was evaluated for the older child and adult receptors. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

A subarea was identified on EA 35 where activities are more intensive. Risks were calculated for the subarea, in addition to the entire EA. The subarea consisted of the maintained utility easements on EA 35 and was designated as subarea 35A. The location of the subarea is presented in Figure 5-35. In addition to the recreational activities, utility worker exposure would occur during the installation and maintenance of equipment on the utility easements. Sections 5.5.1.65 and 5.5.1.66 present the risk assessments for the utility worker at each of the easements.

Future Use

EA 35 is assumed to be unsuitable for development due to the presence of seasonally inundated wetlands, which would make future development unlikely. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

5.5.1.35.1 Exposure Area 35 – Entire Area

EA 35 is considered a high-use area because it is readily accessible via the trails that run through the area and from the railroad tracks that mark the western border of tax parcel 33-40. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-35. The EPC for the entire area for both the current and future uses, based on the spatially and use-weighted data, is 23 mg/kg.

Results

Table 5-141 presents the older child cancer risk estimates for the entire area. The total RME cancer risk is 6E-06. The total CTE cancer risk is 4E-07. Table 5-142 presents the adult cancer risk estimates for the entire area. The total RME cancer risk is 2E-05. The total CTE cancer risk is 4E-07.

Table 5-143 presents the older child HQs and HIs for the entire area. The total RME HI is 0.85. The total CTE HI is 0.13. Table 5-144 presents the adult HQs and HIs for the entire area. The total RME HI is 0.59. The total CTE HI is 0.097. These cancer risks and HIs apply to the current and future uses of EA 35.

5.5.1.35.2 Subarea 35A

Subarea 35A is considered a high-use subarea because it consists of readily accessible, frequently used trails. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 35A were used to calculate the EPC. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-35. The EPC for subarea 35A for both the current and future uses, based on the spatially and use-weighted data, is 12 mg/kg.

Results

Table 5-145 presents the older child cancer risk estimates for subarea 35A. The total RME cancer risk is 3E-06. The total CTE cancer risk is 2E-07. Table 5-146 presents the adult cancer risk estimates for subarea 35A. The total RME cancer risk is 8E-06. The total CTE cancer risk is 2E-07.

Table 5-147 presents the older child HQs and HIs for subarea 35A. The total RME HI is 0.45. The total CTE HI is 0.068. Table 5-148 presents the adult HQs and HIs for subarea 35A. The total RME HI is 0.31. The total CTE HI is 0.051. These cancer risks and HIs apply to the current and future uses of subarea 35A.

5.5.1.36 Exposure Area 36

Exposure Area 36 consists of a portion of tax parcel 34-1, as shown in Figure 5-36, and is approximately 20.4 acres. Tax parcel 34-1 is owned by Electric Power Research Institute (EPRI) and is located along East Street in Lenox. It is bounded by a privately owned property used for agricultural purposes to the north, a state-owned property to the south, and residences to the east less than ½ of a mile away. Tax parcel 34-1 contains equipment such as high-voltage overhead wires and large electrical transformers. Two maintained utility easements run across the area.

The majority of EA 36 is characterized as walkable with a smaller portion being wadable, difficult-to-access, and/or boatable.

Current Use

Current activities at this area include groundskeeping-related activities and agricultural activities. These activities meet the criteria for the groundskeeper and farmer exposure scenarios. This EA was divided into two subareas based on the different activities that occur in each area. The first, designated as subarea 36A, consists of the area that is not used for agricultural purposes and was evaluated using the groundskeeper scenario. The second subarea, designated as subarea 36B, consists of the area used for agricultural purposes and was evaluated using the farmer scenario. Figure 5-36 shows the location of subareas 36A and 36B. A summary of the exposure assumptions for the farmer and groundskeeper scenarios are presented in Tables 4-19 and 4-20, respectively.

Future Use

Future residential development is considered unlikely at EA 36 given the current industrial use. Equipment such as high-voltage overhead wires and large electrical transformers make such future development unlikely. Possible recreational use of the area was investigated but considered unlikely because of limited access (i.e., fenced areas). Thus, the exposure scenarios identified above also reflect the likely future uses.

5.5.1.36.1 Subarea 36A (Groundskeeper Scenario)

EA-specific EF values of 30 and 15 days/year were used to calculate the exposure doses and risks from the groundskeeper exposure scenario for the RME and CTE evaluations, respectively. These EFs were selected based on the assumption that a groundskeeper would spend 1 day per week, or less, mowing or maintaining site grounds. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 36A were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-36. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 20 mg/kg.

Results

Table 5-149 presents the cancer risk estimates for the groundskeeper. The total RME cancer risk is 2E-06. The total CTE cancer risk is 1E-07. Table 5-150 presents the HQs and the total HIs for the groundskeeper. The total RME HI is 0.16. The total CTE HI is 0.035. These cancer risks and HIs apply to the current and future uses of subarea 36A.

5.5.1.36.2 Subarea 36B (Farmer Scenario)

As shown in Table 4-19, the EFs for the farming scenario are 40 and 10 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 36B were used to calculate the EPC for the farmer exposure. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-36. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 8 mg/kg.

Results

Table 5-151 presents the cancer risk estimates for the farmer. The total RME cancer risk is 6E-06. The total CTE cancer risk is 2E-07. Table 5-152 presents the HQs and the total HIs for the farmer. The total RME HI is 0.18. The total CTE HI is 0.022. These cancer risks and HIs apply to the current and future uses of subarea 36B.

5.5.1.37 Exposure Area 37

Exposure Area 37 consists of a portion of tax parcel 29-3, as shown in Figure 5-37, and is approximately 21.6 acres. Tax parcel 29-3 is owned by the Massachusetts Division of Fisheries and Wildlife and is located along New Lenox Road in Lenox. It is bounded by a privately owned property to the north, a state-owned property to the south across New Lenox Road, and railroad tracks to the west. There are a number of residences located along New Lenox Road to the west less than ¼ of a mile away. As shown in Figure 5-37, a maintained utility easement runs across this area. EA 37 can be accessed via the utility easement at the southern portion of the area along New Lenox Road. Approximately half of EA 37 is characterized as walkable with the remaining area being wadable, difficult-to-access, and/or boatable.

Current Use

Activities observed in this area by EPA and/or GE personnel or consultants include hunting (nonwaterfowl), fishing from shore, bird watching, hiking, horseback riding, riding ATVs, and collecting fiddlehead ferns. These activities can occur both on and off trail and meet the criteria for the general recreation, ATV/dirt- and mountain-bike riding, and angler scenarios. The general recreation and the ATV/dirt- and mountain-bike riding scenarios can occur throughout the area whereas the angler scenario is confined to the area along the river. Because the general recreation scenario would result in the higher exposure, it was evaluated for the entire area and included the older child and adult receptors. Two subareas were identified in EA 37 where activities are more intensive. Risks were calculated for each subarea, in addition to the entire EA. The subareas consisted of the area used by anglers to fish from the riverbank (subarea 37A) and the easement used by hikers, bird watchers, and hunters (subarea 37B). The angler scenario was evaluated for subarea 37A and the general recreation scenario was evaluated for subarea 37B for the older child and adult receptors. The locations of the subareas are presented in Figure 5-37. A summary of the exposure assumptions for the general recreation and angler scenarios are presented in Tables 4-12 and 4-16, respectively.

In addition to the recreational activities, utility worker exposure would occur during the installation and maintenance of equipment on the utility easement. Section 5.5.1.66 presents the risk assessment for the utility worker exposure at this location.

Future Use

EA 37 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.37.1 Exposure Area 37 – Entire Area

EA 37 is considered a high-use area because it is readily accessible from the easement that runs through the area and it is within close proximity of numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-37. The EPC for the entire area for both the current and future uses, based on the spatially and use-weighted data, is 16 mg/kg.

Results

Table 5-153 presents the older child cancer risk estimates for the entire area. The total RME cancer risk is 4E-06. The total CTE cancer risk is 3E-07. Table 5-154 presents the adult cancer risk estimates for the entire area. The total RME cancer risk is 1E-05. The total CTE cancer risk is 3E-07.

Table 5-155 presents the older child HQs and HIs for the entire area. The total RME HI is 0.61. The total CTE HI is 0.092. Table 5-156 presents the adult HQs and HIs for the entire area. The total RME HI is 0.42. The total CTE HI is 0.069. These cancer risks and HIs apply to the current and future uses of EA 37.

5.5.1.37.2 Subarea 37A

As shown in Table 4-16, the EFs for the angler scenario are 30 and 10 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 37A were used to calculate the EPC for the angler. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-37. The EPC for subarea 37A for both the current and future uses, based on the spatially and use-weighted data, is 55.1 mg/kg.

Results

Table 5-157 presents the cancer risk estimates for the older child angler. The total RME cancer risk is 9E-06. The total CTE cancer risk is 1E-06. Table 5-158 presents the cancer risk estimates for the adult angler. The total RME cancer risk is 2E-05. The total CTE cancer risk is 8E-07.

Table 5-159 presents the HQs and the total HIs for the older child angler. The total RME HI is 1.3. The total CTE HI is 0.31. Table 5-160 presents the HQs and the total HIs for the adult angler. The total RME HI is 0.99. The total CTE HI is 0.25. These cancer risks and HIs apply to the current and future uses of subarea 37A.

5.5.1.37.3 Subarea 37B

The general recreation scenario was applied to subarea 37B and included the older child and adult. Subarea 37B is considered a high-use subarea because it consists of a readily accessible, frequently used trail. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 37B were used to calculate the EPC. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-37. The EPC for subarea 37B for both the current and future uses, based on the spatially and use-weighted data, is 7 mg/kg.

Results

Table 5-161 presents the older child cancer risk estimates for subarea 37B. The total RME cancer risk is 2E-06. The total CTE cancer risk is 1E-07. Table 5-162 presents the adult cancer risk estimates for subarea 37B. The total RME cancer risk is 5E-06. The total CTE cancer risk is 1E-07.

Table 5-163 presents the older child HQs and HIs for subarea 37B. The total RME HI is 0.26. The total CTE HI is 0.040. Table 5-164 presents the adult HQs and HIs for subarea 37B. The total RME HI is 0.18. The total CTE HI is 0.030. These cancer risks and HIs apply to the current and future uses of subarea 37B.

5.5.1.38 Exposure Area 38

Exposure Area 38 consists of a portion of tax parcel 29-9, as shown in Figure 5-38, and is approximately 14.4 acres. Tax parcel 29-9 is owned by the Massachusetts Division of Fisheries and Wildlife and is located at the northwestern corner of the intersection of New Lenox and East New Lenox Roads in Lenox. It is bounded by an industrial property to the north, a residential property to the south, and numerous residences to the east less than ¼ of a mile away. EA 38 can be accessed from New Lenox and East New Lenox Roads and from the nearby residences. Approximately half of EA 38 is characterized as walkable with the remaining area being wadable, difficult-to-access, and/or boatable.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include hunting (nonwaterfowl), fishing from shore, walking, hiking, running, and bird watching. These activities meet the criteria for the general recreation and angler scenarios. The general recreation scenario was selected to evaluate the entire area for the adult receptor. The angler scenario was selected to evaluate the area along the riverbank where angling occurs, which was designated as subarea 38A. A summary of the exposure assumptions for the general recreation and angler scenarios are presented in Tables 4-12 and 4-16, respectively.

Future Use

EA 38 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.38.1 Exposure Area 38 – Entire Area

EA 38 is considered a high-use area because it is readily accessible from New Lenox and East New Lenox Roads and it is within close proximity of numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-38. The EPC for the entire area for both the current and future uses, based on the spatially and use-weighted data, is 29 mg/kg.

Results

Table 5-165 presents the general recreation cancer risk estimates for the adult. The total RME cancer risk is 2E-05. The total CTE cancer risk is 5E-07. Table 5-166 presents the general recreation HQs and the total HIs for the adult. The total RME HI is 0.75. The total CTE HI is 0.12. These cancer risks and HIs apply to the current and future uses of EA 38.

5.5.1.38.2 Subarea 38A

As shown in Table 4-16, the EFs for the angler scenario are 30 and 10 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 38A were used to calculate the EPC for the angler. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-38. The EPC for subarea 38A for both the current and future uses, based on the spatially and use-weighted data, is 83.3 mg/kg.

Results

Table 5-167 presents the cancer risk estimates for the older child angler. The total RME cancer risk is 1E-05. The total CTE cancer risk is 2E-06. Table 5-168 presents the cancer risk estimates for the adult angler. The total RME cancer risk is 3E-05. The total CTE cancer risk is 1E-06.

Table 5-169 presents the HQs and the total HIs for the older child angler. The total RME HI is 2.0. The total CTE HI is 0.46. Table 5-170 presents the HQs and the total HIs for the adult angler. The total RME HI is 1.5. The total CTE HI is 0.38. These cancer risks and HIs apply to the current and future uses of subarea 38A.

5.5.1.39 Exposure Area 39

Exposure Area 39 consists of the John Decker Canoe Launch (JDCL), a portion of tax parcel 29-2, as shown in Figure 5-39, and is approximately 3.5 acres. Tax parcel 29-2 is owned by the Massachusetts Division of Fisheries and Wildlife. It is located along New Lenox Road in Lenox, a short distance from the Lenox Sportsmen Club. EA 39 can be accessed via a dirt road turnoff from New Lenox Road. At the end of the dirt road, a distance of about 200 ft, there is a parking lot that provides space for multiple vehicles. Portions of EA 39 just north and south of the parking lot fall into the wadable and/or difficult-to-access accessibility classes.

Current Use

Activities observed in this area by EPA and/or GE personnel or consultants include canoe/boat launching, walking, hiking, fishing, bird watching, nonwaterfowl hunting, and picnicking. There are two distinct types of canoe/boat launching activities that occur at this EA. The first consists of organizations such as local schools, outdoor/nature clubs, and the Audubon Society, launching canoes from JDCL for recreational canoe trips. The second consists of competitive canoeists, termed marathon canoeists, using the EA as a launching point for training for canoe races. The activities currently occurring at EA 39 meet the criteria of the marathon canoeist, recreational canoeist/boater, and general recreation exposure scenarios. Because the exposure parameters for the canoeist scenarios (marathon and recreational) would result in higher exposure, the marathon canoeist and recreational canoeist/boater scenarios were evaluated. A summary of the exposure assumptions for the marathon canoeist and recreational canoeist/boater scenarios is presented in Tables 4-14 and 4-15, respectively.

Future Uses

EA 39 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and

Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.39.1 Marathon Canoeist

The EFs for the marathon canoeist scenario are 150 and 90 days/year for the RME and CTE scenarios, respectively, for both the current and future use evaluations (see Table 4-14). The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-39. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 19 mg/kg.

Results

Table 5-171 presents the cancer risk estimates for the marathon canoeist. The total RME cancer risk is 2E-05. The total CTE cancer risk is 3E-06. Table 5-172 presents the HQs and the total HIs for the marathon canoeist. The total RME HI is 1.4. The total CTE HI is 0.77. These cancer risks and HIs apply to both the current and future uses of EA 39.

5.5.1.39.2 Recreational Canoeist/Boater

As noted in Section 4.3.5.2.4, it is assumed that older children and adults are the most likely receptors to engage in recreational canoeing. The adult receptor is assumed to be the leader/guide of the trips that are sponsored by multiple organizations. The older children are assumed to assist the adult leader. As shown in Table 4-15, the EFs for the older child are 30 and 15 days/year for the RME and CTE, respectively. The EFs for the adult are 60 and 30 days/year for the RME and CTE, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-47. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 19 mg/kg.

Results

Tables 5-173 and 5-174 present the cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 3E-06 and 2E-05, respectively. The total CTE cancer risks for the older child and adult are 5E-07 and 1E-06, respectively.

Tables 5-175 and 5-176 present the HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.45 and 0.69, respectively. The total CTE HIs for the older child and adult are 0.16 and 0.26, respectively. These cancer risks and HIs apply to both the current and future uses of EA 39.

5.5.1.40 Exposure Area 40

Exposure Area 40 consists of the area located on tax parcel 29-2 that was not included in EA 39, as shown in Figure 5-40, and is approximately 102.6 acres. Tax parcel 29-2 is owned by the Massachusetts Division of Fisheries and Wildlife and is located along New Lenox Road in Lenox, a short distance from the Lenox Sportsmen Club (LSC). It is bounded by New Lenox Road and the JDCL to the north, a privately owned property to the south, and railroad tracks to the west. The LSC is located on the other side of the railroad tracks. There is parking space at the LSC to accommodate multiple vehicles. Access to EA 40 can be gained from the LSC, the railroad tracks, and from the JDCL to the north. As shown in Figure 5-40, there is a network of walking trails, both in and outside of the 1-ppm tPCB isopleth, that run across the area. There are a number of residences within ½ mile. Roughly half of EA 40 is characterized as walkable. The remaining area is wadable, difficult-to-access, and/or boatable.

Current Use

Activities observed in this area by EPA and/or GE personnel or consultants include hunting (nonwaterfowl), bird watching, fishing from shore, walking, hiking, running, horseback riding, fiddlehead fern collecting, and bow shooting. These activities can occur both on and off the trails. The general recreation scenario was selected to evaluate the entire area and included the young child and adult receptors.

Two subareas were identified in EA 40 where activities are more intensive. Risks were calculated for each subarea, in addition to the entire EA. Subarea 40A is the area along the riverbank where angling occurs. The angler scenario was selected to evaluate this subarea. Subarea 40B consists of a readily accessible, frequently used trail area. The general recreation scenario was selected to evaluate subarea 40B for the young child and adult receptors. The locations of the subareas are presented in Figure 5-40. Summaries of the exposure assumptions for the general recreation and angler scenarios are presented in Tables 4-12 and 4-16, respectively.

Future Use

EA 40 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.40.1 Exposure Area 40 – Entire Area

EA 40 is considered a high-use area because it is readily accessible from the LSC and the JDCL and contains a network of frequently used trails. Thus, for the adult, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. Although young children have been observed using the area (TER, 2003), they are not expected to use the area at the same frequency as the adult. The EF for the young child is 15 days/year for both the RME and CTE and applies for both the current and future uses. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-40. The EPC for the entire area for both the current and future uses, based on the spatially and use-weighted data, is 9 mg/kg.

Results

Table 5-177 presents the general recreation cancer risk estimates for the young child. The total RME cancer risk is 1E-06. The total CTE cancer risk is 2E-07. Table 5-178 presents the general recreation cancer risk estimates for the adult. The total RME cancer risk is 6E-06. The total CTE cancer risk is 1E-07.

Table 5-179 presents the general recreation HQs and the total HIs for the young child. The total RME HI is 0.32. The total CTE HI is 0.14. Table 5-180 presents the general recreation HQs and the total HIs for the adult. The total RME HI is 0.23. The total CTE HI is 0.038. These cancer risks and HIs apply to both the current and future uses of EA 40.

5.5.1.40.2 Subarea 40A

As shown in Table 4-16, the EFs for the angler scenario are 30 and 10 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 40A were used to calculate the EPC for the angler. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-40. The EPC for subarea 40A for both the current and future uses, based on the spatially and use-weighted data, is 37 mg/kg.

Results

Table 5-181 presents the cancer risk estimates for the older child angler. The total RME cancer risk is 6E-06. The total CTE cancer risk is 7E-07. Table 5-182 presents the cancer risk estimates for the adult angler. The total RME cancer risk is 1E-05. The total CTE cancer risk is 5E-07.

Table 5-183 presents the HQs and the total HIs for the older child angler. The total RME HI is 0.87. The total CTE HI is 0.21. Table 5-184 presents the HQs and the total HIs for the adult angler. The total RME HI is 0.67. The total CTE HI is 0.17. These cancer risks and HIs apply to both the current and future uses of subarea 40A.

5.5.1.40.3 Subarea 40B

Subarea 40B is considered a high-use subarea because it consists of a readily accessible, frequently used trail. Thus, for the adult, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. Although young children have been observed using the trail (TER, 2003), they are not expected to use the area at the same frequency as the adult. The EF for the young child is 15 days/year for both the RME and CTE and applies for both the current and future uses. The data from subarea 40B were used to calculate the EPC. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-40. The EPC for subarea 40B for both the current and future uses, based on the spatially and use-weighted data, is 61.6 mg/kg.

Results

Table 5-185 presents the general recreation cancer risk estimates for the young child. The total RME cancer risk is 8E-06. The total CTE cancer risk is 2E-06. Table 5-186 presents the general recreation cancer risk estimates for the adult. The total RME cancer risk is 4E-05. The total CTE cancer risk is 1E-06.

Table 5-187 presents the general recreation HQs and the total HIs for the young child. The total RME HI is 2.2. The total CTE HI is 0.98. Table 5-188 presents the general recreation HQs and the total HIs for the adult. The total RME HI is 1.6. The total CTE HI is 0.26. These cancer risks and HIs apply to both the current and future uses of subarea 40B.

5.5.1.41 Exposure Area 41

Exposure Area 41 consists of a portion of tax parcel 29-1, as shown in Figure 5-41, and is approximately 22.8 acres. Tax parcel 29-1 is owned by the General Electric Company and is located along New Lenox Road in Lenox. It is bounded by a residential property across New Lenox Road to the north, a state-owned property to the south, and a number of residences to the east. There are abandoned buildings on tax parcel 29-1. The majority of EA 41 is characterized as walkable with small portions identified as wadable and/or difficult-to-access.

Current Use

Activities observed in this area by EPA personnel or consultants include hunting (nonwaterfowl), bird watching, fishing from shore, and hiking. The general recreation scenario was selected to evaluate the entire area for the adult receptor. The angler scenario was selected to evaluate the area along the riverbank where angling occurs, which was designated as subarea 41A. A summary of the exposure assumptions for the general recreation and angler scenarios are presented in Tables 4-12 and 4-16, respectively.

Future Use

The land use at EA 41 is not expected to change to a more restrictive land use (i.e., residential) in the future as it is unlikely that GE will develop any portion of the property. Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.41.1 Exposure Area 41 – Entire Area

EA 41 is considered a medium-use area because it is reasonably accessible but more well-known recreational areas are located nearby (i.e., the LSC across the river). Thus, EF values of 60 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-41. The EPC for the entire area for both the current and future uses, based on the spatially and use-weighted data, is 18 mg/kg.

Results

Table 5-189 presents the general recreation cancer risk estimates for the adult. The total RME cancer risk is 8E-06. The total CTE cancer risk is 2E-07. Table 5-190 presents the general recreation HQs and the total HIs for the adult. The total RME HI is 0.32. The total CTE HI is 0.076. These cancer risks and HIs apply to both the current and future uses of EA 41.

5.5.1.41.2 Subarea 41A

As shown in Table 4-16, the EFs for the angler scenario are 30 and 10 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 41A were used to calculate the EPC for the angler. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC are presented in Figure 5-41. The EPC for subarea 41A for both the current and future uses, based on the spatially and use-weighted data, is 55.3 mg/kg.

Results

Table 5-191 presents the cancer risk estimates for the older child angler. The total RME cancer risk is 9E-06. The total CTE cancer risk is 1E-06. Table 5-192 presents the cancer risk estimates for the adult angler. The total RME cancer risk is 2E-05. The total CTE cancer risk is 8E-07.

Table 5-193 presents the HQs and the total HIs for the older child angler. The total RME HI is 1.3. The total CTE HI is 0.31. Table 5-194 presents the HQs and the total HIs for the adult angler. The total RME HI is 0.99. The total CTE HI is 0.25. These cancer risks and HIs apply to both the current and future uses of subarea 41A.

5.5.1.42 Exposure Area 42

Exposure Area 42 consists of a portion of tax parcel 24-7, as shown in Figure 5-42, and is approximately 14.5 acres. Tax parcel 24-7 is located along Roaring Brook Road in Lenox and is owned by the Commonwealth of Massachusetts. It is bounded by a property owned by GE to the north and a residential property to the south. There are about 10 residences located on Roaring Brook Road, less than ½ of a mile away. Roaring Brook runs across this property. As shown in Figure 5-42, a trail from Roaring Brook Road provides access to the area. The majority of EA 42 is characterized as wadable, difficult-to-access, and/or boatable. A small portion is considered walkable.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include walking, hiking, running, bird watching, and other general recreation-related activities. The general recreation scenario was selected to evaluate the entire area for the adult receptor. In addition, it was assumed that the area along the riverbank, which was designated as subarea 42A, is used by anglers. Thus, the angler scenario was evaluated for subarea 42A. A summary of the exposure assumptions for the general recreation and angler scenarios are presented in Tables 4-12 and 4-16, respectively.

Future Use

EA 42 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.42.1 Exposure Area 42 – Entire Area

EA 42 is considered a medium-use area because only the easternmost portion of the area is accessible via a trail from Roaring Brook Road, and a western portion is accessible from EA 41; the remainder of the parcel is relatively inaccessible. Thus, EF values of 60 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-42. The EPC for the entire area for both the current and future uses, based on the spatially and use-weighted data, is 15 mg/kg.

Results

Table 5-195 presents the general recreation cancer risk estimates for the adult. The total RME cancer risk is 7E-06. The total CTE cancer risk is 2E-07. Table 5-196 presents the general recreation HQs and the total HIs for the adult. The total RME HI is 0.26. The total CTE HI is 0.064. These cancer risks and HIs apply to both the current and future uses of EA 42.

5.5.1.42.2 Subarea 42A

As shown in Table 4-16, the EFs for the angler scenario are 30 and 10 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 42A were used to calculate the EPC for the angler. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-42. The EPC for subarea 42A for both the current and future uses, based on the spatially and use-weighted data, is 51.1 mg/kg.

Results

Table 5-197 presents the cancer risk estimates for the older child angler. The total RME cancer risk is 8E-06. The total CTE cancer risk is 1E-06. Table 5-198 presents the cancer risk estimates for the adult angler. The total RME cancer risk is 2E-05. The total CTE cancer risk is 7E-07.

Table 5-199 presents the HQs and the total HIs for the older child angler. The total RME HI is 1.2. The total CTE HI is 0.28. Table 5-200 presents the HQs and the total HIs for the adult angler. The total RME HI is 0.92. The total CTE HI is 0.23. These cancer risks and HIs apply to both the current and future uses of subarea 42A.

5.5.1.43 Exposure Area 43

Exposure Area 43 consists of a small portion of tax parcels 24-6 and 24-5, as shown in Figure 5-43, and is approximately 1.8 acres. Tax parcels 24-6 and 24-5 are privately owned residential parcels that are located along Roaring Brook Road in Lenox. There are homes located on each of these parcels. EA 43 is bounded by a state-owned property to the north and residential properties to the south. There are a number of residences located within ½ of a mile on Roaring Brook Road. The majority of EA 43 is characterized as wadable, difficult-to-access, and/or boatable. A small portion is considered walkable.

Current Use

Although EA 43 is a portion of privately owned residential tax parcels, it is currently used for recreational purposes such as walking, running, hiking, and other general recreation-related activities. Therefore, EA 43 was evaluated using the general recreation exposure scenario for the adult receptor. In addition, it was assumed that the area along the riverbank, which was designated as subarea 43A, is used by anglers. Thus, the angler scenario evaluated subarea 43A. A summary of the exposure assumptions for the general recreation and angler scenarios are presented in Tables 4-12 and 4-16, respectively.

Future Use

EA 43 was assumed to be undevelopable because of inundated wetlands on parcel 24-6 and the steep slope on tax parcel 24-5 as evidenced by the lack of area within the 1-ppm tPCB isopleth. Thus, it is expected that the site uses will not change and the exposure scenarios identified above also reflect the likely future uses.

5.5.1.43.1 Exposure Area 43 – Entire Area (General Recreation)

EA 43 is considered a medium-use area because of the steep slope to the river. Thus, EF values of 60 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-43. The EPC for the entire area for both the current and future uses, based on the spatially and use-weighted data, is 17 mg/kg.

Results

Table 5-201 presents the general recreation cancer risk estimates for the adult. The total RME cancer risk is 8E-06. The total CTE cancer risk is 3E-07. Table 5-202 presents the general recreation HQs and the total HIs for the adult. The total RME HI is 0.30. The total CTE HI is 0.073. These cancer risks and HIs apply to both the current and future uses of EA 43.

5.5.1.43.2 Subarea 43A

As shown in Table 4-16, the EFs for the angler scenario are 30 and 10 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 43A were used to calculate the EPC for the angler. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-43. The EPC for subarea 43A for both the current and future uses, based on the spatially weighted data, is 52.7 mg/kg.

Results

Table 5-203 presents the cancer risk estimates for the older child angler. The total RME cancer risk is 9E-06. The total CTE cancer risk is 1E-06. Table 5-204 presents the cancer risk estimates for the adult angler. The total RME cancer risk is 2E-05. The total CTE cancer risk is 8E-07.

Table 5-205 presents the HQs and the total HIs for the older child angler. The total RME HI is 1.2. The total CTE HI is 0.29. Table 5-206 presents the HQs and the total HIs for the adult angler. The total RME HI is 0.95. The total CTE HI is 0.24. These cancer risks and HIs apply to both the current and future uses of subarea 43A.

5.5.1.44 Exposure Area 44

Exposure Area 44 consists of portions of tax parcels 24-4, 24-3, and 24-1, as shown in Figure 5-44, and is approximately 2.2 acres. These tax parcels are privately owned residential parcels and are located along Roaring Brook Road in Lenox. There is a home located on each tax parcel. EA 44 is bounded by a residential property to the north and a state-owned property to the south. There are a number of residences located within ½ of a mile on Roaring Brook Road. As shown in Figure 5-44, a trail runs across this area. The majority of EA 44, with the exception of a small area of inundated wetland on parcel 24-1, is characterized as walkable. A small portion is considered wadable and/or difficult-to-access.

Current Use

Although EA 44 is a portion of privately owned residential tax parcels, it is currently used for recreational purposes. EPA and GE personnel or consultants have observed activities such as walking, running, hiking, and other general recreation-related activities. Therefore, EA 44 was evaluated using the general recreation exposure scenario for adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 44 was assumed to be undevelopable because of wetlands on parcel 24-1 and the steep slope on tax parcels 24-4 and 24-3. Thus, it is expected that the site uses will not change and the exposure scenarios identified above also reflect the likely future uses.

Results

EA 44 is considered a high-use area because it is readily accessible from the residences present on tax parcels 24-4, 24-3, and 24-1, from the trail that runs through the area, and it is within close proximity of other residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-44. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 43 mg/kg.

Table 5-207 presents the cancer risk estimates for the adult. The total RME cancer risk is 3E-05. The total CTE cancer risk is 7E-07. Table 5-208 presents the HQs and the total HIs for the adult. The total RME HI is 1.1. The total CTE HI is 0.18. These cancer risks and HIs apply to both the current and future uses of EA 44.

5.5.1.45 Exposure Area 45

Exposure Area 45 consists of the northern portion of tax parcel 19-3, as shown in Figure 5-45, and is approximately 16.7 acres. Tax parcel 19-3 is located along East New Lenox Road in Lenox and is owned by the Massachusetts Division of Fisheries and Wildlife. EA 45 is bounded by residential properties to the north and east and state-owned properties to the south. Access to EA 45 can be gained via a trail from East New Lenox Road, an area commonly used by walkers, runners, dog walkers, and hikers, and from the nearby homes. In addition to the walkable areas, which constitute the majority of EA 45, portions are wadable, difficult-to-access, and/or boatable.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include walking, hiking, running, and other general recreation activities. These activities meet the criteria for the general recreation scenario. In addition, it is assumed that this EA is used for waterfowl hunting. Both the general recreation and the waterfowl hunter scenarios were applied to EA 45.

As part of typical hunting activities, the waterfowl hunter is assumed to contact soil in areas that are characterized as wadable, difficult-to-access, and boatable, in addition to walkable areas. The general recreation receptor is assumed to spend more time in readily accessible walkable areas with limited to no contact in other areas. This difference affects the calculation of the EPCs for each scenario. For the calculation of the EPC for the waterfowl hunter, use-weighting factors were not applied to data in wadable, difficult-to-access, and boatable areas. However, use-weighting factors were applied to wadable, difficult-to-access, and boatable areas to calculate the EPC for the general recreation scenario. Section 4.4.1.1.1 describes the accessibility categories and the approach to use-weighting. A summary of the exposure assumptions for the general recreation and waterfowl hunter scenarios are presented in Tables 4-12 and 4-17, respectively.

Future Use

EA 45 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.45.1 Waterfowl Hunter Scenario

As shown in Table 4-17, the EFs for the waterfowl hunter scenario are 14 and 7 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC.

Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-45. The EPC for both the current and future uses, based on the spatially weighted data, is 23 mg/kg.

Results

Table 5-209 presents the cancer risk estimates for the older child waterfowl hunter. The total RME cancer risk is 6E-07. The total CTE cancer risk is 1E-07. Table 5-210 presents the cancer risk estimates for the adult waterfowl hunter. The total RME cancer risk is 3E-6. The total CTE cancer risk is 3E-07.

Table 5-211 presents the HQs and the total HIs for the older child waterfowl hunter. The total RME HI is 0.16. The total CTE HI is 0.058. Table 5-212 presents the HQs and the total HIs for the adult waterfowl hunter. The total RME HI is 0.12. The total CTE HI is 0.043. These cancer risks and HIs apply to both the current and future uses of EA 45.

5.5.1.45.2 General Recreational Scenario

The general recreation scenario was applied to the entire area for the adult receptor. EA 45 is considered a high-use area because it is readily accessible from East New Lenox Road and is within close proximity of residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-45. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 20 mg/kg.

Results

Table 5-213 presents the cancer risk estimates for the adult. The total RME cancer risk is 1E-05. The total CTE cancer risk is 3E-07. Table 5-214 presents the HQs and the total HIs for the adult. The total RME HI is 0.52. The total CTE HI is 0.085. These cancer risks and HIs apply to both the current and future uses of EA 45.

5.5.1.46 Exposure Area 46

Exposure Area 46 consists of a portion of tax parcel 19-3, as shown in Figure 5-46, and is approximately 7.3 acres. Tax parcel 19-3 is located along October Mountain Road in Lenox and is owned by the Massachusetts Division of Fisheries and Wildlife. EA 46 is bounded by state-owned properties to the north and south and October Mountain State Forest to the east. Residences are located within ½ of a mile to the north. Access to EA 46 can be gained from East New Lenox Road, an area commonly used by walkers, runners, dog walkers, and hikers. In addition to the walkable areas that constitute the majority of EA 46, portions are wadable, difficult-to-access, and/or boatable.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include hunting (nonwaterfowl) and other general recreation activities. These activities meet the criteria for the general recreation scenario. In addition, it is assumed that this EA is used for waterfowl hunting. Both the general recreation and the waterfowl hunter scenarios were applied to EA 46.

A summary of the exposure assumptions for the general recreation and waterfowl hunter scenarios is presented in Tables 4-12 and 4-17, respectively.

Future Use

EA 46 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.46.1 Waterfowl Hunter Scenario

As shown in Table 4-17, the EFs for the waterfowl hunter scenario are 14 and 7 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-46. The EPC for both the current and future uses, based on the spatially weighted data, is 17 mg/kg.

Results

Table 5-215 presents the cancer risk estimates for the older child waterfowl hunter. The total RME cancer risk is 4E-07. The total CTE cancer risk is 7E-08. Table 5-216 presents the cancer risk estimates for the adult waterfowl hunter. The total RME cancer risk is 2E-06. The total CTE cancer risk is 2E-07.

Table 5-217 presents the HQs and the total HIs for the older child waterfowl hunter. The total RME HI is 0.12. The total CTE HI is 0.042. Table 5-218 presents the HQs and the total HIs for the adult waterfowl hunter. The total RME HI is 0.085. The total CTE HI is 0.031. These cancer risks and HIs apply to both the current and future uses of EA 46.

5.5.1.46.2 General Recreational Scenario

The general recreation scenario was applied to the entire area for the adult receptor. EA 46 is considered a high-use area because it is readily accessible from East New Lenox Road and is within close proximity of residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-46. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 11 mg/kg.

Results

Table 5-219 presents the cancer risk estimates for the adult. The total RME cancer risk is 8E-06. The total CTE cancer risk is 2E-07. Table 5-220 presents the HQs and the total HIs for the adult. The total RME HI is 0.29. The total CTE HI is 0.047. These cancer risks and HIs apply to both the current and future uses of EA 46.

5.5.1.47 Exposure Area 47

Exposure Area 47 consists of a boat launch area located on tax parcel 19-3, as shown in Figure 5-47, and is approximately 1 acre. Tax parcel 19-3 is owned by the Massachusetts Division of Fisheries and Wildlife and is located along East New Lenox Road in Lenox. EA 47 can be accessed via a dirt road turnoff. It is bounded by state-owned property to the north and south and by October Mountain State Forest to the east. A significant portion of the western and southern area falls into the wadable and/or difficult-to-access accessibility classes.

Current Use

Activities observed in this area by EPA personnel or consultants include launching canoes/boats. GE personnel or consultants have observed individuals walking, running, and hiking in this area. These activities meet the criteria for the general recreation and recreational canoeist/boater scenarios. Because the recreational canoeist/boater scenario would result in higher exposure, it was evaluated for the older child and adult receptors. A summary of the exposure assumptions for the recreational canoeist/boater scenario is presented in Table 4-15.

Future Use

EA 47 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses. There is the possibility that the launching area could be expanded or improved at some point in the future; however, the activities that could occur on the expanded area are not expected to differ significantly from those currently occurring at EA 47. Figure 5-47 shows the area that was considered to be the location of a future expansion. The data from the expanded area in addition to the current area of EA 47 was used to estimate risks for the future use of the site.

Results

As noted in Section 4.3.5.2.4, it is assumed that older children and adults are the most likely recreational canoeists/boaters. The adult is assumed to be the leader/guide of the trips that are sponsored by multiple organizations. As shown in Table 4-15, the EFs for the older child are 30 and 15 days/year for the RME and CTE, respectively. The EFs for the adult are 60 and 30 days/year for the RME and CTE, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA.

Current Use

The data from the current area of EA 47 were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-47. The EPC for the current area, based on the spatially and use-weighted data, is 27 mg/kg.

Tables 5-221 and 5-222 present the cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 4E-06 and 2E-05, respectively. The total CTE cancer risks for the older child and adult are 8E-07 and 2E-06, respectively.

Tables 5-223 and 5-224 present the HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.64 and 0.97, respectively. The total CTE HIs for the older child and adult are 0.23 and 0.37, respectively.

Future Use

The data from the expanded area of EA 47 were included in the calculation of the EPC. Summary statistics for the expanded EA, including the data distribution, the 95% UCL, and the

EPC, are presented in Figure 5-47. The EPC for the expanded area, based on the spatially and use-weighted data, is 14 mg/kg.

Tables 5-225 and 5-226 present the cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 2E-06 and 1E-05, respectively. The total CTE cancer risks for the older child and adult are 4E-07 and 1E-06, respectively.

Tables 5-227 and 5-228 present the HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.33 and 0.50, respectively. The total CTE HIs for the older child and adult are 0.12 and 0.19, respectively.

5.5.1.48 Exposure Area 48

Exposure Area 48 consists of portions of tax parcel 19-3 and tax parcel 19-2, as shown in Figure 5-48, and is approximately 6.5 acres. These tax parcels are owned by the Massachusetts Division of Fisheries and Wildlife and are located along October Mountain Road in Lenox. It is bounded by a canoe/boat launch to the north, state-owned property to the south, and October Mountain State Forest to the east. EA 48 can be accessed from the boat launch area and from October Mountain Road, an area commonly used by walkers, runners, dog walkers, and hikers. The majority of EA 48 is characterized as wadable, difficult-to-access, or boatable.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include hunting (nonwaterfowl), walking, hiking, running, and other general recreation-related activities. These activities meet the criteria for the general recreation scenario. In addition, it is assumed that this EA is used for waterfowl hunting. Both the general recreation and the waterfowl hunter scenarios were applied to EA 48.

Future Use

EA 48 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.48.1 Waterfowl Hunter Scenario

As shown in Table 4-17, the EFs for the waterfowl hunter scenario are 14 and 7 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-48. The EPC for both the current and future uses, based on the spatially weighted data, is 20 mg/kg.

Results

Table 5-229 presents the cancer risk estimates for the older child waterfowl hunter. The total RME cancer risk is 5E-07. The total CTE cancer risk is 9E-08. Table 5-230 presents the cancer risk estimates for the adult waterfowl hunter. The total RME cancer risk is 2E-06. The total CTE cancer risk is 3E-07.

Table 5-231 presents the HQs and the total HIs for the older child waterfowl hunter. The total RME HI is 0.14. The total CTE HI is 0.050. Table 5-232 presents the HQs and the total HIs for the adult waterfowl hunter. The total RME HI is 0.10. The total CTE HI is 0.037. These cancer risks and HIs apply to both the current and future uses of EA 48.

5.5.1.48.2 General Recreational Scenario

The general recreation scenario was applied to the entire area for the adult receptor. EA 48 is considered a high-use area because it is readily accessible from October Mountain Road and the boat launch to the north. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-46. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 4 mg/kg.

Results

Table 5-233 presents the cancer risk estimates for the adult. The total RME cancer risk is 3E-06. The total CTE cancer risk is 7E-08. Table 5-234 presents the HQs and the total HIs for the adult. The total RME HI is 0.11. The total CTE HI is 0.018. These cancer risks and HIs apply to both the current and future uses of EA 48.

5.5.1.49 Exposure Area 49

Exposure Area 49 consists of tax parcel 19-5, as shown in Figure 5-49, and is approximately 7.7 acres. Tax parcel 19-5 is privately owned and is located in Lenox. It is bounded by state-owned properties to the north and south and by railroad tracks to the west. There are no homes located within ½ of a mile. Access can be gained from the railroad tracks. The majority of EA 49 is classified as wadable, difficult-to-access, and boatable, with a small fraction being classified as walkable.

Current Use

Activities observed in this area by EPA personnel or consultants include hunting (nonwaterfowl). This activity meets the criteria for the general recreation scenario. In addition, it is assumed that this EA is used for waterfowl hunting. Both the general recreation and the waterfowl hunter scenarios were applied to EA 49.

Future Use

EA 49 is not considered to be suitable for future development because all of tax parcel 19-5 lies within the 10-year floodplain, making future development unlikely. Thus, it is expected that the site use will not change and the exposure scenarios identified above also reflect the likely future uses.

5.5.1.49.1 Waterfowl Hunter Scenario

As shown in Table 4-17, the EFs for the waterfowl hunter scenario are 14 and 7 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-49. The EPC for both the current and future uses, based on the spatially weighted data, is 47.4 mg/kg.

Results

Table 5-235 presents the cancer risk estimates for the older child waterfowl hunter. The total RME cancer risk is 1E-06. The total CTE cancer risk is 2E-07. Table 5-236 presents the cancer risk estimates for the adult waterfowl hunter. The total RME cancer risk is 5E-06. The total CTE cancer risk is 6E-07.

Table 5-237 presents the HQs and the total HIs for the older child waterfowl hunter. The total RME HI is 0.34. The total CTE HI is 0.12. Table 5-238 presents the HQs and the total HIs for the adult waterfowl hunter. The total RME HI is 0.24. The total CTE HI is 0.088. These cancer risks and HIs apply to both the current and future uses of EA 49.

5.5.1.49.2 General Recreational Scenario

The general recreation scenario was applied to the entire area for the adult receptor. EA 49 is considered a low-use area because the majority of the area is relatively inaccessible. Thus, EF values of 30 and 15 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-49. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 26 mg/kg.

Results

Table 5-239 presents the cancer risk estimates for the adult. The total RME cancer risk is 6E-06. The total CTE cancer risk is 2E-07. Table 5-240 presents the HQs and the total HIs for the adult. The total RME HI is 0.23. The total CTE HI is 0.056. These cancer risks and HIs apply to both the current and future uses of EA 49.

5.5.1.50 Exposure Area 50

Exposure Area 50 consists of a portion of tax parcel 19-1, as shown in Figure 5-50, and is approximately 80.7 acres. Tax parcel 19-1 is located in Lenox and owned by the Massachusetts Division of Fisheries and Wildlife. It is bounded by privately owned land to the north, land owned by the Town of Lenox to the south, and by railroad tracks to the west. There are no homes located within ½ of a mile. Access can be gained from the railroad tracks. Approximately half of EA 50 is classified as walkable, with the remainder being wadable, difficult-to-access, and/or boatable.

Current Use

Activities observed in this area by EPA personnel or consultants include waterfowl hunting, deer hunting, hiking, and bird watching. The general recreation scenario was selected to evaluate the entire area for the adult receptor. The waterfowl hunter scenario was selected to evaluate the wet areas and along the riverbank where waterfowl hunting occurs, which was designated as subarea 50A.

Future Use

EA 50 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.50.1 Exposure Area 50 – Entire Area

EA 50 is considered a low-use area because the area is relatively inaccessible. Thus, EF values of 30 and 15 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-50. The EPC for the entire for both the current and future uses, based on the spatially and use-weighted data, is 6 mg/kg.

Results

Table 5-241 presents the general recreation cancer risk estimates for the adult. The total RME cancer risk is 1E-06. The total CTE cancer risk is 5E-08. Table 5-242 presents the general recreation HQs and the total HIs for the adult. The total RME HI is 0.054. The total CTE HI is 0.013. These cancer risks and HIs apply to both the current and future uses of EA 50.

5.5.1.50.2 Subarea 50A

As shown in Table 4-17, the EFs for the waterfowl hunter scenario are 14 and 7 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from subarea 50A were used to calculate the EPC for the waterfowl hunter. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-50. The EPC for subarea 50A for both the current and future uses, based on the spatially weighted data, is 24 mg/kg.

Results

Table 5-243 presents the cancer risk estimates for the older child waterfowl hunter. The total RME cancer risk is 6E-07. The total CTE cancer risk is 1E-07. Table 5-244 presents the cancer risk estimates for the adult waterfowl hunter. The total RME cancer risk is 3E-06. The total CTE cancer risk is 3E-07.

Table 5-245 presents the HQs and the total HIs for the older child waterfowl hunter. The total RME HI is 0.17. The total CTE HI is 0.060. Table 5-246 presents the HQs and the total HIs for the adult waterfowl hunter. The total RME HI is 0.12. The total CTE HI is 0.045. These cancer risks and HIs apply to both the current and future uses of subarea 50A.

5.5.1.51 Exposure Area 51

Exposure Area 51 consists of tax parcel 14-4, as shown in Figure 5-51, and is approximately 118.8 acres. Tax parcel 14-4 is owned by the Town of Lenox. It is bounded to the north by a state-owned property, to the south by a privately owned property, and to the west by railroad tracks. There are no homes located within ½ of a mile. Access can be gained from the railroad tracks. The majority of EA 51 is classified as walkable with the remainder being wadable, difficult-to-access, and/or boatable.

Current Use

Activities observed in this area by EPA personnel or consultants include waterfowl hunting and general recreation. The general recreation scenario was selected to evaluate the entire area for the adult receptor. The waterfowl hunter scenario was selected to evaluate the wet areas and along the riverbank where waterfowl hunting occurs, which was designated as subarea 51A. As part of typical hunting activities, the waterfowl hunter is assumed to contact soil in areas that are characterized as wadable, difficult-to-access, and boatable, in addition to walkable areas. Thus, use-weighting factors were not applied to data in wadable, difficult-to-access, and boatable areas in the EPC calculation. Summaries of the exposure assumptions for the general recreation and waterfowl hunter scenarios are presented in Tables 4-12 and 4-17, respectively.

Future Use

A discussion with the Town of Lenox Planner indicated that tax parcel 14-4 is deeded as conservation land and is assumed to be “forever green.” Thus, it is expected that the site uses will not change in the future (i.e., it will remain recreational) and the exposure scenarios identified above also reflect the likely future uses.

5.5.1.51.1 Exposure Area 51 – Entire Area (General Recreation)

EA 51 is considered a low-use area because the majority of the area is relatively inaccessible. Thus, EF values of 30 and 15 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. Data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-51. The EPC for the entire area for both the current and future uses, based on the spatially and use-weighted data, is 11 mg/kg.

Results

Table 5-247 presents the general recreation cancer risk estimates for the adult. The total RME cancer risk is 3E-06. The total CTE cancer risk is 9E-08. Table 5-248 presents the general recreation HQs and the total HIs for the adult. The total RME HI is 0.095. The total CTE HI is 0.023. These cancer risks and HIs apply to both the current and future uses of EA 51.

5.5.1.51.2 Subarea 51A (Waterfowl Hunter)

As shown in Table 4-17, the EFs for the waterfowl hunter scenario are 14 and 7 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 51A were used to calculate the EPC for the waterfowl hunter. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-51. The EPC for subarea 51A for both the current and future uses, based on the spatially weighted data, is 17 mg/kg.

Results

Table 5-249 presents the cancer risk estimates for the older child waterfowl hunter. The total RME cancer risk is 4E-07. The total CTE cancer risk is 8E-08. Table 5-250 presents the cancer risk estimates for the adult waterfowl hunter. The total RME cancer risk is 2E-06. The total CTE cancer risk is 2E-07.

Table 5-251 presents the HQs and the total HIs for the older child waterfowl hunter. The total RME HI is 0.13. The total CTE HI is 0.044. Table 5-252 presents the HQs and the total HIs for the adult waterfowl hunter. The total RME HI is 0.089. The total CTE HI is 0.033. These cancer risks and HIs apply to both the current and future uses of subarea 51A.

5.5.1.52 Exposure Area 52

Exposure Area 52 consists of a boat launching area located on tax parcel 1-4, as shown in Figure 5-52, and is approximately 0.92 acre. Tax parcel 1-4 is owned by the Massachusetts Division of Fisheries and Wildlife and is located along October Mountain Road in Lenox. EA 52 can be accessed via a dirt road turnoff. It is bounded by state-owned property to the north and south and by October Mountain State Forest to the east. A significant portion of the area falls into the wadable, difficult-to-access, and boatable accessibility classes.

Current Use

Activities observed in the area by EPA personnel or consultants include launching canoes/boats and hunting (nonwaterfowl). GE personnel or consultants have observed individuals walking, running, hiking, and fishing in this area. These activities meet the criteria for the general recreation, angler, and recreational canoeist/boater scenarios. Because the recreational canoeist/boater scenario would result in the higher exposure, it was evaluated for both the older child and adult receptors. A summary of the exposure assumptions for the recreational canoeist/boater scenario is presented in Table 4-15.

Future Use

EA 52 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

Results

As noted in Section 4.3.5.2.4, it is assumed that older children and adults are the most likely recreational canoeists/boaters. The adult is assumed to be the leader/guide of the trips that are sponsored by multiple organizations. As shown in Table 4-15, the EFs for the older child are 30 and 15 days/year for the RME and CTE cases, respectively. The EFs for the adult are 60 and 30 days/year for the RME and CTE cases, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-52. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 3 mg/kg.

Tables 5-253 and 5-254 present the cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 6E-07 and 3E-06, respectively. The total CTE cancer risks for the older child and adult are 1E-07 and 3E-07, respectively.

Tables 5-255 and 5-256 present the HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.081 and 0.12, respectively. The total CTE HIs for the older child and adult are 0.029 and 0.047, respectively. These cancer risks and HIs apply to both the current and future uses of EA 52.

5.5.1.53 Exposure Area 53

Exposure Area 53 consists of a boat launching area located on tax parcel 1-4, as shown in Figure 5-53, and is approximately 0.74 acre. Tax parcel 1-4 is owned by the Massachusetts Division of Fisheries and Wildlife and is located along October Mountain Road in Lenox. EA 53 can be accessed via a dirt road turnoff. It is bounded by state-owned property to the north and south and by October Mountain State Forest to the east. A significant portion of the area falls into the wadable, difficult-to-access, and/or boatable accessibility classes.

Current Use

Activities observed in the area by EPA personnel or consultants include launching canoes/boats and hunting (nonwaterfowl). GE personnel or consultants have observed individuals walking, running, hiking, hunting, and fishing in this area. These activities meet the criteria for the general recreation, angler, and recreational canoeist/boater scenarios. Because the recreational canoeist/boater scenario would result in higher exposure, it was evaluated for both the older child and adult receptors. A summary of the exposure assumptions for the recreational canoeist/boater scenario is presented in Table 4-15.

Future Use

EA 53 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

Results

As noted in Section 4.3.5.2.4, it is assumed that older children and adults are the most likely recreational canoeists/boaters. The adult is assumed to be the leader/guide of the trips that are sponsored by multiple organizations. As shown in Table 4-15, the EFs for the older child are 30 and 15 days/year for the RME and CTE cases, respectively. The EFs for the adult are 60 and 30 days/year for the RME and CTE cases, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-53. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 14 mg/kg.

Tables 5-257 and 5-258 present the cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 2E-06 and 1E-05, respectively. The total CTE cancer risks for the older child and adult are 4E-07 and 1E-06, respectively.

Tables 5-259 and 5-260 present the HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.33 and 0.50, respectively. The total CTE HIs for the older child and adult are 0.12 and 0.19, respectively. These cancer risks and HIs apply to both the current and future uses of EA 53.

5.5.1.54 Exposure Area 54

Exposure Area 54 consists of a portion of tax parcel 1-4, as shown in Figure 5-54, and is approximately 13.2 acres. Tax parcel 1-4 is located along October Mountain Road in Lenox and is owned by the Massachusetts Department of Environmental Management. EA 54 is bounded by state-owned properties to the north and south and by October Mountain State Forest to the east. There are two boat launch areas (evaluated as EAs 52 and 53) that are also located on tax parcel 1-4. There are no homes located within ½ of a mile. Access can be gained from October Mountain Road, an area commonly used by walkers, runners, dog walkers, and hikers. The majority of EA 54 is classified as wadable, difficult-to-access, and boatable with a small fraction being classified as walkable.

Current Use

Activities observed in this area by EPA personnel or consultants include hunting (nonwaterfowl). GE personnel or consultants have observed individuals walking, hiking, and running in this area. These activities meet the criteria for the general recreation scenario. In addition, it is assumed that this EA is used for waterfowl hunting. Both the general recreation and the waterfowl hunter scenarios were applied to EA 54.

Future Use

EA 54 is owned by the Massachusetts Department of Environmental Management. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.54.1 Waterfowl Hunter Scenario

As shown in Table 4-17, the EFs for the waterfowl hunter scenario are 14 and 7 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-54. The EPC for both the current and future uses, based on the spatially weighted data, is 37 mg/kg.

Results

Table 5-261 presents the cancer risk estimates for the older child waterfowl hunter. The total RME cancer risk is 9E-07. The total CTE cancer risk is 2E-07. Table 5-262 presents the cancer risk estimates for the adult waterfowl hunter. The total RME cancer risk is 4E-06. The total CTE cancer risk is 5E-07.

Table 5-263 presents the HQs and the total HIs for the older child waterfowl hunter. The total RME HI is 0.26. The total CTE HI is 0.093. Table 5-264 presents the HQs and the total HIs for the adult waterfowl hunter. The total RME HI is 0.19. The total CTE HI is 0.069. These cancer risks and HIs apply to both the current and future uses of EA 54.

5.5.1.54.2 General Recreational Scenario

The general recreation scenario was applied to the entire area for the adult receptor. EA 54 is considered a high-use area because it is readily accessible from the two canoe launch areas and October Mountain Road. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-54. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 8 mg/kg.

Results

Table 5-265 presents the cancer risk estimates for the adult. The total RME cancer risk is 6E-06. The total CTE cancer risk is 1E-07. Table 5-266 presents the HQs and the total HIs for the adult. The total RME HI is 0.22. The total CTE HI is 0.036. These cancer risks and HIs apply to both the current and future uses of EA 54.

5.5.1.55 Exposure Area 55

Exposure Area 55 consists of a portion of tax parcel 1-3, as shown in Figure 5-55, and is approximately 17.81 acres. Tax parcel 1-3 is owned by the Massachusetts Department of Environmental Management and is located along October Mountain Road in Lenox. It is bounded by a state-owned property and canoe/boat launch to the north, a state-owned property to the south, and October Mountain State Forest to the east. Access can be gained from October Mountain Road, an area commonly used by walkers, runners, dog walkers, and hikers. A portion of EA 55 is characterized as walkable. The remaining area is considered wadable, difficult-to-access, and/or boatable.

Current Use

Activities observed in this area by EPA and/or GE personnel or consultants include hunting (nonwaterfowl), walking, hiking, running, and picnicking. The general recreation scenario was selected to evaluate the entire area for the young child and adult receptors. The waterfowl hunter scenario was selected to evaluate the wet areas and along the riverbank where waterfowl hunting occurs, which was designated as subarea 55A. As part of typical hunting activities, the waterfowl hunter is assumed to contact soil in areas that are characterized as wadable, difficult-to-access, and boatable, in addition to walkable areas. Thus, use-weighting factors were not applied to data in wadable, difficult-to-access, and boatable areas in the EPC calculation. Summaries of the exposure assumptions for the general recreation and waterfowl hunter scenarios are presented in Tables 4-12 and 4-17, respectively.

Future Use

EA 55 is owned by the State of Massachusetts Department of Environmental Management. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.55.1 Exposure Area 55 – Entire Area

EA 55 is considered a high-use area because it is readily accessible from October Mountain Road and from the canoe/boat launch to the north. Thus, for the adult, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. Although young children have been observed using the area (TER, 2003), they are not expected to use the area at the same frequency as the adult. The EF for the young child is 15 days/year for both the RME and CTE and applies for both the current and future uses. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-55. The EPC for the entire area for both the current and future uses, based on the spatially and use-weighted data, is 21 mg/kg.

Results

Table 5-267 presents the general recreation cancer risk estimates for the young child. The total RME cancer risk is 3E-06. The total CTE cancer risk is 6E-07. Table 5-268 presents the general recreation cancer risk estimates for the adult. The total RME cancer risk is 2E-05. The total CTE cancer risk is 3E-07.

Table 5-269 presents the general recreation HQs and the total HIs for the young child. The total RME HI is 0.76. The total CTE HI is 0.33. Table 5-270 presents the general recreation HQs and the total HIs for the adult. The total RME HI is 0.54. The total CTE HI is 0.090. These cancer risks and HIs apply to both the current and future uses of EA 55.

5.5.1.55.2 Subarea 55A

As shown in Table 4-17, the EFs for the waterfowl hunter scenario are 14 and 7 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 55A were used to calculate the EPC for the waterfowl hunter. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-55. The EPC for subarea 55A for both the current and future uses, based on the spatially weighted data, is 59 mg/kg.

Results

Table 5-271 presents the cancer risk estimates for the older child waterfowl hunter. The total RME cancer risk is 1E-06. The total CTE cancer risk is 3E-07. Table 5-272 presents the cancer risk estimates for the adult waterfowl hunter. The total RME cancer risk is 7E-06. The total CTE cancer risk is 8E-07.

Table 5-273 presents the HQs and the total HIs for the older child waterfowl hunter. The total RME HI is 0.42. The total CTE HI is 0.15. Table 5-274 presents the HQs and the total HIs for the adult waterfowl hunter. The total RME HI is 0.30. The total CTE HI is 0.11. These cancer risks and HIs apply to both the current and future uses of subarea 55A.

5.5.1.56 Exposure Area 56

Exposure Area 56 consists of a portion of tax parcel 9-18, as shown in Figure 5-56, and is approximately 41.6 acres. Tax parcel 9-18 is a privately owned residential parcel that is located in Lenox. The entire parcel lies within the 1-ppm tPCB isopleth (approximately equivalent to the 10-year floodplain). EA 56 is bounded to the north by a property owned by the Town of Lenox, to the south by a residential property with a home, and to the west by railroad tracks and commercial/industrial properties. The majority of EA 56 is characterized as walkable. A small portion is considered wadable and/or difficult-to-access.

Current Use

Activities observed in this area by EPA personnel or consultants include hunting (nonwaterfowl), waterfowl hunting, and general recreation. GE personnel or consultants have observed individuals biking in this area. These activities meet the criteria for the general recreation, ATV/dirt- and mountain bike riding, and waterfowl hunter scenarios. Because the general recreation scenario would result in the higher exposure, it was evaluated for the entire area for the older child and adult receptors. The waterfowl hunter scenario was selected to evaluate the wet areas and along the riverbank where waterfowl hunting occurs, which was designated as subarea 56A. As part of typical hunting activities, the waterfowl hunter is assumed to contact soil in areas that are characterized as wadable, difficult-to-access, and boatable, in addition to walkable areas. Thus, use-weighting factors were not applied to data in wadable, difficult-to-access, and boatable areas in the EPC calculation. Summaries of the exposure assumptions for the general recreation and waterfowl hunter scenarios are presented in Tables 4-12 and 4-17, respectively.

Future Use

This EA is not considered to be suitable for future development because the entire area lies within the 10-year floodplain. Thus, it is expected that the site uses will not change and the exposure scenarios identified above are also the likely future uses.

5.5.1.56.1 Exposure Area 56 – Entire Area

EA 56 is close to a number of residences and near to the Woods Pond Footbridge, but considered a medium-use area because much of the area is relatively inaccessible. Thus, EF values of 60 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses for this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-56. The EPC for the entire area for both the current and future uses, based on the spatially and use-weighted data, is 44 mg/kg.

Results

Table 5-275 presents the older child cancer risk estimates for the entire area. The total RME cancer risk is 8E-06. The total CTE cancer risk is 8E-07. Table 5-276 presents the adult cancer risk estimates for the entire area. The total RME cancer risk is 2E-05. The total CTE cancer risk is 6E-07.

Table 5-277 presents the older child HQs and HIs for the entire area. The total RME HI is 1.10. The total CTE HI is 0.24. Table 5-278 presents the adult HQs and HIs for the entire area. The total RME HI is 0.76. The total CTE HI is 0.019. These cancer risks and HIs apply to the current and future uses of EA 56.

5.5.1.56.2 Subarea 56A

As shown in Table 4-17, the EFs for the waterfowl hunter scenario are 14 and 7 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 56A were used to calculate the EPC for the waterfowl hunter. Summary statistics for this subarea including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-56. The EPC for subarea 56A for both the current and future uses, based on the spatially weighted data, is 117 mg/kg.

Results

Table 5-279 presents the cancer risk estimates for the older child waterfowl hunter. The total RME cancer risk is 3E-06. The total CTE cancer risk is 5E-07. Table 5-280 presents the cancer risk estimates for the adult waterfowl hunter. The total RME cancer risk is 1E-05. The total CTE cancer risk is 2E-06.

Table 5-281 presents the HQs and the total HIs for the older child waterfowl hunter. The total RME HI is 0.84. The total CTE HI is 0.29. Table 5-282 presents the HQs and the total HIs for the adult waterfowl hunter. The total RME HI is 0.60. The total CTE HI is 0.22. These cancer risks and HIs apply to the current and future uses of subarea 56A.

5.5.1.57 Exposure Area 57

Exposure Area 57 consists of a portion of tax parcel 1-1, as shown in Figure 5-57, and is approximately 12.8 acres. Tax parcel 1-1 is located along October Mountain Road on the eastern shore of Woods Pond and is owned by the Massachusetts Division of Fisheries and Wildlife. It is bounded by a state-owned property to the north, a private commercial property to the south, and October Mountain State Forest to the east. Access to EA 57 can be gained from October Mountain Road, an area commonly used by walkers, hikers, and runners. Portions of the area are classified as walkable, wadable, and difficult-to-access.

Current Use

Activities observed in this area by GE personnel or consultants include walking, hiking, running, bird watching, and other general recreation activities. These activities meet the criteria for the general recreation scenario. In addition, it is assumed that this EA is used for waterfowl hunting. Both the general recreation and the waterfowl hunter scenarios were applied to EA 57.

Future Use

EA 57 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses.

5.5.1.57.1 Waterfowl Hunter Scenario

As shown in Table 4-17, the EFs for the waterfowl hunter scenario are 14 and 7 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-57. The EPC for both the current and future uses, based on the spatially weighted data, is 22 mg/kg.

Results

Table 5-283 presents the cancer risk estimates for the older child waterfowl hunter. The total RME cancer risk is 5E-07. The total CTE cancer risk is 9E-08. Table 5-284 presents the cancer risk estimates for the adult waterfowl hunter. The total RME cancer risk is 2E-06. The total CTE cancer risk is 3E-07.

Table 5-285 presents the HQs and the total HIs for the older child waterfowl hunter. The total RME HI is 0.16. The total CTE HI is 0.055. Table 5-286 presents the HQs and the total HIs for the adult waterfowl hunter. The total RME HI is 0.11. The total CTE HI is 0.041. These cancer risks and HIs apply to both the current and future uses of EA 57.

5.5.1.57.2 General Recreational Scenario

The general recreation scenario was applied to the entire area for the young child and adult receptors. EA 57 is considered a high-use area because it is readily accessible from October Mountain Road. Thus, for the adult, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. Although young children have been observed using EA 57 (TER, 2003), they are not expected to use the area at the same frequency as the older child and adult. The EF for the young child is 15 days/year for both the RME and CTE and applies for both the current and future uses. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-57. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 9 mg/kg.

Results

Table 5-287 presents the young child cancer risk estimates for the entire area. The total RME cancer risk is 1E-06. The total CTE cancer risk is 2E-07. Table 5-288 presents the adult cancer risk estimates for the entire area. The total RME cancer risk is 6E-06. The total CTE cancer risk is 1E-07.

Table 5-289 presents the young child HQs and HIs for the entire area. The total RME HI is 0.33. The total CTE HI is 0.14. Table 5-290 presents the adult HQs and HIs for the entire area. The total RME HI is 0.23. The total CTE HI is 0.038. These cancer risks and HIs apply to both the current and future uses of EA 57.

5.5.1.58 Exposure Area 58

Exposure Area 58 consists of a small portion of tax parcel 2-8, as shown in Figure 5-58, and is approximately 1.3 acres. Tax parcel 2-8 is a privately owned parcel located along October Mountain Road in Lenox, an area commonly used by walkers, hikers, and runners on the southern shore of Woods Pond. Approximately half of EA 58 is walkable. The remaining area is wadable and/or difficult-to-access.

Current Use

Activities observed in this area by EPA and GE personnel or consultants include walking, hiking, running, and fishing from shore. These activities meet the criteria for the general recreation and angler scenarios, both of which were used to evaluate EA 58. Summaries of the exposure assumptions for the general recreation and angler scenarios are presented in Tables 4-12 and 4-16, respectively.

Future Use

EA 58 is not considered to be suitable for future development because it consists of a small portion of land that lies within the 10-year floodplain. Thus, it is expected that the site uses will not change and the exposure scenarios identified above will also be the likely future uses.

5.5.1.58.1 Angler Scenario

As shown in Table 4-16, the EFs for the angler scenario are 30 and 10 days/year for the RME and CTE scenarios, respectively. The EFs are assumed to be appropriate for both the current and future uses of this area. The data from EA 58 were used to calculate the EPC for the angler.

Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-58. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 27 mg/kg.

Results

Table 5-291 presents the cancer risk estimates for the older child angler. The total RME cancer risk is 4E-06. The total CTE cancer risk is 5E-07. Table 5-292 presents the cancer risk estimates for the adult angler. The total RME cancer risk is 1E-05. The total CTE cancer risk is 4E-07.

Table 5-293 presents the HQs and the total HIs for the older child angler. The total RME HI is 0.64. The total CTE HI is 0.15. Table 5-294 presents the HQs and the total HIs for the adult angler. The total RME HI is 0.49. The total CTE HI is 0.12. These cancer risks and HIs apply to both the current and future uses of EA 58.

5.5.1.58.2 General Recreational Scenario

The general recreation scenario was applied to the entire area for the adult receptor. EA 58 is considered a high-use area because it is readily accessible from October Mountain Road. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-58. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 27 mg/kg.

Results

Table 5-295 presents the cancer risk estimates. The total RME cancer risk is 2E-05. The total CTE cancer risk is 4E-07. Table 5-296 presents the HQs and the total HIs. The total RME HI is 0.70. The total CTE HI is 0.12. These cancer risks and HIs apply to both the current and future uses of EA 58.

5.5.1.59 Exposure Area 59

Exposure Area 59 consists of a small portion of tax parcel 2-4, as shown in Figure 5-59, and is approximately 2.7 acres. Tax parcel 2-4 is a privately owned parcel located on the eastern side of the Woods Pond Footbridge in Lenox. There are trails on EA 59 including the well-known, frequently used path from the Woods Pond footbridge. All of EA 59 is characterized as walkable.

Current Use

Activities observed in this area by EPA and/or GE personnel or consultants include hiking, walking, running, riding dirt bikes, bird watching, and fishing from shore. Because the general recreation scenario would result in higher exposure, it was selected to evaluate the entire area for the young child and adult receptors. The angler scenario evaluated the area along the riverbank where angling occurs, which was designated as subarea 59A. Summaries of the exposure assumptions for the general recreation and angler scenarios are presented in Tables 4-12 and 4-16, respectively.

Future Use

EA 59 is not considered to be suitable for future development because it consists of a small portion of land that lies within the 10-year floodplain. It is expected that the path from the Woods Pond Footbridge will remain in its current location because of the presence of the footbridge. Thus, it is expected that the site uses will not change and the exposure scenarios identified above will also be the likely future uses.

5.5.1.59.1 Exposure Area 59 – Entire Area

EA 59 is considered a high-use area because it is readily accessible from the Woods Pond Footbridge and trails. Thus, for the adult, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. Although young children have been observed using EA 59 (TER, 2003), they are not expected to use the area at the same frequency as the older child and adult. The EF for the young child is 15 days/year for both the RME and CTE and applies for both the current and future uses. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-59. The EPC for the entire for both the current and future uses, based on the spatially and use-weighted data, is 32 mg/kg.

Results

Table 5-297 presents the young child cancer risk estimates for the entire area. The total RME cancer risk is 4E-06. The total CTE cancer risk is 9E-07. Table 5-298 presents the adult cancer risk estimates for the entire area. The total RME cancer risk is 2E-05. The total CTE cancer risk is 5E-07.

Table 5-299 presents the young child HQs and HIs for the entire area. The total RME HI is 1.2. The total CTE HI is 0.51. Table 5-300 presents the adult HQs and HIs for the entire area. The total RME HI is 0.83. The total CTE HI is 0.14. These cancer risks and HIs apply to both the current and future uses of EA 59.

5.5.1.59.2 Subarea 59A

As shown in Table 4-16, the EFs for the angler scenario are 30 and 10 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 59A were used to calculate the EPC for the angler. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-59. The EPC for subarea 59A for both the current and future uses, based on the spatially and use-weighted data, is 48 mg/kg.

Results

Table 5-301 presents the cancer risk estimates for the older child angler. The total RME cancer risk is 8E-06. The total CTE cancer risk is 9E-07. Table 5-302 presents the cancer risk estimates for the adult angler. The total RME cancer risk is 2E-05. The total CTE cancer risk is 7E-07.

Table 5-303 presents the HQs and the total HIs for the older child angler. The total RME HI is 1.1. The total CTE HI is 0.27. Table 5-304 presents the HQs and the total HIs for the adult angler. The total RME HI is 0.87. The total CTE HI is 0.22. These cancer risks and HIs apply to both the current and future uses of subarea 59A.

5.5.1.60 Exposure Area 60

Exposure Area 60 consists of a portion of tax parcel 9-16, as shown in Figure 5-60, and is approximately 1.0 acre. Tax parcel 9-16 is a privately owned parcel located on the western side of the Woods Pond Footbridge. It is bounded by railroad tracks to the west and a path to the Woods Pond Footbridge and a residence to the north. A portion of this site consists of a boat launch. Approximately half of EA 60 is walkable. The remaining area is wadable and/or difficult-to-access.

Current Use

Activities observed in this area by EPA and/or GE personnel or consultants include walking, hiking, running, riding ATVs and dirt bikes, fishing from shore, bird watching, and canoe/boat launching. These activities meet the criteria for the general recreation, ATV/dirt- and mountain bike-riding, angler, and recreational canoeist/boater scenarios. Because the general recreation scenario would result in higher exposure, it was evaluated for the entire area for the young child and adult receptors. The recreational canoeist/boater scenario evaluated the boat launching area, which was designated as subarea 60A, and included the older child and adult receptors. Summaries of the exposure assumptions for general recreation and the recreational canoeist/boater scenario are presented in Tables 4-12 and 4-15, respectively.

Future Use

Tax parcel 9-16 is not considered to be suitable for future development because the entire area lies within the 10-year floodplain. Thus, it is expected that the site uses will not change and the exposure scenarios identified above are also the likely future uses.

5.5.1.60.1 Exposure Area 60 – Entire Area

EA 60 is considered a high-use area because it is readily accessible from the path to the Woods Pond footbridge and is located in close proximity to a residence. Thus, for the adult, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. Although young children have been observed using EA 60 (TER, 2003), they are not expected to use the area at the same frequency as the older child and adult. The EF for the young child is 15 days/year for both the RME and CTE and applies for both the current and future uses. The data from the entire EA were used to calculate the EPC for the general recreation scenario. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-60. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 10 mg/kg.

Results

Table 5-305 presents the young child cancer risk estimates for the entire area. The total RME cancer risk is 1E-06. The total CTE cancer risk is 3E-07. Table 5-306 presents the adult cancer risk estimates for the entire area. The total RME cancer risk is 7E-06. The total CTE cancer risk is 2E-07.

Table 5-307 presents the young child HQs and HIs for the entire area. The total RME HI is 0.36. The total CTE HI is 0.16. Table 5-308 presents the adult HQs and HIs for the entire area. The total RME HI is 0.26. The total CTE HI is 0.043. These cancer risks and HIs apply to both the current and future uses of EA 60.

5.5.1.60.2 Subarea 60A

As noted in Section 4.3.5.2.4, it is assumed that older children and adults are the most likely recreational canoeists/boaters. The adult is assumed to be the leader/guide of the trips that are sponsored by multiple organizations. As shown in Table 4-15, the EFs for the older child are 30 and 15 days/year for the RME and CTE cases, respectively. The EFs for the adult are 60 and 30 days/year for the RME and CTE cases, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 60A were used to calculate the EPC for the recreational canoeist/boater scenario. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-60. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 17 mg/kg.

Results

Tables 5-309 and 5-310 present the recreational canoeist/boater cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 3E-06 and 1E-05, respectively. The total CTE cancer risks for the older child and adult are 5E-07 and 1E-06, respectively.

Tables 5-311 and 5-312 present the recreational canoeist/boater HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.40 and 0.61, respectively. The total CTE HIs for the older child and adult are 0.14 and 0.23, respectively. These cancer risks and HIs apply to both the current and future uses of subarea 60A.

5.5.1.61 Exposure Area 61

Exposure Area 61 consists of a maintained utility easement located on tax parcel I6-1-41 in Pittsfield, as shown in Figure 5-61. The utility easement is maintained for overhead wires. Both utility worker and recreational exposure occur at this area; worker exposure is evaluated here and recreational exposure is evaluated in Section 5.5.1.4.

Current Use

Current activities on this easement include the installation and maintenance of equipment. These activities meet the criteria of the utility worker scenario. A summary of the exposure assumptions for the utility worker scenario is presented in Table 4-21.

Future Use

It is assumed that the utility easements will remain in their current locations and that the use of the easements will not change in the future. Thus, the exposure scenario identified above also reflects the likely future uses.

Results

As shown in Table 4-21, the EF for the utility worker is 5 days/year for both the RME and CTE cases. This EF is considered to be appropriate for both current and future uses of the easement. The data located within the easement were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-61. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 59 mg/kg.

Table 5-313 presents the cancer risk estimates. The total RME cancer risk is 3E-06. The total CTE cancer risk is 3E-07. Table 5-314 presents the HQs and the total HIs. The total RME HI is 0.24. The total CTE HI is 0.082. These cancer risks and HIs apply to both the current and future uses of the easement.

5.5.1.62 Exposure Area 62

Exposure Area 62 is a utility easement located on tax parcel J4-3-13 in Pittsfield, as shown in Figure 5-62. EA 62 is not maintained and includes an underground pipeline. A significant portion of EA 62 runs through wadable, difficult-to-access, and boatable accessibility classes.

Current Use

Current activities on this easement include the installation and maintenance of equipment. These activities meet the criteria of the utility worker scenario. A summary of the exposure assumptions for the utility worker scenario is presented in Table 4-21.

Future Use

It is assumed that the utility easements will remain in their current locations and that the use of the easements will not change in the future. Thus, the exposure scenario identified above also reflects the likely future uses.

Results

As shown in Table 4-21, the EF for the utility worker is 5 days/year for both the RME and CTE cases. This EF is considered to be appropriate for both current and future uses of the easement. The data located within the easement were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-62. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 121 mg/kg.

Table 5-315 presents the cancer risk estimates. The total RME cancer risk is 7E-06. The total CTE cancer risk is 6E-07. Table 5-316 presents the HQs and the total HIs. The total RME HI is 0.50. The total CTE HI is 0.17. These cancer risks and HIs apply to both the current and future uses of the easement.

5.5.1.63 Exposure Area 63

Exposure Area 63 is a maintained utility easement located in Pittsfield on tax parcel J4-3-12, as shown in Figure 5-63. EA 63 includes an underground sewage pipe. Both utility worker and recreational exposure occur at this area; worker exposure is evaluated here and recreational exposure is evaluated in Section 5.5.1.12.

Current Use

Current activities on this easement include the installation and maintenance of equipment. These activities meet the criteria of the utility worker scenario. A summary of the exposure assumptions for the utility worker scenario is presented in Table 4-21.

Future Use

It is assumed that the utility easements will remain in their current locations and that the use of the easements will not change in the future. Thus, the exposure scenario identified above also reflects the likely future uses.

Results

As shown in Table 4-21, the EF for the utility worker is 5 days/year for both the RME and CTE cases. This EF is considered to be appropriate for both current and future uses of the easement. The data located within the easement were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-63. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 39 mg/kg.

Table 5-317 presents the cancer risk estimates. The total RME cancer risk is 2E-06. The total CTE cancer risk is 2E-07. Table 5-318 presents the HQs and the total HIs. The total RME HI is 0.16. The total CTE HI is 0.054. These cancer risks and HIs apply to both the current and future uses of the easement.

5.5.1.64 Exposure Area 64

Exposure Area 64 is a maintained utility easement located in Pittsfield on tax parcel K2-1-4, as shown in Figure 5-64. EA 64 includes an underground pipe. Both utility worker and recreational exposure occur at this area; worker exposure is evaluated here and recreational exposure is evaluated in Section 5.5.1.31.

Current Use

Current activities on this easement include the installation and maintenance of equipment. These activities meet the criteria of the utility worker scenario. A summary of the exposure assumptions for the utility worker scenario is presented in Table 4-21.

Future Use

It is assumed that the utility easements will remain in their current locations and that the use of the easements will not change in the future. Thus, the exposure scenario identified above also reflects the likely future uses.

Results

As shown in Table 4-21, the EF for the utility worker is 5 days/year for both the RME and CTE cases. This EF is considered to be appropriate for both current and future uses of the easement. The data located within the easement were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-64. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 37.6 mg/kg.

Table 5-319 presents the cancer risk estimates. The total RME cancer risk is 2E-06. The total CTE cancer risk is 2E-07. Table 5-320 presents the HQs and the total HIs. The total RME HI is 0.16. The total CTE HI is 0.052. These cancer risks and HIs apply to both the current and future uses of the easement.

5.5.1.65 Exposure Area 65

Exposure Area 65 consists of a maintained utility easement located in Lenox on tax parcels K1-1-10, 34-1, and 33-40, as shown in Figure 5-65. EA 65 is maintained for overhead wires. Both utility worker and recreational exposure occur at this area; worker exposure is evaluated here and recreational exposure is evaluated in Section 5.5.1.35.

Current Use

Current activities on this easement include the installation and maintenance of equipment. These activities meet the criteria of the utility worker scenario. A summary of the exposure assumptions for the utility worker scenario is presented in Table 4-21.

Future Use

It is assumed that the utility easements will remain in their current locations and that the use of the easements will not change in the future. Thus, the exposure scenario identified above also reflects the likely future uses.

Results

As shown in Table 4-21, the EF for the utility worker is 5 days/year for both the RME and CTE cases. This EF is considered to be appropriate for both current and future uses of the easement. The data from the easement were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-65. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 19 mg/kg.

Table 5-321 presents the cancer risk estimates. The total RME cancer risk is 1E-06. The total CTE cancer risk is 9E-08. Table 5-322 presents the HQs and the total HIs. The total RME HI is 0.079. The total CTE HI is 0.027. These cancer risks and HIs apply to both the current and future uses of the easement.

5.5.1.66 Exposure Area 66

Exposure Area 66 consists of a maintained utility easement located in Lenox on tax parcels 34-1, 33-40, and 29-3, as shown in Figure 5-66. EA 66 is maintained for overhead wires. Both utility worker and recreational exposure occur at this area; worker exposure is evaluated here and recreational exposure is evaluated in Section 5.5.1.37.

Current Use

Current activities on this easement include the installation and maintenance of equipment. These activities meet the criteria of the utility worker scenario. A summary of the exposure assumptions for the utility worker scenario is presented in Table 4-21.

Future Use

It is assumed that the utility easements will remain in their current locations and that the use of the easements will not change in the future. Thus, the exposure scenario identified above also reflects the likely future uses.

Results

As shown in Table 4-21, the EF for the utility worker is 5 days/year for both the RME and CTE cases. This EF is considered to be appropriate for both current and future uses of the easement. The data from the easement were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-66. The EPC for both the current and future uses, based on the spatially and use-weighted data, is 12 mg/kg.

Table 5-323 presents the cancer risk estimates. The total RME cancer risk is 7E-07. The total CTE cancer risk is 6E-08. Table 5-324 presents the HQs and the total HIs. The total RME HI is 0.050. The total CTE HI is 0.017. These cancer risks and HIs apply to both the current and future uses of the easement.

5.5.2 Reach 7 Exposure Area Specific Risk Assessments

The following sections include a description of each of the EAs and subareas, a table showing the cancer risks and hazard indices for each area and subarea, and a figure with the following information:

- The river hydrography.
- The EA boundary.
- The subarea boundary (if applicable).
- The tax parcel identification number(s).
- The 100-year floodplain.
- The sampling locations.

- A table listing the activities that occur at the EA.
- A table presenting the exposure scenario(s) evaluated, the EPC(s), and summary statistics for the EA and each subarea (if applicable).
- Trails or easements.
- Identification of areas with tPCB concentrations greater than or equal to 50 mg/kg.

There are several differences between the Reach 5 and 6 and the Reach 7 evaluations. These differences are due primarily to data availability and the level of precision and scale of source material used when the data were created. For Reaches 5 and 6, Geographic Information System (GIS) layers were obtained from Blasland, Bouck and Lee, Inc. (BB&L) as computer-aided design (CAD) files and converted to GIS themes. These files were derived from aerial photography using photogrammetry techniques. These data are very accurate, in terms of horizontal location of physical features, however these coverages were not available below Reach 6. The best available coverage below Reach 6 was obtained from public sources such as United States Geological Survey (USGS) quad maps; however, these sources are not as accurate as data derived from low-level aerial photography.

Another major difference in GIS data between Reaches 5 and 6 and Reach 7 is the definition of the 1-ppm PCB isopleth in Reaches 5 and 6 and the 100-year floodplain boundary in Reach 7. The 1-ppm PCB isopleth is the site boundary as defined in the Consent Decree, and was derived for Reaches 5 and 6. This boundary is roughly equivalent to the 10-year floodplain. However, because neither the 10-year floodplain nor the 1-ppm isopleth was derived below Reach 6, the most relevant existing delineation available for the area below Reach 6 was determined to be the 100-year floodplain boundary.

The 100-year floodplain delineation was obtained from MassGIS, Commonwealth of Massachusetts Executive Office of Environmental Affairs, which provides a clearinghouse of GIS Data for the Commonwealth of Massachusetts. These data were provided by the Federal Emergency Management Agency (FEMA) at http://www.fema.gov. The flood data were developed to support floodplain management and planning activities but do not replace the official paper maps. These data are not suitable for engineering applications or site work, nor can the data be used to determine absolute delineations of flood boundaries. Instead, the data can be used to portray zones of uncertainty and possible risks associated with flooding. Historically, FEMA maps were created with very little attention to horizontal control and as such can present discrepancies when overlaid on data with a higher level of positional accuracy.

In a similar situation to the use of the 100-year floodplain information, the tax parcel boundaries in Reach 7 were manually digitized from Berkshire County tax maps. The use of these tax maps can result in some discrepancies and conflicts with physical features when presented as overlays on more accurate GIS base layers such as the aerial photos used in the Reach 7 figures.

Given the major differences in the data sources and the accuracy of GIS data available for Reach 7, it was decided to limit the information included on the figures for Reach 7 to an aerial photo background, sample locations, parcel boundaries, and 100-year floodplain. In some cases, the figures for Reach 7 have some apparent inaccuracies in the way these layers align. These apparent inaccuracies did not affect the results of the analysis.

Table 5-325 summarizes the cancer and noncancer risks for all of the EAs and subareas in Reach 7. The EA number, the exposure scenario(s) evaluated, the receptor(s), the land use for which the exposure scenario(s) apply, the EPC, the cancer risks, and noncancer hazard indices are presented. Figure 5-1B presents the locations of the EAs and subareas in Reach 7 that were evaluated as part of the risk assessment.

5.5.2.1 Exposure Area 67

Exposure Area 67 consists of a portion of tax parcel 2-32, as shown in Figure 5-67, and is approximately 0.21 acre. Tax parcel 2-32 is owned by GE and is located along Valley Street in Lenoxdale in a heavily developed residential area. There are numerous residences located within ¼ of a mile. There are also commercial properties located in close proximity. Railroad tracks form the eastern border of the area.

Current Uses

Because the EA is located in a developed residential area, it is assumed that nearby residents can access and recreate on EA 67. Therefore, EA 67 was evaluated using the general recreation exposure scenario for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Uses

The land use at EA 67 is not expected to change to a more restrictive land use (i.e., residential) in the future. It is considered unlikely that GE will develop any portion of the property. Thus, the exposure scenario identified above also reflects the likely future uses.

Results

EA 67 is considered a high-use area because it is located within close proximity to numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-67. The EPC for both the current and future uses is 16 mg/kg.

Table 5-326 presents the cancer risk estimates for the adult. The total RME cancer risk is 1E-05. The total CTE cancer risk is 3E-07. Table 5-327 presents the HQs and the total HIs for the adult. The total RME HI is 0.42. The total CTE HI is 0.068. The cancer risks and HIs apply to both the current and future uses of EA 67.

5.5.2.2 Exposure Area 68

Exposure Area 68 consists of a small portion of tax parcel 38-49, as shown in Figure 5-68, and is approximately 0.08 acre. Tax parcel 38-49 is owned by the Town of Lenox and is located along Walker Street. It is located in a heavily developed residential area, and two residential properties directly abut EA 68. There is a water treatment facility immediately adjacent to the south. There are numerous residences located within ¼ of a mile. The area is characterized as having a steep slope to the river and a small amount of area within the floodplain.

Current Use

It is assumed that current activities at EA 67 include general recreation. Thus, the general recreation scenario was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 68 is not considered to be suitable for future development because it consists of a small, narrow portion of tax parcel 38-49 that slopes to the river. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 68 is considered a high-use area because it is located within close proximity to numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-68. The EPC for both the current and future uses is 5.5 mg/kg.

Table 5-328 presents the cancer risk estimates for the adult. The total RME cancer risk is 4E-06. The total CTE cancer risk is 9E-08. Table 5-329 presents the HQs and the total HIs for the adult. The total RME HI is 0.14. The total CTE HI is 0.024. The cancer risks and HIs apply to both the current and future uses of EA 68.

5.5.2.3 Exposure Area 69

Exposure Area 69 consists of the southern portion of tax parcel 2-31, as shown in Figure 5-69, and is approximately 1.9 acres. Tax parcel 2-31 is privately owned and is located along Columbia Street in Lenox. There are a number of residences located across Columbia Street within close proximity. There is a paved access road and a parking lot that provide access to the area. The northern portion of tax parcel 2-31 is used for industrial purposes, a residential property abuts EA 69 to the south, and railroad tracks are located to the east. The PCB concentrations at the northern portion of tax parcel 2-31 were less than screening criteria; thus, this area was eliminated in the Phase 1 screening process and was not evaluated further.

Current Use

Activities observed in this area by EPA personnel or consultants include fishing from shore and general recreation-related activities. These activities meet the criteria for the general recreation and angler scenarios, both of which were used to evaluate EA 69. A summary of the exposure assumptions for the general recreation and angler scenarios are presented in Tables 4-12 and 4-16, respectively.

Future Use

EA 69 is not considered to be suitable for future development because the majority of the area lies within the 100-year floodplain, making future development unlikely. Thus, it is expected that the site uses will not change and the exposure scenarios identified above also reflect the likely future uses.

5.5.2.3.1 Angler Scenario

As shown in Table 4-16, the EFs for the angler scenario are 30 and 10 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-69. The EPC for both the current and future uses is 12 mg/kg.

Results

Table 5-330 presents the cancer risk estimates for the older child angler. The total RME cancer risk is 2E-06. The total CTE cancer risk is 2E-07. Table 5-331 presents the cancer risk estimates for the adult angler. The total RME cancer risk is 5E-06. The total CTE cancer risk is 2E-07.

Table 5-332 presents the HQs and the total HIs for the older child angler. The total RME HI is 0.28. The total CTE HI is 0.067. Table 5-333 presents the HQs and the total HIs for the adult angler. The total RME HI is 0.22. The total CTE HI is 0.054. The cancer risks and HIs apply to both the current and future uses of EA 69.

5.5.2.3.2 General Recreational Scenario

The general recreation scenario evaluated EA 69 for the adult receptor. EA 69 is considered a high-use area because it is located within close proximity to numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-69. The EPC for both the current and future uses is 12 mg/kg.

Results

Table 5-334 presents the cancer risk estimates for the adult. The total RME cancer risk is 8E-06. The total CTE cancer risk is 2E-07. Table 5-335 presents the HQs and the total HIs for the adult. The total RME HI is 0.31. The total CTE HI is 0.051. The cancer risks and HIs apply to both the current and future uses of EA 69.

5.5.2.4 Exposure Area 70

Exposure Area 70 consists of a portion of tax parcel 8-38, as shown in Figure 5-70, and is approximately 8.9 acres. Tax parcel 8-38 is a privately owned residential parcel that is located along Columbia Street in Lee. Tax parcel 8-38 is transected by railroad tracks that run north and south. There is a home located on tax parcel 8-38 with numerous residences located within ¼ of a mile away to the east (two residences directly abut EA 70). It is bounded by an industrial property and a residential property to the north, Golden Hill Road to the south, and raised railroad tracks to the east. Access to EA 70 can be gained from the nearby residences, the railroad tracks, and Golden Hill Road.

Current Use

Activities observed in this area by EPA personnel or consultants include fishing from shore and general recreation. The general recreation scenario was selected to evaluate the entire area for the young child and adult receptors. The angler scenario was selected to evaluate the area along the riverbank where angling occurs, which was designated as subarea 70A. Summaries of the exposure assumptions for the general recreation and angler scenarios are presented in Tables 4-12 and 4-16, respectively.

Future Use

EA 70 was not assumed to be developable because of inundated wetlands that characterize a significant portion of the area. Thus, it is expected that the site uses will not change and the exposure scenarios identified above also reflect the likely future uses.

5.5.2.4.1 Exposure Area 70 – Entire Area (General Recreation)

EA 70 is considered a high-use area because it is readily accessible from the railroad tracks that run through the area, from Golden Hill Road to the south, and from the nearby residential area. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation exposure scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-70. The EPC for the entire area for both the current and future uses is 12.5 mg/kg.

Results

Tables 5-336 and 5-337 present the general recreation cancer risk estimates for the young child and adult, respectively. The total RME cancer risk for both the young child and adult is 9E-06. The total CTE cancer risks for the young child and adult are 7E-07 and 2E-07, respectively.

Tables 5-338 and 5-339 present the general recreation HQs and the total HIs for the young child and adult, respectively. The total RME HIs for the young child and adult are 2.7 and 0.33, respectively. The total CTE HIs for the young child and adult are 0.40 and 0.053, respectively. The cancer risks and HIs apply to both the current and future uses of EA 70.

5.5.2.4.2 Subarea 70A (Angler)

As shown in Table 4-16, the EFs for the angler scenario are 30 and 10 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 70A were used to calculate the EPC for the angler. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-70. The EPC for subarea 70A for both the current and future uses is 5.9 mg/kg.

Results

Table 5-340 presents the cancer risk estimates for the older child angler. The total RME cancer risk is 1E-06. The total CTE cancer risk is 1E-07. Table 5-341 presents the cancer risk estimates for the adult angler. The total RME cancer risk is 2E-06. The total CTE cancer risk is 8E-08.

Table 5-342 presents the HQs and the total HIs for the older child angler. The total RME HI is 0.14. The total CTE HI is 0.033. Table 5-343 presents the HQs and the total HIs for the adult angler. The total RME HI is 0.11. The total CTE HI is 0.027. The cancer risks and HIs apply to both the current and future uses of subarea 70A.

5.5.2.5 Exposure Area 71

Exposure Area 71 consists of a narrow portion of tax parcel 13-1, as shown in Figure 5-71, and is approximately 1.7 acres. This tax parcel is privately owned and is located along Columbia Street in Lee, close to existing residences. It is bounded by Golden Hill Road to the north, an industrial property to the south, and raised railroad tracks to the east. EA 71 is located just upstream of the Columbia Mill impoundment.

Current Use

It is assumed that general recreation-related activities and fishing from shore occurs in this area. These activities meet the criteria for the general recreation and angler scenarios, both of which were used to evaluate EA 71. A summary of the exposure assumptions for the general recreation and angler scenarios are presented in Tables 4-12 and 4-16, respectively.

Future Use

EA 71 is not considered to be suitable for future development because it consists of a very narrow tract of the tax parcel, making future development unlikely. Thus, it is expected that the site uses will not change and the exposure scenarios identified above also reflect the likely future uses.

5.5.2.5.1 Angler Scenario

As shown in Table 4-16, the EFs for the angler scenario are 30 and 10 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-71. The EPC for both the current and future uses is 12 mg/kg.

Results

Table 5-344 presents the cancer risk estimates for the older child angler. The total RME cancer risk is 2E-06. The total CTE cancer risk is 2E-07. Table 5-345 presents the cancer risk estimates for the adult angler. The total RME cancer risk is 5E-06. The total CTE cancer risk is 2E-07.

Table 5-346 presents the HQs and the total HIs for the older child angler. The total RME HI is 0.28. The total CTE HI is 0.065. Table 5-347 presents the HQs and the total HIs for the adult angler. The total RME HI is 0.21. The total CTE HI is 0.053. The cancer risks and HIs apply to both the current and future uses of EA 71.

5.5.2.5.2 General Recreational Scenario

The general recreation scenario evaluated EA 71 for the adult receptor. EA 71 is considered a low-use area because it consists of a small portion of land that is bordered to the east by active railroad tracks, therefore access is limited. Thus, EF values of 30 and 15 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-71. The EPC for both the current and future uses is 12 mg/kg.

Results

Table 5-348 presents the cancer risk estimates for the adult. The total RME cancer risk is 3E-06. The total CTE cancer risk is 1E-07. Table 5-349 presents the HQs and the total HIs for the adult. The total RME HI is 0.10. The total CTE HI is 0.026. The cancer risks and HIs apply to both the current and future uses of EA 71.

5.5.2.6 Exposure Area 72

Exposure Area 72 consists of a portion of tax parcel 7-49A, as shown in Figure 5-72. Tax parcel 7-49A is privately owned and is located off Golden Hill Road in Lee. It is located directly upstream of the Columbia Mill Dam. There is a path from Golden Hill Road that extends onto the area.

Current Use

Current activities at EA 72 include fishing from shore. This activity meets the criteria for the angler scenario, which was used to evaluate EA 72. A summary of the exposure assumptions for the angler scenario is presented in Table 4-16.

Future Use

Potential future residential development was considered possible at tax parcel 7-49A, which includes EAs 72 and 73. Thus, these EAs were combined and the future residential scenario was evaluated for the young child and adult receptors. A summary of the exposure assumptions for the future residential scenario is presented in Tables 4-9 through 4-11.

5.5.2.6.1 Angler Scenario

As shown in Table 4-16, the EFs for the angler scenario are 30 and 10 days/year for the RME and CTE scenarios, respectively. The data from EA 72 were used to calculate the EPC for the angler. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-72. The EPC for the current use is 34 mg/kg.

Results

Table 5-350 presents the cancer risk estimates for the older child angler. The total RME cancer risk is 5E-06. The total CTE cancer risk is 6E-07. Table 5-351 presents the cancer risk estimates for the adult angler. The total RME cancer risk is 1E-05. The total CTE cancer risk is 5E-07.

Table 5-352 presents the HQs and the total HIs for the older child angler. The total RME HI is 0.80. The total CTE HI is 0.19. Table 5-353 presents the HQs and the total HIs for the adult angler. The total RME HI is 0.61. The total CTE HI is 0.15. The cancer risks and HIs apply to the current use of EA 72.

5.5.2.6.2 Future Residential Scenario

It was assumed tax parcel 7-49A (EAs 72 and 73 combined) had the potential for future residential development, including future residential lawn areas. Therefore, the EF value used to calculate the exposure doses and risks for the future residential exposure scenario was 150 days/year for both the RME and CTE evaluations. The data from the entire tax parcel (EAs 72 and 73) were used to calculate the EPC. Summary statistics for this area, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-72. The EPC for the future use is 34 mg/kg.

Results

Table 5-354 presents the cancer risk estimates for the future residential scenario. The total RME cancer risk is 8E-05. The total CTE cancer risk is 2E-05. Tables 5-355 and 5-356 present the HQs and the total HIs from the future residential scenario for the young child and adult, respectively. The total RME HIs for the young child and adult are 12 and 1.5, respectively. The total CTE HIs for the young child and adult are 7.7 and 0.98, respectively. The cancer risks and HIs apply to the future use of EAs 72 and 73.

5.5.2.7 Exposure Area 73

Exposure Area 73 consists of a portion of tax parcel 7-49A, as shown in Figure 5-72. Tax parcel 7-49A is privately owned and is located off Golden Hill Road in Lee. It is located directly downstream of the Columbia Mill Dam. There are numerous residences located within ¼ of a mile to the west (several residences abut EA 73). A walking trail runs through this area.

Current Use

Current activities at this EA include walking and hiking. These activities meet the criteria for the general recreation scenario which was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

Potential future residential development was considered possible at tax parcel 7-49A, which includes EAs 72 and 73. The future residential scenario is evaluated in Section 5.5.2.6.

Results

EA 73 is considered a high-use area because it is readily accessible from the trail that runs through the area and the nearby residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-72. The EPC for the current use is 2.5 mg/kg.

Table 5-357 presents the cancer risk estimates for the adult. The total RME cancer risk is 2E-06. The total CTE cancer risk is 4E-08. Table 5-358 presents the HQs and the total HIs for the adult. The total RME HI is 0.065. The total CTE HI is 0.011. The cancer risks and HIs apply to the current use of EA 73.

5.5.2.8 Exposure Area 74

Exposure Area 74 consists of a narrow portion of tax parcel 12-205, as shown in Figure 5-73, and is approximately 5.2 acres. Tax parcel 12-205 is privately owned and is located off Route 20 in Lee. There are numerous residences located within ¼ of a mile (several directly abut EA 74). A walking trail runs along the river in this area.

Current Use

Current activities at this area include walking, hiking, riding snowmobiles, and dog walking. These activities meet the criteria for the general recreation exposure scenario which was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 74 is not considered to be suitable for future development because it consists of a narrow tract of tax parcel 12-205, making future development unlikely. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 74 is considered a high-use area because it is readily accessible from Route 20, has a trail that runs through the area, and is close to nearby residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-73. The EPC for both the current and future uses is 17.9 mg/kg.

Table 5-359 presents the cancer risk estimates for the adult. The total RME cancer risk is 1E-05. The total CTE cancer risk is 3E-07. Table 5-360 presents the HQs and the total HIs for the adult. The total RME HI is 0.47. The total CTE HI is 0.076. The cancer risks and HIs apply to both the current and future uses of EA 74.

5.5.2.9 Exposure Area 75

Exposure Area 75 consists of a portion of tax parcel 12A-52, as shown in Figure 5-74, and is approximately 3.4 acres. Tax parcel 12A-52 is a privately owned residential parcel and is located along Summer Street by Route 20 in Lee. There is a home located on this parcel and numerous residences located within ¼ of a mile (several residences directly abut EA 75). A walking trail runs along the river in this area.

Current Use

Although EA 75 is a portion of a privately owned residential tax parcel, it is currently used for recreational purposes. Therefore, EA 75 was evaluated using the general recreation exposure scenario for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 75 is not considered to be suitable for future development because it consists of a portion of tax parcel 12A-52, which slopes to the river, making future development unlikely. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 75 is considered a high-use area because it is readily accessible from the trail that runs through the area and nearby residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-74. The EPC for both the current and future uses is 15 mg/kg.

Table 5-361 presents the cancer risk estimates for the adult. The total RME cancer risk is 1E-05. The total CTE cancer risk is 2E-07. Table 5-362 presents the HQs and the total HIs for the adult.

The total RME HI is 0.39. The total CTE HI is 0.064. The cancer risks and HIs apply to both the current and future uses of EA 75.

5.5.2.10 Exposure Area 76

Exposure Area 76 consists of a portion of tax parcel 12A-51, as shown in Figure 5-75, and is approximately 1.1 acres. Tax parcel 12A-51 is privately owned and is located along Prospect Street in Lee. An abandoned nursing home is located on the parcel. There are numerous residences located within ¼ of a mile (several residences directly abut EA 76). The area is characterized as having a very steep slope. A walking trail runs along the river in this area.

Current Use

EA 76 is currently used for general recreation purposes. Thus, the general recreation exposure scenario was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

Potential future residential development was considered possible at this parcel. Thus, the future residential exposure scenario was evaluated for the young child and adult receptors. A summary of the exposure assumptions for the future residential scenario is presented in Tables 4-9 through 4-11.

5.5.2.10.1 General Recreation Scenario

Currently, EA 76 is considered a high-use area because it is readily accessible via the trail that runs through the area and nearby residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation exposure scenario for the RME and CTE evaluations, respectively. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-75. The EPC for the current use is 2.2 mg/kg.

Results

Table 5-363 presents the general recreation cancer risk estimates. The total RME cancer risk is 2E-06. The total CTE cancer risk is 3E-08. Table 5-364 presents the general recreation HQs and the total HIs. The total RME HI is 0.057. The total CTE HI is 0.0094. The cancer risks and HIs apply to the current use of EA 76.

5.5.2.10.2 Future Residential Scenario

It was assumed that a portion of EA 76 has the potential for future residential development. However, the area has steep banks, which would preclude future residential lawn areas. Therefore, the EF values used to calculate the exposure doses and risks for the future residential exposure scenario were 90 and 30 days/year for the RME and CTE evaluations, respectively. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-75. The data from the entire EA were used to calculate the EPC. The EPC for the future use is 2.2 mg/kg.

Results

Table 5-365 presents the cancer risk estimates from the future residential scenario. The total RME cancer risk is 3E-06. The total CTE cancer risk is 2E-07. Tables 5-366 and 5-367 present the HQs and the total HIs from the future residential scenario for the young child and adult, respectively. The total RME HIs for the young child and adult are 0.48 and 0.057, respectively. The total CTE HIs for the young child and adult are 0.10 and 0.013, respectively. The cancer risks and HIs apply to the future use of EA 76.

5.5.2.11 Exposure Area 77

Exposure Area 77 consists of a portion of tax parcel 18A-21A, as shown in Figure 5-76, and is approximately 4.2 acres. Tax parcel 18A-21A is privately owned and is located off Prospect Street in Lee. There are numerous residences situated to the west (several residences abut EA 77). There is a walking trail along the river in this area.

Current Use

EA 77 is currently used for general recreation purposes. Thus, the general recreation exposure scenario was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 77 is not considered to be suitable for future development because it consists of a portion of tax parcel 18A-21A with a steep slope to the river. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 77 is considered a high-use area because it is readily accessible via the trail that runs through the area and nearby residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-76. The EPC for both the current and future uses is 2 mg/kg.

Table 5-368 presents the cancer risk estimates for the adult. The total RME cancer risk is 2E-06. The total CTE cancer risk is 4E-08. Table 5-369 presents the HQs and the total HIs for the adult. The total RME HI is 0.058. The total CTE HI is 0.0096. The cancer risks and HIs apply to both the current and future uses of EA 77.

5.5.2.12 Exposure Area 78

Exposure Area 78 consists of portions of tax parcels 19-2, 19-5, and 19-8, as shown in Figure 5-77, and is approximately 6.2 acres. These tax parcels are privately owned and are located along Route 20 in downtown Lee. EA 78 is bounded on the north by athletic fields. Access to EA 78 from the athletic fields is not restricted (i.e., there is no fence).

Current Use

Tax parcels 19-2, 19-5, and 19-8 are used for recreational and commercial purposes (i.e., motels and a retail store). Current activities at EA 78 include general recreation and groundskeeping-related activities. It is assumed that older children can visit this area given the unrestricted access and the frequently used athletic fields to the north. These activities meet the criteria for the general recreation and groundskeeper scenarios. Because the general recreation scenario would result in the higher exposure, it was evaluated for the older child. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

Potential future residential development was considered possible at these parcels. Thus, the future residential scenario was evaluated for the young child and adult receptors. A summary of the exposure assumptions for the future residential scenario is presented in Tables 4-9 through 4-11.

5.5.2.12.1 General Recreation Scenario

EA 78 is considered a high-use area because it is readily accessible from the athletic fields immediately adjacent to the north. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-77. The EPC for the current use is 11.9 mg/kg.

Results

Table 5-370 presents the cancer risk estimates for the older child. The total RME cancer risk is 3E-06. The total CTE cancer risk is 2E-07. Table 5-371 presents the HQs and the total HIs for the older child. The total RME HI is 0.45. The total CTE HI is 0.067. The cancer risks and HIs apply to the current use of EA 78.

5.5.2.12.2 Future Residential Scenario

It was assumed that EA 78 has the potential for future residential development, including future residential lawn areas. Therefore, the EF value used to calculate the exposure doses and risks for the future residential exposure scenario was 150 days/year for both the RME and CTE evaluations. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-77. The EPC for the future use is 11.9 mg/kg.

Results

Table 5-372 presents the cancer risk estimates from the future residential scenario. The total RME cancer risk is 3E-05. The total CTE cancer risk is 5E-06. Tables 5-373 and 5-374 present the HQs and the total HIs from the future residential scenario for the young child and adult, respectively. The total RME HIs for the young child and adult are 4.3 and 0.51, respectively. The total CTE HIs for the young child and adult are 2.7 and 0.34, respectively. The cancer risks and HIs apply to the future use of EA 78.

5.5.2.13 Exposure Area 79

Exposure Area 79 consists of a portion of tax parcel 25-6, as shown in Figure 5-78, and is approximately 16.5 acres. Tax parcel 25-6 is a privately owned parcel with a residence and is located on Marble Street in Lee just south of the Massachusetts Turnpike. There are a number of residences to the south within ¼ of a mile (several directly abut EA 79).

Current Use

Although EA 79 is a portion of a residential parcel, current activities at EA 79 is general recreation. Thus, the general recreation exposure scenario was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 79 is not considered to be suitable for future development because it consists of a portion of tax parcel 25-6, which is characterized as having a steep slope to the river. Thus, it is expected that the site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 79 is considered a high-use area because it is readily accessible from the nearby residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-78. The EPC for both the current and future uses is 5 mg/kg.

Table 5-375 presents the cancer risk estimates for the adult. The total RME cancer risk is 3E-06. The total CTE cancer risk is 8E-08. Table 5-376 presents the HQs and the total HIs for the adult. The total RME HI is 0.12. The total CTE HI is 0.021. The cancer risks and HIs apply to both the current and future uses of EA 79.

5.5.2.14 Exposure Area 80

Exposure Area 80 consists of a large portion of tax parcel 35-5A, as shown in Figure 5-79, and is approximately 29.3 acres. Tax parcel 35-5A is privately owned and is located along Meadow Street in South Lee. There are a number of residences that abut tax parcel 35-5A.

Current Use

Currently, tax parcel 35-5A is used for agricultural and general recreation purposes. This EA was divided into two subareas based on the different activities that occur in each area. The first, designated as subarea 80A, consists of the area that is used for recreational purposes. The general recreation scenario was evaluated for the adult receptor. The second subarea, designated as subarea 80B, consists of the area used for agriculture. The farmer scenario evaluated subarea

80B. Figure 5-80 presents location of subareas 80A and 80B. A summary of the exposure assumptions for the general recreation and the farmer scenarios are presented in Tables 4-12 and 4-19, respectively.

Future Use

Potential future residential development was considered possible at EA 80. The future residential scenario was evaluated for the young child and adult receptors. A summary of the exposure assumptions for the future residential scenario is presented in Tables 4-9 through 4-11.

5.5.2.14.1 Subarea 80A (General Recreation)

Subarea 80A is considered a low-use subarea because it is not readily accessible because of limited access and remote location. Thus, EF values of 30 and 15 days/year were used to calculate the exposure doses and risk for the general recreation exposure scenario for the RME and CTE scenarios, respectively. The data from subarea 80A were used to calculate the EPC. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-79. The EPC for subarea 80A for both the current uses is 5 mg/kg.

Results

Table 5-377 presents the cancer risk estimates for the adult based on the general recreation scenario. The total RME cancer risk is 1E-06. The total CTE cancer risk is 4E-08. Table 5-378 presents the HQs and the total HIs for the adult based on the general recreation scenario. The total RME HI is 0.039. The total CTE HI is 0.0096. The cancer risks and HIs apply to the current use of subarea 80A.

5.5.2.14.2 Subarea 80B (Farmer)

As shown in Table 4-19, the EFs for the farmer scenario were 40 and 10 days/year for the RME and CTE scenarios, respectively. The data from subarea 80B were used to calculate the EPC for the farmer exposure. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-79. The EPC for subarea 80B for the current use is 3 mg/kg.

Results

Table 5-379 presents the cancer risk estimates for the farmer. The total RME cancer risk is 3E-06. The total CTE cancer risk is 7E-08. Table 5-380 presents the HQs and the total HIs for the farmer. The total RME HI is 0.070. The total CTE HI is 0.0087. The cancer risks and HIs apply to the current use of subarea 80B.

5.5.2.14.3 Exposure Area 80 – Entire Area (Future Residential)

It was assumed that EA 80 has the potential for future residential development, including future residential lawn areas. Therefore, the EF value used to calculate the exposure doses and risks for the future residential exposure scenario was 150 days/year for both the RME and CTE evaluations. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-79. The EPC for the entire area for the future use is 3 mg/kg.

Results

Table 5-381 presents the cancer risk estimates from the future residential scenario. The total RME cancer risk is 6E-06. The total CTE cancer risk is 1E-06. Tables 5-382 and 5-383 present the HQs and the total HIs from the future residential scenario for the young child and adult, respectively. The total RME HIs for the young child and adult are 1.0 and 0.12, respectively. The total CTE HIs for the young child and adult are 0.64 and 0.082, respectively. The cancer risks and HIs apply to the future use of EA 80.

5.5.2.15 Exposure Area 81

Exposure Area 81 consists of a portion of tax parcel 35-2, as shown in Figure 5-80, and is approximately 32.7 acres. Tax parcel 35-2 is privately owned and is located along Meadow Street in South Lee. Two residential properties abut tax parcel 35-2. It is bounded by Beartown State Forest to the south and the Oak N' Spruce Resort to the west.

Current Use

Currently, EA 81 is used for recreational purposes. Thus, the general recreation scenario was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenarios is presented in Table 4-12.

Future Use

Because of the presence of a conservation deed restriction for tax parcel 35-2 that prohibits future development at EA 81, it is expected that the site uses will not change in the future (i.e., it will remain recreational). There is the possibility that trails could be developed at some point in the future; however, the type of activities, while potentially occurring in additional portions of the EA, are not expected to differ significantly from those currently occurring at EA 81.

Results

Currently, EA 81 is considered a low-use area because it is not readily accessible and is in a remote location. Thus, EF values of 30 and 15 days/year were used to calculate the exposure doses and risk for the RME and CTE evaluations, respectively, for the current use evaluation. However, it can be reasonably anticipated that areas could be cleared of brush and developed into walking trails in the future. Thus, EFs of 90 and 30 days/year were used for the RME and CTE evaluations, respectively, indicating more intense future use.

The data from the entire area were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-80. The EPC for both the current and future uses is 3.7 mg/kg.

Current Use

Table 5-384 presents the cancer risk estimates for the adult based on the current use. The total RME cancer risk is 9E-07. The total CTE cancer risk is 3E-08. Table 5-385 presents the HQs and the total HIs for the adult based on the current use. The total RME HI is 0.032. The total CTE HI is 0.0079.

Future Use

Tables 5-384 and 3-385 also present the cancer risks and HIs for the future use of EA 81. The cancer risks are 3E-06 (RME) and 6E-08 (CTE). The total HIs are 0.097 (RME) and 0.016 (CTE).

5.5.2.16 Exposure Area 82

Exposure Area 82 consists of a portion of tax parcel 35-1A, as shown in Figure 5-81, and is approximately 15.5 acres. Tax parcel 35-1A is owned by the Massachusetts Division of Fisheries and Wildlife and is located along Meadow Street in South Lee. It is bounded by Beartown State Forest to the south and the Oak N' Spruce Resort to the west.

Current Use

Current activities at EA 82 include general recreation. Thus, the general recreation exposure scenario was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 82 is owned by the Massachusetts Division of Fisheries and Wildlife. Because of state law governing the disposition of state-owned properties and a Consent Decree provision requiring that the state grant in the future, without compensation, Environmental Restrictions and Easements (EREs) for state-owned properties along the river that allow for recreational use and continued use for activities which were occurring at the time the Consent Decree was lodged, it is expected that the site use will not change in the future (i.e., it will remain recreational). Thus, the exposure scenario identified above also reflects the likely future uses. There is the possibility that trails could be developed at some point in the future; however, the type of activities, while potentially occurring in additional portions of the EA, are not expected to differ significantly from those currently occurring at EA 82.

Results

Currently, EA 82 is considered a low-use area because it is not readily accessible because of its remote location and its difficulty of access. Thus, EF values of 30 and 15 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively, for the current use evaluation. However, it can be reasonably anticipated that areas could be cleared of brush and developed into walking trails in the future. Thus, EFs of 90 and 30 days/year were used for the RME and CTE evaluations, respectively, indicating more intense future use.

The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-81. The EPC for both the current and future uses is 7 mg/kg.

Current Use

Table 5-386 presents the cancer risk estimates for the adult based on the current use. The total RME cancer risk is 2E-06. The total CTE cancer risk is 5E-08. Table 5-387 presents the HQs and the total HIs for the adult based on the current use. The total RME HI is 0.060. The total CTE HI is 0.015.

Future Use

Tables 5-386 and 3-387 also present the cancer risks and HIs for the future use of EA 82. The cancer risks are 5E-06 (RME) and 1E-07 (CTE). The total HIs are 0.18 (RME) and 0.029 (CTE).

5.5.2.17 Exposure Area 83

Exposure Area 83 consists of a portion of tax parcel 35-1, as shown in Figure 5-83, and is approximately 22.1 acres. Tax parcel 35-1 is a privately owned resort area that is located along Meadow Street in South Lee. It is bounded by railroad tracks to the northwest and a state-owned property to the east.

Current Use

Activities observed in this area by EPA personnel or consultants include chip-and-putt golf, groundskeeping, and related activities. These activities meet the criteria for the general recreation and groundskeeper exposure scenarios. Because the groundskeeper is expected to be on-site more frequently than an individual playing chip-and-putt golf, the groundskeeper was evaluated for EA 83. A summary of the exposure assumptions for the groundskeeper scenario is presented in Table 4-20.

Future Use

Potential future residential development was considered possible at EA 83. Thus, the future residential scenario was evaluated for young child and adult receptors. A summary of the exposure assumptions for the future residential scenario is presented in Tables 4-9 through 4-11.

5.5.2.17.1 Groundskeeper Scenario

An EA-specific EF value of 150 days/year was used to calculate the exposure doses and risks for the groundskeeper scenario for both the RME and CTE evaluations, respectively. This EF was selected based on the assumption that a groundskeeper would typically spend 5 days per week performing golf course groundskeeping duties such as mowing and maintaining site grounds. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-82. The EPC for the current use is 3 mg/kg.

Results

Table 5-388 presents the cancer risk estimates for the groundskeeper. The total RME cancer risk is 2E-06. The total CTE cancer risk is 2E-07. Table 5-389 presents the general recreation HQs and the total HIs for the groundskeeper. The total RME HI is 0.11. The total CTE HI is 0.047. The cancer risks and HIs apply to the current use of EA 83.

5.5.2.17.2 Future Residential Scenario

It was assumed that EA 83 has the potential for future residential development including future residential lawn areas. Therefore, the EF value used to calculate the exposure doses and risks for the future residential exposure scenario was 150 days/year for both the RME and CTE evaluations. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-82. The EPC for the future use is 3 mg/kg.

Results

Table 5-390 presents the cancer risk estimates from the future residential scenario. The total RME cancer risk is 6E-06. The total CTE cancer risk is 1E-06. Tables 5-391 and 5-392 present the HQs and the total HIs from the future residential scenario for the young child and adult, respectively. The total RME HIs for the young child and adult are 0.98 and 0.12, respectively. The total CTE HIs for the young child and adult are 0.61 and 0.077, respectively. The cancer risks and HIs apply to the future use of EA 83.

5.5.2.18 Exposure Area 84

Exposure Area 84 consists of a portion of tax parcels 29-93A and 29-68, as shown in Figure 5-83, and is approximately 8.5 acres. These tax parcels are privately owned and are located off Meadow Street in South Lee. EA 84 is bounded by an industrial property to the west, a residential property to the east, and railroad tracks to the south.

Current Use

Current activities at EA 84 include general recreation. Thus, the general recreation exposure scenario was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

Because tax parcels 29-93A and 29-68 are located within the 100-year floodplain, future development is considered unlikely. Thus, it is expected that the site uses will not change in the future (i.e., it will remain recreational). There is the possibility that trails could be developed at some point in the future; however, the type of activities, while potentially occurring in additional portions of the EA, are not expected to differ significantly from those currently occurring at EA 84.

Results

Currently, EA 84 is considered a low-use area because it is not readily accessible and in a remote location. Thus, EF values of 30 and 15 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively, for the current use evaluation. However, it can be reasonably anticipated that areas could be cleared of brush and developed with trails in the future. Thus, EFs of 90 and 30 days/year were used for the RME and CTE evaluations, respectively, indicating more intense future use.

The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-83. The EPC for both the current and future uses is 7.4 mg/kg.

Current Use

Table 5-393 presents the cancer risk estimates for the adult based on the current use. The total RME cancer risk is 2E-06. The total CTE cancer risk is 6E-08. Table 5-394 presents the HQs and the total HIs for the adult based on the current use. The total RME HI is 0.064. The total CTE HI is 0.016.

Future Use

Tables 5-393 and 3-394 also present the cancer risks and HIs for the future use of EA 84. The cancer risks are 5E-06 (RME) and 1E-07 (CTE). The total HIs are 0.19 (RME) and 0.031 (CTE).

5.5.2.19 Exposure Area 85

Exposure Area 85 consists of a portion of tax parcel 21-62, as shown in Figure 5-84, and is approximately 10.5 acres. Tax parcel 21-62 is owned by the Town of Stockbridge and is located along Park Street by the Route 7 Bridge. There are numerous residences within ¼ of a mile. EA 85 is composed of maintained ball fields and has a parking lot that provides space for multiple vehicles.

Current Use

Activities observed in this area by EPA personnel or consultants include playing baseball, basketball, and soccer; skateboarding; and canoe/boat launching. These activities meet the criteria for the general recreation and recreational canoeist/boater scenario. This EA was divided into two subareas based on the different activities that occur in each area. The first, designated as subarea 85A, consists of the boat launch area. The recreational canoeist/boater scenario was evaluated for the boat launching area for the older child and adult receptors. The second, designated as subarea 85B, consists of the area that is not used as a boat launch. The general recreation scenario was evaluated for subarea 85B for the older child receptor. Summaries of the exposure assumptions for general recreation and the recreational canoeist/boater scenario are presented in Tables 4-12 and 4-15, respectively.

Future Use

This area was not assumed to be suitable for future development because the majority of tax parcel 21-62 lies within the 100-year floodplain, which would make residential development unlikely. It is expected that the site uses will not change in the future (i.e., it will remain recreational). Thus, the exposure scenarios identified above also reflect the likely future uses.

5.5.2.19.1 Subarea 85A (Recreational Canoeist/Boater)

As noted in Section 4.3.5.2.4, it is assumed that older children and adults are the most likely receptors to engage in recreational canoe outings. As shown in Table 4-15, the EFs for the older child are 30 and 15 days/year for the RME and CTE cases, respectively. The EFs for the adult are 60 and 30 days/year for the RME and CTE cases, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 85A were used to calculate the EPC for the recreational canoeist/boater scenario. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-84. The EPC for both the current and future uses is 4.8 mg/kg.

Results

Tables 5-395 and 5-396 present the recreational canoeist/boater cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 8E-07 and 4E-06, respectively. The total CTE cancer risks for the older child and adult are 1E-07 and 4E-07, respectively.

Tables 5-397 and 5-398 present the recreational canoeist/boater HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.11 and 0.17, respectively. The total CTE HIs for the older child and are were 0.040 and 0.066, respectively. The cancer risks and HIs apply to both the current and future uses of subarea 85A.

5.5.2.19.2 Subarea 85B (General Recreation)

Subarea 85B is considered a high-use subarea because it is a popular and frequently used recreational area where children participate in sports and the proximity to numerous residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 85B were used to calculate the EPC for the general recreation scenario. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-84. The EPC for both the current and future uses is 2.3 mg/kg.

Results

Table 5-399 presents the general recreation cancer risk estimates for the older child. The total RME cancer risk is 6E-07. The total CTE cancer risk is 4E-08. Table 5-400 presents the general recreation HQs and the total HIs for the older child. The total RME HI is 0.086. The total CTE HI is 0.013. The cancer risks and HIs apply to both the current and future uses of subarea 85B.

5.5.2.20 Exposure Area 86

Exposure Area 86 consists of portions of the Stockbridge Golf Course, as shown in Figure 5-85, and is approximately 117.4 acres. It is located in the center of Stockbridge and is surrounded by commercial and residential properties.

Current Use

Current activities at EA 86 include golfing, groundskeeping, and related activities. These activities meet the criteria for the general recreation and groundskeeper exposure scenarios. Because the groundskeeper is expected to be on-site much more frequently than an individual golfing, the groundskeeper was evaluated for EA 86. A summary of the exposure assumptions for the groundskeeper scenario is presented in Table 4-20.

Future Use

Potential future residential development is considered possible at EA 86. Thus, the future residential scenario was evaluated for the young child and adult receptors. A summary of the exposure assumptions for the future residential scenario is presented in Tables 4-9 through 4-11.

5.5.2.20.1 Groundskeeper Scenario

An EA-specific EF value of 150 days/year was used to calculate the exposure doses and risks for the groundskeeper scenario for both the RME and CTE evaluations. This EF was selected based on the assumption that a groundskeeper would typically spend 5 days per week performing golf course groundskeeping duties such as mowing and maintaining the course. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-85. The EPC for the current use is 4 mg/kg.

Results

Table 5-401 presents the cancer risk estimates for the groundskeeper. The total RME cancer risk is 2E-06. The total CTE cancer risk is 2E-07. Table 5-402 presents the HQs and the total HIs for the groundskeeper. The total RME HI is 0.15. The total CTE HI is 0.065. The cancer risks and HIs apply to the current use of EA 86.

5.5.2.20.2 Future Residential Scenario

It was assumed that EA 86 has the potential for future residential development, including future residential lawn areas. Based on this, the EF value used to calculate the exposure doses and risks for the future residential exposure scenario was 150 days/year for both the RME and CTE evaluations. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-85. The EPC for the future use is 4 mg/kg.

Results

Table 5-403 presents the cancer risk estimates from the future residential scenario. The total RME cancer risk is 8E-06. The total CTE cancer risk is 2E-06. Tables 5-404 and 5-405 present the HQs and the total HIs from the future residential scenario for the young child and adult, respectively. The total RME HIs for the young child and adult are 1.3 and 0.16, respectively. The total CTE HIs for the young child and adult are 0.84 and 0.11, respectively. The cancer risks and HIs apply to the future use of EA 86.

5.5.2.21 Exposure Area 87

Exposure Area 87 consists of a portion of tax parcel 9-59, as shown in Figure 5-86, and is approximately 17.1 acres. Tax parcel 9-59 is privately owned and is located by Cherry Hill Road in Glendale just upstream of the Glendale Impoundment. EA 87 is a well-known recreational area with trails and benches present. It is bounded by railroad tracks to the south.

Current Use

Current activities at EA 87 include fishing from shore, walking, and hiking. These activities meet the criteria for the general recreation and angler scenarios. The general recreation scenario was selected to evaluate the entire area for the young child and adult receptors. The angler scenario was selected to evaluate the area along the riverbank where angling occurs, which was designated as subarea 87A. A summary of the exposure assumptions for the general recreation and angler scenarios are presented in Tables 4-12 and 4-16, respectively.

Future Use

Tax parcel 9-59 is owned by a local conservation organization. It is expected that the site uses will not change in the future (i.e., it will remain recreational). Thus, the exposure scenarios identified above also reflect the likely future uses.

5.5.2.21.1 Exposure Area 87 – Entire Area

EA 87 is considered a high-use area because it is a well-known, frequently used recreational area that is readily accessible from trails that run through the area. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the general recreation exposure scenario for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-86. The EPC for both the current and future uses is 24 mg/kg.

Results

Tables 5-406 and 5-407 present the general recreation cancer risk estimates for the young child and adult, respectively. The total RME cancer risks for both the young child and adult are 2E-05. The total CTE cancer risks for the young child and adult are 1E-06 and 4E-07, respectively.

Tables 5-408 and 5-409 present the general recreation HQs and the total HIs for the young child and adult, respectively. The total RME HIs for the young child and adult are 5.2 and 0.62, respectively. The total CTE HIs for the young child and adult are 0.76 and 0.10, respectively. The cancer risks and HIs apply to both the current and future uses of EA 87.

5.5.2.21.2 Subarea 87A

As shown in Table 4-16, the EFs for the angler scenario are 30 and 10 days/year for the RME and CTE scenarios, respectively. The EFs are considered to be appropriate for both the current and future uses of this subarea. The data from subarea 87A were used to calculate the EPC for the angler. Summary statistics for this subarea, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-86. The EPC for subarea 87A for both the current and future uses is 3.5 mg/kg.

Results

Table 5-410 presents the cancer risk estimates for the older child angler. The total RME cancer risk is 6E-07. The total CTE cancer risk is 7E-08. Table 5-411 presents the cancer risk estimates for the adult angler. The total RME cancer risk is 1E-06. The total CTE cancer risk is 5E-08.

Table 5-412 presents the HQs and the total HIs for the older child angler. The total RME HI is 0.083. The total CTE HI is 0.020. Table 5-413 presents the HQs and the total HIs for the adult angler. The total RME HI is 0.064. The total CTE HI is 0.016. The cancer risks and HIs apply to both the current and future uses of subarea 87A.

5.5.2.22 Exposure Area 88

Exposure Area 88 consists of a portion of tax parcel 8-30, as shown in Figure 5-87, and is approximately 0.98 acre. Tax parcel 8-30 is a privately owned residential parcel that is located along Route 183 in Glendale just upstream of the Glendale Dam. There is a residence located on this parcel with numerous other residences located within ¼ of a mile. The area is characterized as having a steep slope to the river, with a small area within the floodplain.

Current Use

Although EA 88 is a portion of a privately owned residential tax parcel, it is currently used for recreational purposes. It is assumed that the riverbank can be used by older children for play. Therefore, EA 88 was evaluated using the general recreation exposure scenario for the older child receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 88 is not considered to be suitable for future development because it consists of a small portion of tax parcel 8-30 that is characterized as having a steep slope. Thus, it is expected that site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 88 is considered a medium-use area because of the steep slope to the river and the small area in the floodplain. Thus, EF values of 60 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-87. The EPC for both the current and future uses is 12 mg/kg.

Table 5-414 presents the cancer risk estimates for the older child. The total RME cancer risk is 2E-06. The total CTE cancer risk is 2E-07. Table 5-415 presents the HQs and the total HIs for the older child. The total RME HI is 0.30. The total CTE HI is 0.068. The cancer risks and HIs apply to both the current and future uses of EA 88.

5.5.2.23 Exposure Area 89

Exposure Area 89 consists of a portion of tax parcel 8-25, as shown in Figure 5-88, and is approximately 4.3 acres. Tax parcel 8-25 is privately owned and is located along Route 183 just downstream of the Glendale Dam. There are a number of residences located within ¼ of a mile away.

Current Use

Current activities at EA 89 include general recreation. Thus, the general recreation exposure scenario was evaluated for the adult receptor. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 89 is not considered to be suitable for future development because it consists of a narrow strip of land within the floodplain. Thus, it is expected that site uses will not change and the exposure scenario identified above also reflects the likely future uses.

Results

EA 89 is considered a high-use area because it is readily accessible from nearby residences. Thus, EF values of 90 and 30 day/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-88. The EPC for both the current and future uses is 2 mg/kg.

Table 5-416 presents the cancer risk estimates for the adult. The total RME cancer risk is 2E-06. The total CTE cancer risk is 4E-08. Table 5-417 presents the HQs and the total HIs for the adult. The total RME HI is 0.063. The total CTE HI is 0.010. The cancer risks and HIs apply to both the current and future uses of EA 89.

5.5.2.24 Exposure Area 90

Exposure Area 90 consists of a narrow portion of tax parcels 5-7 and 5-12, as shown in Figure 5-89, and is approximately 5.0 acres. These tax parcels are privately owned and are adjacent to a public building in the Town of Housatonic.

Current Use

Current activities at EA 90 include general recreation. Thus, the general recreation exposure scenario was evaluated for the older child and adult receptors. A summary of the exposure assumptions for the general recreation scenario is presented in Table 4-12.

Future Use

EA 90 is not considered to be suitable for future development because it consists of a narrow portion of tax parcels 5-7 and 5-12 that slopes to the river. Thus, it is expected that the site will continue to be used for general recreation and the exposure scenario identified above reflects such use.

The river in this area was designated by the Commonwealth of Massachusetts in 2004 as a catch-and-release trout fishery and is now stocked with trout. Accordingly, this area will likely be frequented by anglers in the future. The general recreation scenario evaluated, however, is more conservative than the angler scenario.

Results

EA 90 is considered a high-use area because it is readily accessible from trails that run through the area and by its proximity to residences. Thus, EF values of 90 and 30 days/year were used to calculate the exposure doses and risks for the RME and CTE evaluations, respectively. The EFs are considered to be appropriate for both the current and future uses of this EA. The data from the entire EA were used to calculate the EPC. Summary statistics for this EA, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-89. The EPC for both the current and future uses is 19.1 mg/kg.

Table 5-418 presents the older child cancer risk estimates for the entire area. The total RME cancer risk is 5E-06. The total CTE cancer risk is 4E-07. Table 5-419 presents the adult cancer risk estimates for the entire area. The total RME cancer risk is 1E-05. The total CTE cancer risk is 3E-07.

Table 5-420 presents the older child HQs and HIs for the entire area. The total RME HI is 0.72. The total CTE HI is 0.11. Table 5-421 presents the adult HQs and HIs for the entire area. The total RME HI is 0.50. The total CTE HI is 0.082. These cancer risks and HIs apply to the current and future uses of EA 90.

5.5.3 Sediment Exposure Risk Assessments

Eight sediment exposure areas required a detailed assessment. The following sections include a description of each of the sediment areas, a table showing the cancer risks and noncancer hazard quotients for each area and a figure with the following information:

- The river hydrography.
- The sediment area.
- The sampling locations.
- A table presenting the exposure point concentration(s), and summary statistics for the area.

Table 5-422 summarizes the risks from incidental ingestion and dermal contact with sediment. The area description, the scenario(s) evaluated, the receptors, and the cancer and noncancer risk estimates are presented. Figure 5-1C presents the locations of the sediment areas that were evaluated as part of the risk assessment.

5.5.3.1 Sediment Area 1

Sediment Area 1 consists of the portion of the river beginning at the confluence of the East and West Branches and extends downstream to New Lenox Road, as shown in Figure 5-90. The river in this area is predominantly free flowing and meanders through a variety of surrounding land uses including residential, recreational, agricultural, and commercial/industrial. Sediment contact may occur as a result of activities such as wading, fishing along the riverbank, canoeing, and other related activities.

As shown in Table 4-18, the EFs for the sediment exposure scenario are 36 and 12 days/year for the RME and CTE scenarios, respectively. All sediment data were used in the development of the EPCs at free-flowing stretches of the river given the movement of sediment during periods of high flow and flooding. Summary statistics for this sediment area, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-90. The EPC is 23 mg/kg.

Tables 5-423 and 5-424 present the sediment exposure cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 5E-06 and

2E-05, respectively. The total CTE cancer risk for the older child and adult are 6E-07 and 8E-07, respectively.

Tables 5-425 and 5-426 present the sediment exposure HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.74 and 0.58, respectively. The total CTE HIs for the older child and adult are 0.18 and 0.15, respectively.

5.5.3.2 Sediment Area 2

Sediment Area 2 consists of the portion of the river beginning at New Lenox Road and extends downstream to the headwaters of Woods Pond, as shown in Figure 5-91. The river in this area is predominantly free flowing and meanders through primarily recreational areas. Sediment contact may occur as a result of activities such as wading, fishing along the riverbank, canoeing, waterfowl hunting, and other related activities.

As shown in Table 4-18, the EFs for the sediment exposure scenario are 36 and 12 days/year for the RME and CTE scenarios, respectively. All sediment data were used in the development of the EPCs at free-flowing stretches of the river given the movement of sediment during periods of high flow and flooding. Summary statistics for this sediment area, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-91. The EPC is 24 mg/kg.

Tables 5-427 and 5-428 present the sediment exposure cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 5E-06 and 2E-05, respectively. The total CTE cancer risks for the older child and adult are 7E-07 and 9E-07, respectively.

Tables 5-429 and 5-430 present the sediment exposure HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.77 and 0.60, respectively. The total CTE HIs for the older child and adult are 0.19 and 0.16, respectively.

5.5.3.3 Sediment Area 3

Sediment Area 3 consists of the Woods Pond impoundment, as shown in Figure 5-92. The flow of the river in this area is slow because of the dam, which allows for sediment deposition. The land surrounding Woods Pond is used primarily for recreational purposes with a small portion used for residential. Sediment contact may occur as a result of activities such as wading, fishing along the riverbank, canoeing, waterfowl hunting, and other related activities.

As shown in Table 4-18, the EFs for the sediment exposure scenario are 36 and 12 days/year for the RME and CTE scenarios, respectively. Data collected from locations up to 6 meters from the water's edge at impoundment areas were used in the calculation of the 95% UCLs and EPCs. This was based on the assumption that receptors were not likely to come into contact with sediment beyond this distance from shoreline because, in most cases, the water would be too deep for direct contact to occur on a regular basis. Summary statistics for this sediment area, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-92. The EPC is 110 mg/kg.

Tables 5-431 and 5-432 present the sediment exposure cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 2E-05 and 8E-05, respectively. The total CTE cancer risks for the older child and adult are 3E-06 and 4E-06, respectively.

Tables 5-433 and 5-434 present the sediment exposure HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 3.5 and 2.8, respectively. The total CTE HIs for the older child and adult are 0.88 and 0.72, respectively.

5.5.3.4 Sediment Area 4

Sediment Area 4 consists of the Columbia Mill Dam impoundment, as shown in Figure 5-93. The flow of the river in this area is slow because of the dam, which allows for settling of transported sediment and other materials. The land surrounding the Columbia Mill Dam impoundment is used for residential, recreational, and commercial/industrial uses. Sediment contact may occur as a result of activities such as wading, fishing along the riverbank, canoeing, and other related activities.

As shown in Table 4-18, the EFs for the sediment exposure scenario are 36 and 12 days/year for the RME and CTE scenarios, respectively. Data collected from locations up to 6 meters from the water's edge at impoundment areas were used in the calculation of the 95% UCLs and EPCs. This was based on the assumption that receptors were not likely to come into contact with sediment beyond this distance from shoreline because, in most cases, the water would be too deep for direct contact to occur on a regular basis. Summary statistics for this sediment area, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-93. The EPC is 19.2 mg/kg.

Tables 5-435 and 5-436 present the sediment exposure cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 4E-06 and 1E-05, respectively. The total CTE cancer risks for the older child and adult are 5E-07 and 7E-07, respectively.

Tables 5-437 and 5-438 present the sediment exposure HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.62 and 0.48, respectively. The total CTE HIs for the older child and adult are 0.15 and 0.13, respectively.

5.5.3.5 Sediment Area 5

Sediment Area 5 consists of the Eagle Mill Dam impoundment, as shown in Figure 5-94. The flow of the river in this area is slow because of the dam, which allows for settling of transported sediment and other materials. The land surrounding the Eagle Mill Dam impoundment is used for recreational and commercial/industrial uses. Sediment contact may occur as a result of activities such as wading, fishing along the riverbank, canoeing, and other related activities.

As shown in Table 4-18, the EFs for the sediment exposure scenario are 36 and 12 days/year for the RME and CTE scenarios, respectively. Data collected from locations up to 6 meters from the water's edge at impoundment areas were used in the calculation of the 95% UCLs and EPCs. This was based on the assumption that receptors were not likely to come into contact with sediment beyond this distance from shoreline because, in most cases, the water would be too deep for direct contact to occur on a regular basis. Summary statistics for this sediment area, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-94. The EPC is 24.6 mg/kg.

Tables 5-439 and 5-440 present the sediment exposure cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 5E-06 and 2E-05, respectively. The total CTE cancer risks for the older child and adult are 7E-07 and 9E-07, respectively.

Tables 5-441 and 5-442 present the sediment exposure HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.79 and 0.62, respectively. The total CTE HIs for the older child and adult are 0.20 and 0.16, respectively.

5.5.3.6 Sediment Area 6

Sediment Area 6 consists of the Willow Mill Dam impoundment, as shown in Figure 5-95. The flow of the river in this area is slow because of the dam, which allows for settling of transported sediment and other materials. The land surrounding the Willow Mill Dam impoundment is used for residential, recreational, and commercial/industrial uses. Sediment contact may occur as a result of activities such as wading, fishing along the riverbank, canoeing, and other related activities.

As shown in Table 4-18, the EFs for the sediment exposure scenario are 36 and 12 days/year for the RME and CTE scenarios, respectively. Data collected from locations up to 6 meters from the water's edge at impoundment areas were used in the calculation of the 95% UCLs and EPCs. This was based on the assumption that receptors were not likely to come into contact with sediment beyond this distance from shoreline because, in most cases, the water would be too deep for direct contact to occur on a regular basis. Summary statistics for this sediment area, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-95. The EPC is 7 mg/kg.

Tables 5-443 and 5-444 present the sediment exposure cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 2E-06 and 6E-06, respectively. The total CTE cancer risks for the older child and adult are 2E-07 and 3E-07, respectively.

Tables 5-445 and 5-446 present the sediment exposure HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.24 and 0.19, respectively. The total CTE HIs for the older child and adult are 0.060 and 0.049, respectively.

5.5.3.7 Sediment Area 7

Sediment Area 7 consists of the Glendale Dam impoundment, as shown in Figure 5-96. The flow of the river in this area is slow because of the dam, which allows for settling of transported sediment and other materials. The land surrounding the Glendale Dam impoundment is used for residential, recreational, and commercial/industrial uses. Sediment contact may occur as a result of activities such as wading, fishing along the riverbank, canoeing, and other related activities.

As shown in Table 4-18, the EFs for the sediment exposure scenario are 36 and 12 days/year for the RME and CTE scenarios, respectively. Data collected from locations up to 6 meters from the water's edge at impoundment areas were used in the calculation of the 95% UCLs and EPCs. This was based on the assumption that receptors were not likely to come into contact with sediment beyond this distance from shoreline because, in most cases, the water would be too deep for direct contact to occur on a regular basis. Summary statistics for this sediment area, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-96. The EPC is 37.5 mg/kg.

Tables 5-447 and 5-448 present the sediment exposure cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 8E-06 and 3E-05, respectively. The total CTE cancer risk for both the older child and adult is 1E-06.

Tables 5-449 and 5-450 present the sediment exposure HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 1.2 and 0.94, respectively. The total CTE HIs for the older child and adult are 0.30 and 0.25, respectively.

5.5.3.8 Sediment Area 8

Sediment Area 8 consists of the Rising Pond impoundment, as shown in Figure 5-97. The flow of the river in this area is slow because of the dam, which allows for settling of transported sediment and other materials. The land surrounding Rising Pond is used for residential, recreational, and commercial/industrial uses. Sediment contact may occur as a result of activities such as wading, fishing along the riverbank, canoeing, and other related activities.

As shown in Table 4-18, the EFs for the sediment exposure scenario are 36 and 12 days/year for the RME and CTE scenarios, respectively. Data collected from locations up to 6 meters from the water's edge at impoundment areas were used in the calculation of the 95% UCLs and EPCs. This was based on the assumption that receptors were not likely to come into contact with sediment beyond this distance from shoreline because, in most cases, the water would be too deep for direct contact to occur on a regular basis. Summary statistics for this sediment area, including the data distribution, the 95% UCL, and the EPC, are presented in Figure 5-97. The EPC is 6 mg/kg.

Tables 5-451 and 5-452 present the sediment exposure cancer risk estimates for the older child and adult, respectively. The total RME cancer risks for the older child and adult are 1E-06 and 5E-06, respectively. The total CTE cancer risk for both the older child and adult is 2E-07.

Tables 5-453 and 5-454 present the sediment exposure HQs and the total HIs for the older child and adult, respectively. The total RME HIs for the older child and adult are 0.20 and 0.16, respectively. The total CTE HIs for the older child and adult are 0.051 and 0.042, respectively.

5.6 REFERENCES

TER (Triangle Economic Research). 2003. Housatonic River Floodplain User Survey Summary Report. Prepared for General Electric Company. January 20, 2003.

SECTION 5

TABLES

Table 5-1

Summary of the Cancer Risks and Hazard Indices from tPCBs for Soil Exposure in Exposure Areas and Subareas within Reaches 5 and 6

Exposure Area	Scenario Evaluated	Receptor	Land Use	EPC (mg/kg)	RME Total Cancer Risk	RME Total Hazard Index	CTE Total Cancer Risk	CTE Total Hazard Index
1	General recreation (entire EA)	Older child	current/future	15	2E-06	0.38	2E-07	0.086
		Adult			8E-06	0.26	2E-07	0.064
2	General recreation (entire EA)	Older child	current/future	24	6E-06	0.92	5E-07	0.14
		Adult			2E-05	0.64	4E-07	0.10
	General recreation (subarea 2A)	Older child	current/future	24	2E-06	0.30	2E-07	0.069
	General recreation (subarea 2B)	Older child	current/future	26	7E-06	0.97	5E-07	0.15
3	General recreation (entire EA)	Adult	current/future	8	6E-06	0.21	1E-07	0.034
4	General recreation (entire EA)	Young child	current/future	40	5E-06	1.5	1E-06	0.63
		Older child			1E-05	1.5	8E-07	0.23
		Adult			3E-05	1.0	6E-07	0.17
5	General recreation (entire EA)	Older child	current/future	22	6E-06	0.83	4E-07	0.12
		Adult			2E-05	0.57	3E-07	0.094
6	General recreation (entire EA)	Adult	current	32	7E-06	0.28	3E-07	0.068
	Future residential (entire EA)	Young child/Adult	future		4E-05	NA	3E-06	NA
		Young child			NA	7.0	NA	1.5
		Adult			NA	0.83	NA	0.18
7	General recreation (entire EA)	Older child	current/future	24	6E-06	0.89	5E-07	0.13
		Adult			2E-05	0.62	4E-07	0.10
8	Recreational canoeist (entire EA)	Older child	current/future	23	4E-06	0.54	7E-07	0.19
		Adult			2E-05	0.83	2E-06	0.31
9	General recreation (entire EA)	Older child	current/future	15	1E-06	0.19	1E-07	0.043
10	General recreation (entire EA)	Young child	current/future	14	1E-05	3.1	8E-07	0.45
		Adult			1E-05	0.37	2E-07	0.061
	General recreation (subarea 10A)	Young child	current/future	53.1	4E-05	12	3E-06	1.7
		Adult			4E-05	1.4	8E-07	0.23
11	General recreation (entire EA)	Adult	current/future	21	1E-05	0.55	3E-07	0.090
12	General recreation (entire EA)	Young child	current/future	9	1E-06	0.31	2E-07	0.14
		Older child			2E-06	0.32	2E-07	0.049
		Adult			6E-06	0.22	1E-07	0.037
13	General recreation (entire EA)	Adult	current/future	18	1E-05	0.47	3E-07	0.077
14	General recreation (entire EA)	Adult	current/future	5	3E-06	0.13	8E-08	0.021
15	General recreation (entire EA)	Adult	current/future	6.9	5E-06	0.18	1E-07	0.030
16	General recreation (entire EA)	Adult	current/future	48	3E-05	1.2	8E-07	0.21
17	General recreation (entire EA)	Adult	current/future	26	2E-05	0.68	4E-07	0.11
18	General recreation (entire EA)	Adult	current	43	2E-05	0.75	7E-07	0.18
	Future residential (entire EA)	Young child/Adult	future		1E-04	NA	2E-05	NA
		Young child			NA	16	NA	10
		Adult			NA	1.8	NA	1.3
19	General recreation (entire EA)	Adult	current/future	76	5E-05	2.0	1E-06	0.32
20	General recreation (entire EA)	Adult	current/future	28	2E-05	0.73	4E-07	0.12

Table 5-1

Summary of the Cancer Risks and Hazard Indices from tPCBs for Soil Exposure in Exposure Areas and Subareas within Reaches 5 and 6

Exposure Area	Scenario Evaluated	Receptor	Land Use	EPC (mg/kg)	RME Total Cancer Risk	RME Total Hazard Index	CTE Total Cancer Risk	CTE Total Hazard Index
21	Farmer (entire EA)	Adult	current	4	3E-06	0.094	1E-07	0.012
	Future residential (EAs 21 and 22)	Young child/Adult	future	25	6E-05	NA	1E-05	NA
		Young child			NA	9.1	NA	5.7
		Adult			NA	1.1	NA	0.72
22	General recreation (entire EA)	Older child	current	29	7E-06	1.1	6E-07	0.16
		Adult			2E-05	0.75	5E-07	0.12
	ATV/Dirt and Mountain Biker (subarea 22A)	Older child	current	61	3E-05	4.3	2E-06	0.61
23	General recreation (entire EA)	Older child	current/future	12	2E-06	0.30	2E-07	0.068
24	General recreation (entire EA)	Adult	current/future	29	2E-05	0.75	5E-07	0.12
25	General recreation (entire EA)	Older child	current/future	44	1E-05	1.7	9E-07	0.25
26	General recreation (entire EA)	Older child	future	5	1E-06	0.20	1E-07	0.030
		Adult			4E-06	0.14	8E-08	0.022
	General recreation (subarea 26A)	Older child	current	6	2E-06	0.23	1E-07	0.034
		Adult			4E-06	0.16	9E-08	0.026
	Farmer (subarea 26B)	Adult	current	2	2E-06	0.047	5E-08	0.0058
27	General recreation (entire EA)	Older child	current/future	6	2E-06	0.23	1E-07	0.034
		Adult			4E-06	0.16	1E-07	0.026
	ATV/Dirt and Mountain Biker (subarea 27A)	Older child	current/future	8.0	4E-06	0.57	3E-07	0.081
28	General recreation (entire EA)	Young child	current/future	40.4	5E-06	1.5	1E-06	0.64
		Older child			1E-05	1.5	8E-07	0.23
		Adult			3E-05	1.0	6E-07	0.17
	ATV/Dirt and Mountain Biker (subarea 28A)	Older child	current/future	23	1E-05	1.6	8E-07	0.23
29	General recreation (entire EA)	Older child	current/future	28	2E-06	0.35	3E-07	0.079
		Adult			7E-06	0.24	2E-07	0.060
30	General recreation (entire EA)	Older child	current/future	34.8	9E-06	1.3	7E-07	0.20
		Adult			2E-05	0.91	6E-07	0.15
31	General recreation (entire EA)	Older child	current/future	23	6E-06	0.86	4E-07	0.13
		Adult			2E-05	0.60	4E-07	0.098
	General recreation (subarea 31A)	Older child	current/future	37.6	1E-05	1.4	7E-07	0.21
		Adult			3E-05	0.98	6E-07	0.16
32	General recreation (entire EA)	Adult	current/future	23	2E-05	0.60	4E-07	0.098
33	General recreation (entire EA)	Adult	current/future	33	2E-05	0.86	5E-07	0.14
34	Farmer (entire EA)	Adult	current	29	2E-05	0.67	7E-07	0.083
	Future residential (entire EA)	Young child/Adult	future		6E-05	NA	1E-05	NA
		Young child			NA	11	NA	6.6
		Adult			NA	1.3	NA	0.83
35	General recreation (entire EA)	Older child	current/future	23	6E-06	0.85	4E-07	0.13
		Adult			2E-05	0.59	4E-07	0.097
	General recreation (subarea 35A)	Older child	current/future	12	3E-06	0.45	2E-07	0.068
		Adult			8E-06	0.31	2E-07	0.051

Table 5-1

Summary of the Cancer Risks and Hazard Indices from tPCBs for Soil Exposure in Exposure Areas and Subareas within Reaches 5 and 6

Exposure Area	Scenario Evaluated	Receptor	Land Use	EPC (mg/kg)	RME Total Cancer Risk	RME Total Hazard Index	CTE Total Cancer Risk	CTE Total Hazard Index
36	Groundskeeper (subarea 36A)	Adult	current/future	20	2E-06	0.16	1E-07	0.035
	Farmer (subarea 36B)	Adult	current/future	8	6E-06	0.18	2E-07	0.022
37	General recreation (entire EA)	Older child	current/future	16	4E-06	0.61	3E-07	0.092
		Adult			1E-05	0.42	3E-07	0.069
	Angler (subarea 37A)	Older child	current/future	55.1	9E-06	1.3	1E-06	0.31
		Adult			2E-05	0.99	8E-07	0.25
	General recreation (subarea 37B)	Older child	current/future	7	2E-06	0.26	1E-07	0.040
		Adult			5E-06	0.18	1E-07	0.030
38	General recreation (entire EA)	Adult	current/future	29	2E-05	0.75	5E-07	0.12
	Angler (subarea 38A)	Older child	current/future	83.3	1E-05	2.0	2E-06	0.46
		Adult			3E-05	1.5	1E-06	0.38
39	Marathon canoeist (entire EA)	Adult	current/future	19	2E-05	1.4	3E-06	0.77
	Recreational canoeist (entire EA)	Older child	current/future		3E-06	0.45	5E-07	0.16
		Adult			2E-05	0.69	1E-06	0.26
40	General recreation (entire EA)	Young child	current/future	9	1E-06	0.32	2E-07	0.14
		Adult			6E-06	0.23	1E-07	0.038
	Angler (subarea 40A)	Older child	current/future	37	6E-06	0.87	7E-07	0.21
		Adult			1E-05	0.67	5E-07	0.17
	General recreation (subarea 40B)	Young child	current/future	61.6	8E-06	2.2	2E-06	0.98
		Adult			4E-05	1.6	1E-06	0.26
41	General recreation (entire EA)	Adult	current/future	18	8E-06	0.32	2E-07	0.076
	Angler (subarea 41A)	Older child	current/future	55.3	9E-06	1.3	1E-06	0.31
		Adult			2E-05	0.99	8E-07	0.25
42	General recreation (entire EA)	Adult	current/future	15	7E-06	0.26	2E-07	0.064
	Angler (subarea 42A)	Older child	current/future	51.1	8E-06	1.2	1E-06	0.28
		Adult			2E-05	0.92	7E-07	0.23
43	General recreation (entire EA)	Adult	current/future	17	8E-06	0.30	3E-07	0.073
	Angler (subarea 43A)	Older child	current/future	52.7	9E-06	1.2	1E-06	0.29
		Adult			2E-05	0.95	8E-07	0.24
44	General recreation (entire EA)	Adult	current/future	43	3E-05	1.1	7E-07	0.18
45	Waterfowl hunter (entire EA)	Older child	current/future	23	6E-07	0.16	1E-07	0.058
		Adult			3E-06	0.12	3E-07	0.043
	General recreation (entire EA)	Adult	current/future	20	1E-05	0.52	3E-07	0.085
46	Waterfowl hunter (entire EA)	Older child	current/future	17	4E-07	0.12	7E-08	0.042
		Adult			2E-06	0.085	2E-07	0.031
	General recreation (entire EA)	Adult	current/future	11	8E-06	0.29	2E-07	0.047
47	Recreational canoeist (entire EA)	Older child	current	27	4E-06	0.64	8E-07	0.23
		Adult			2E-05	0.97	2E-06	0.37
	Recreational canoeist (expanded EA)	Older child	future	14	2E-06	0.33	4E-07	0.12
		Adult			1E-05	0.50	1E-06	0.19
48	Waterfowl hunter (entire EA)	Older child	current/future	20	5E-07	0.14	9E-08	0.050
		Adult			2E-06	0.10	3E-07	0.037
	General recreation (entire EA)	Adult	current/future	4	3E-06	0.11	7E-08	0.018
49	Waterfowl hunter (entire EA)	Older child	current/future	47.4	1E-06	0.34	2E-07	0.12
		Adult			5E-06	0.24	6E-07	0.088
	General recreation (entire EA)	Adult	current/future	26	6E-06	0.23	2E-07	0.056

Table 5-1

Summary of the Cancer Risks and Hazard Indices from tPCBs for Soil Exposure in Exposure Areas and Subareas within Reaches 5 and 6

Exposure Area	Scenario Evaluated	Receptor	Land Use	EPC (mg/kg)	RME Total Cancer Risk	RME Total Hazard Index	CTE Total Cancer Risk	CTE Total Hazard Index
50	General recreation (entire EA)	Adult	current/future	6	1E-06	0.054	5E-08	0.013
	Waterfowl hunter (subarea 50A)	Older child	current/future	24	6E-07	0.17	1E-07	0.060
		Adult			3E-06	0.12	3E-07	0.045
51	General recreation (entire EA)	Adult	current/future	11	3E-06	0.095	9E-08	0.023
	Waterfowl hunter (subarea 51A)	Older child	current/future	17	4E-07	0.13	8E-08	0.044
		Adult			2E-06	0.089	2E-07	0.033
52	Recreational canoeist (entire EA)	Older child	current/future	3	6E-07	0.081	1E-07	0.029
		Adult			3E-06	0.12	3E-07	0.047
53	Recreational canoeist (entire EA)	Older child	current/future	14	2E-06	0.33	4E-07	0.12
		Adult			1E-05	0.50	1E-06	0.19
54	Waterfowl hunter (entire EA)	Older child	current/future	37	9E-07	0.26	2E-07	0.093
		Adult			4E-06	0.19	5E-07	0.069
	General recreation (entire EA)	Adult	current/future	8	6E-06	0.22	1E-07	0.036
55	General recreation (entire EA)	Young child	current/future	21	3E-06	0.76	6E-07	0.33
		Adult			2E-05	0.54	3E-07	0.090
	Waterfowl hunter (subarea 55A)	Older child	current/future	59	1E-06	0.42	3E-07	0.15
		Adult			7E-06	0.30	8E-07	0.11
56	General recreation (entire EA)	Older child	current/future	44	8E-06	1.1	8E-07	0.24
		Adult			2E-05	0.76	6E-07	0.19
	Waterfowl hunter (subarea 56A)	Older child	current/future	117	3E-06	0.84	5E-07	0.29
		Adult			1E-05	0.60	2E-06	0.22
57	Waterfowl hunter (entire EA)	Older child	current/future	22	5E-07	0.16	9E-08	0.055
		Adult			2E-06	0.11	3E-07	0.041
	General recreation (entire EA)	Young child	current/future	9	1E-06	0.33	2E-07	0.14
		Adult			6E-06	0.23	1E-07	0.038
58	Angler (entire EA)	Older child	current/future	27	4E-06	0.64	5E-07	0.15
		Adult			1E-05	0.49	4E-07	0.12
	General recreation (entire EA)	Adult	current/future		2E-05	0.70	4E-07	0.12
59	General recreation (entire EA)	Young child	current/future	32	4E-06	1.2	9E-07	0.51
		Adult			2E-05	0.83	5E-07	0.14
	Angler (subarea 59A)	Older child	current/future	48	8E-06	1.1	9E-07	0.27
		Adult			2E-05	0.87	7E-07	0.22
60	General recreation (entire EA)	Young child	current/future	10	1E-06	0.36	3E-07	0.16
		Adult			7E-06	0.26	2E-07	0.043
	Recreational canoeist (subarea 60A)	Older child	current/future	17	3E-06	0.40	5E-07	0.14
		Adult			1E-05	0.61	1E-06	0.23
61	Utility worker (entire EA)	Adult	current/future	59	3E-06	0.24	3E-07	0.082
62	Utility worker (entire EA)	Adult	current/future	121	7E-06	0.50	6E-07	0.17
63	Utility worker (entire EA)	Adult	current/future	39	2E-06	0.16	2E-07	0.054
64	Utility worker (entire EA)	Adult	current/future	37.6	2E-06	0.16	2E-07	0.052
65	Utility worker (entire EA)	Adult	current/future	19	1E-06	0.079	9E-08	0.027
66	Utility worker (entire EA)	Adult	current/future	12	7E-07	0.050	6E-08	0.017

NA = not applicable.

Table 5-2

Summary of the Exposure Doses and Cancer Risks for Exposure Area 1 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	9.4E-07	3.5E-07	2.0E+00	2E-06	7E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	1.2E-07	1.8E-07	1.0E+00	1E-07	2E-07	2E-07

Table 5-3

Summary of the Exposure Doses and Cancer Risks for Exposure Area 1 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	15	2.4E-06	1.1E-06	2.0E+00	5E-06	2E-06	8E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	15	8.2E-08	1.6E-07	1.0E+00	8E-08	2E-07	2E-07

Table 5-4

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 1 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	5.5E-06	2.0E-06	2.0E-05	0.28	0.102	0.38

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	6.9E-07	1.0E-06	2.0E-05	0.034	0.051	0.086

Table 5-5

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 1 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	3.5E-06	1.7E-06	2.0E-05	0.177	0.084	0.26

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	4.4E-07	8.4E-07	2.0E-05	0.022	0.042	0.064

Table 5-6

Summary of the Exposure Doses and Cancer Risks for Exposure Area 2 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	2.3E-06	8.5E-07	2.0E+00	5E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	1.9E-07	2.8E-07	1.0E+00	2E-07	3E-07	5E-07

Table 5-7

Summary of the Exposure Doses and Cancer Risks for Exposure Area 2 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	5.8E-06	2.8E-06	2.0E+00	1E-05	6E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	1.3E-07	2.6E-07	1.0E+00	1E-07	3E-07	4E-07

Table 5-8

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 2 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	1.3E-05	5.0E-06	2.0E-05	0.67	0.25	0.92

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	1.1E-06	1.7E-06	2.0E-05	0.056	0.083	0.14

Table 5-9

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 2 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	8.6E-06	4.1E-06	2.0E-05	0.43	0.21	0.64

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	7.2E-07	1.4E-06	2.0E-05	0.036	0.069	0.10

Table 5-10

Summary of the Exposure Doses and Cancer Risks for Exposure Area 2 - Subarea 2A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	7.6E-07	2.8E-07	2.0E+00	2E-06	6E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	9.5E-08	1.4E-07	1.0E+00	1E-07	1E-07	2E-07

Table 5-11

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 2 - Subarea 2A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	4.4E-06	1.7E-06	2.0E-05	0.22	0.083	0.30

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	5.5E-07	8.2E-07	2.0E-05	0.028	0.041	0.069

Table 5-12

Summary of the Exposure Doses and Cancer Risks for Exposure Area 2 - Subarea 2B

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	26	2.4E-06	9.1E-07	2.0E+00	5E-06	2E-06	7E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	26	2.0E-07	3.0E-07	1.0E+00	2E-07	3E-07	5E-07

Table 5-13

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 2 - Subarea 2B

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	26	1.4E-05	5.3E-06	2.0E-05	0.71	0.26	0.97

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	26	1.2E-06	1.8E-06	2.0E-05	0.060	0.088	0.15

Table 5-14

Summary of the Exposure Doses and Cancer Risks for Exposure Area 3 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8	1.9E-06	8.9E-07	2.0E+00	4E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8	4.3E-08	8.2E-08	1.0E+00	4E-08	8E-08	1E-07

Table 5-15

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 3 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8	2.8E-06	1.3E-06	2.0E-05	0.14	0.067	0.21

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8	2.3E-07	4.4E-07	2.0E-05	0.012	0.022	0.034

Table 5-16

Summary of Exposure Doses and Cancer Risks for Exposure Area 4 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40	1.9E-06	6.2E-07	2.0E+00	4E-06	1E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40	4.7E-07	6.2E-07	1.0E+00	5E-07	6E-07	1E-06

Table 5-17

Summary of Exposure Doses and Cancer Risks for Exposure Area 4 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40	3.8E-06	1.4E-06	2.0E+00	8E-06	3E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40	3.1E-07	4.7E-07	1.0E+00	3E-07	5E-07	8E-07

Table 5-18

Summary of Exposure Doses and Cancer Risks for Exposure Area 4 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40	9.5E-06	4.5E-06	2.0E+00	2E-05	9E-06	3E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40	2.2E-07	4.2E-07	1.0E+00	2E-07	4E-07	6E-07

Table 5-19

Summary of Exposure Doses and Hazard Quotients for Exposure Area 4 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40	2.2E-05	7.2E-06	2.0E-05	1.1	0.36	1.5

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40	5.5E-06	7.2E-06	2.0E-05	0.27	0.36	0.63

Table 5-20

Summary of Exposure Doses and Hazard Quotients for Exposure Area 4 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40	2.2E-05	8.1E-06	2.0E-05	1.1	0.41	1.5

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40	1.8E-06	2.7E-06	2.0E-05	0.092	0.14	0.23

Table 5-21

Summary of Exposure Doses and Hazard Quotients for Exposure Area 4 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40	1.4E-05	6.7E-06	2.0E-05	0.71	0.34	1.0

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40	1.2E-06	2.2E-06	2.0E-05	0.059	0.11	0.17

Table 5-22

Summary of the Exposure Doses and Cancer Risks for Exposure Area 5 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	22	2.1E-06	7.7E-07	2.0E+00	4E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	22	1.7E-07	2.6E-07	1.0E+00	2E-07	3E-07	4E-07

Table 5-23

Summary of the Exposure Doses and Cancer Risks for Exposure Area 5 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	22	5.2E-06	2.5E-06	2.0E+00	1E-05	5E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	22	1.2E-07	2.3E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-24

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 5 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	22	1.2E-05	4.5E-06	2.0E-05	0.61	0.22	0.83

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	22	1.0E-06	1.5E-06	2.0E-05	0.050	0.075	0.12

Table 5-25

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 5 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	22	7.75E-06	3.70E-06	2.0E-05	0.39	0.19	0.57

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	22	6.5E-07	1.2E-06	2.0E-05	0.032	0.062	0.094

Table 5-26

Summary of Exposure Doses and Cancer Risks for Exposure Area 6 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

	Exposure Point Concentration	RME					
		Exposure Dose (mg/kg-day)			Cancer Risk		
Contaminant	(mg/kg)	Incidental Ingestion	Dermal Contact	CSF $(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	32	2.5E-06	1.2E-06	2.0E+00	5E-06	2E-06	7E-06

	Exposure Point Concentration	CTE					
		Exposure Dose (mg/kg-day)			Cancer Risk		
Contaminant	(mg/kg)	Incidental Ingestion	Dermal Contact	CSF $(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	32	8.7E-08	1.7E-07	1.0E+00	9E-08	2E-07	3E-07

Table 5-27

Summary of Exposure Doses and Hazard Quotients for Exposure Area 6 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	3.8E-06	1.8E-06	2.0E-05	0.19	0.090	0.28

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	4.7E-07	9.0E-07	2.0E-05	0.024	0.045	0.068

Table 5-28

Summary of the Exposure Doses and Cancer Risks for Exposure Area 6 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child/Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	1.5E-05	6.0E-06	2.0E+00	3E-05	1E-05	4E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	1.7E-06	1.2E-06	1.0E+00	2E-06	1E-06	3E-06

Table 5-29

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 6 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	1.1E-04	3.4E-05	2.0E-05	5.3	1.7	7.0

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	1.8E-05	1.1E-05	2.0E-05	0.88	0.57	1.5

Table 5-30

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 6 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	1.1E-05	5.4E-06	2.0E-05	0.56	0.27	0.83

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	1.9E-06	1.8E-06	2.0E-05	0.094	0.090	0.18

Table 5-31

Summary of the Exposure Doses and Cancer Risks for Exposure Area 7 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	2.2E-06	8.3E-07	2.0E+00	4E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	1.9E-07	2.8E-07	1.0E+00	2E-07	3E-07	5E-07

Table 5-32

Summary of the Exposure Doses and Cancer Risks for Exposure Area 7 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	5.6E-06	2.7E-06	2.0E+00	1E-05	5E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	1.3E-07	2.5E-07	1.0E+00	1E-07	2E-07	4E-07

Table 5-33

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 7 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	1.3E-05	4.8E-06	2.0E-05	0.65	0.24	0.89

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	1.1E-06	1.6E-06	2.0E-05	0.054	0.080	0.13

Table 5-34

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 7 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	8.3E-06	4.0E-06	2.0E-05	0.42	0.20	0.62

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	7.0E-07	1.3E-06	2.0E-05	0.035	0.067	0.10

Table 5-35

Summary of the Exposure Doses and Cancer Risks for Exposure Area 8 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)			Cancer Risk		
		Incidental Ingestion	Dermal Contact	CSF $(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	23	7.2E-07	1.1E-06	2.0E+00	1E-06	2E-06	4E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)			Cancer Risk		
		Incidental Ingestion	Dermal Contact	CSF $(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	23	9.0E-08	5.7E-07	1.0E+00	9E-08	6E-07	7E-07

Table 5-36

Summary of the Exposure Doses and Cancer Risks for Exposure Area 8 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	3.1E-06	6.4E-06	2.0E+00	6E-06	1E-05	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	1.9E-07	1.6E-06	1.0E+00	2E-07	2E-06	2E-06

Table 5-37

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 8 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	4.2E-06	6.6E-06	2.0E-05	0.21	0.33	0.54

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	5.3E-07	3.3E-06	2.0E-05	0.026	0.17	0.19

Table 5-38

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 8 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	5.4E-06	1.1E-05	2.0E-05	0.27	0.56	0.83

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	6.8E-07	5.6E-06	2.0E-05	0.034	0.28	0.31

Table 5-39

Summary of the Exposure Doses and Cancer Risks for Exposure Area 9 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	4.8E-07	1.8E-07	2.0E+00	1E-06	4E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	6.0E-08	8.9E-08	1.0E+00	6E-08	9E-08	1E-07

Table 5-40

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 9 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	2.8E-06	1.0E-06	2.0E-05	0.14	0.052	0.19

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	3.5E-07	5.2E-07	2.0E-05	0.017	0.026	0.043

Table 5-41

Summary of the Exposure Doses and Cancer Risks for Exposure Area 10 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	14	4.0E-06	1.3E-06	2.0E+00	8E-06	3E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	14	3.3E-07	4.4E-07	1.0E+00	3E-07	4E-07	8E-07

Table 5-42

Summary of the Exposure Doses and Cancer Risks for Exposure Area 10 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	3.4E-06	1.6E-06	2.0E+00	7E-06	3E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	7.7E-08	1.5E-07	1.0E+00	8E-08	1E-07	2E-07

Table 5-43

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 10 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	4.7E-05	1.5E-05	2.0E-05	2.3	0.77	3.1

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	3.9E-06	5.1E-06	2.0E-05	0.19	0.25	0.45

Table 5-44

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 10 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	14	5.0E-06	2.4E-06	2.0E-05	0.25	0.12	0.37

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	14	4.2E-07	7.9E-07	2.0E-05	0.021	0.040	0.061

Table 5-45

Summary of the Exposure Doses and Cancer Risks for Exposure Area 10 - Subarea 10A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	53.1	1.5E-05	4.9E-06	2.0E+00	3E-05	1E-05	4E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	53.1	1.3E-06	1.6E-06	1.0E+00	1E-06	2E-06	3E-06

Table 5-46

Summary of the Exposure Doses and Cancer Risks for Exposure Area 10 - Subarea 10A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	53.1	1.3E-05	6.0E-06	2.0E+00	3E-05	1E-05	4E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	53.1	2.9E-07	5.5E-07	1.0E+00	3E-07	6E-07	8E-07

Table 5-47

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 10 - Subarea 10A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	53.1	1.8E-04	5.7E-05	2.0E-05	8.8	2.9	12

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	53.1	1.5E-05	1.9E-05	2.0E-05	0.73	0.96	1.7

Table 5-48

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 10 - Subarea 10A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	53.1	1.9E-05	8.9E-06	2.0E-05	0.94	0.45	1.4

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	53.1	1.6E-06	3.0E-06	2.0E-05	0.078	0.15	0.23

Table 5-49

Summary of the Exposure Doses and Cancer Risks for Exposure Area 11 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	21	5.0E-06	2.4E-06	2.0E+00	1E-05	5E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	21	1.2E-07	2.2E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-50

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 11 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	21	7.4E-06	3.5E-06	2.0E-05	0.37	0.18	0.55

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	21	6.2E-07	1.2E-06	2.0E-05	0.031	0.059	0.090

Table 5-51

Summary of the Exposure Doses and Cancer Risks for Exposure Area 12 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	9	4.0E-07	1.3E-07	2.0E+00	8E-07	3E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	9	1.0E-07	1.3E-07	1.0E+00	1E-07	1E-07	2E-07

Table 5-52

Summary of the Exposure Doses and Cancer Risks for Exposure Area 12 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	8.1E-07	3.0E-07	2.0E+00	2E-06	6E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	6.7E-08	1.0E-07	1.0E+00	7E-08	1E-07	2E-07

Table 5-53

Summary of the Exposure Doses and Cancer Risks for Exposure Area 12 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	2.0E-06	9.7E-07	2.0E+00	4E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	4.7E-08	8.9E-08	1.0E+00	5E-08	9E-08	1E-07

Table 5-54

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 12 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	4.7E-06	1.5E-06	2.0E-05	0.24	0.077	0.31

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	1.2E-06	1.5E-06	2.0E-05	0.059	0.077	0.14

Table 5-55

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 12 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	4.7E-06	1.7E-06	2.0E-05	0.24	0.087	0.32

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	3.9E-07	5.8E-07	2.0E-05	0.020	0.029	0.049

Table 5-56

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 12 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	3.0E-06	1.4E-06	2.0E-05	0.15	0.072	0.22

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	2.5E-07	4.8E-07	2.0E-05	0.013	0.024	0.037

Table 5-57

Summary of the Exposure Doses and Cancer Risks for Exposure Area 13 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	18	4.3E-06	2.0E-06	2.0E+00	9E-06	4E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	18	9.8E-08	1.9E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-58

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 13 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	18	6.3E-06	3.0E-06	2.0E-05	0.32	0.15	0.47

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	18	5.3E-07	1.0E-06	2.0E-05	0.026	0.051	0.077

Table 5-59

Summary of the Exposure Doses and Cancer Risks for Exposure Area 14 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	1.2E-06	5.7E-07	2.0E+00	2E-06	1E-06	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	2.7E-08	5.2E-08	1.0E+00	3E-08	5E-08	8E-08

Table 5-60

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 14 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	1.8E-06	8.4E-07	2.0E-05	0.088	0.042	0.13

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	1.5E-07	2.8E-07	2.0E-05	0.0074	0.014	0.021

Table 5-61

Summary of the Exposure Doses and Cancer Risks for Exposure Area 15 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6.9	1.6E-06	7.8E-07	2.0E+00	3E-06	2E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6.9	3.8E-08	7.2E-08	1.0E+00	4E-08	7E-08	1E-07

Table 5-62

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 15 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6.9	2.5E-06	1.2E-06	2.0E-05	0.12	0.059	0.18

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6.9	2.0E-07	3.9E-07	2.0E-05	0.010	0.019	0.030

Table 5-63

Summary of the Exposure Doses and Cancer Risks for Exposure Area 16 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	48	1.1E-05	5.4E-06	2.0E+00	2E-05	1E-05	3E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	48	2.6E-07	5.0E-07	1.0E+00	3E-07	5E-07	8E-07

Table 5-64

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 16 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	48	1.7E-05	8.1E-06	2.0E-05	0.85	0.40	1.2

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	48	1.4E-06	2.7E-06	2.0E-05	0.071	0.13	0.21

Table 5-65

Summary of the Exposure Dose and Cancer Risks for Exposure Area 17 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	26	6.2E-06	2.9E-06	2.0E+00	1E-05	6E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	26	1.4E-07	2.7E-07	1.0E+00	1E-07	3E-07	4E-07

Table 5-66

Summary of the Exposure Dose and Hazard Quotients for Exposure Area 17 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	26	9.2E-06	4.4E-06	2.0E-05	0.46	0.22	0.68

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	26	7.6E-07	1.5E-06	2.0E-05	0.038	0.073	0.11

Table 5-67

Summary of the Exposure Doses and Cancer Risks for Exposure Area 18 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	43	6.8E-06	3.2E-06	2.0E+00	1E-05	6E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	43	2.3E-07	4.5E-07	1.0E+00	2E-07	4E-07	7E-07

Table 5-68

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 18 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	43	1.0E-05	4.8E-06	2.0E-05	0.51	0.24	0.75

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	43	1.3E-06	2.4E-06	2.0E-05	0.063	0.12	0.18

Table 5-69

Summary of the Exposure Doses and Cancer Risks for Exposure Area 18

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child/Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	43	3.5E-05	1.3E-05	2.0E+00	7E-05	3E-05	1E-04

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	43	1.2E-05	8.2E-06	1.0E+00	1E-05	8E-06	2E-05

Table 5-70

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 18

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	43	2.4E-04	7.8E-05	2.0E-05	11.9	3.9	16

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	43	1.2E-04	7.8E-05	2.0E-05	5.9	3.9	10

Table 5-71

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 18

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	43	2.5E-05	1.2E-05	2.0E-05	1.3	0.61	1.8

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	43	1.3E-05	1.2E-05	2.0E-05	0.64	0.61	1.3

Table 5-72

Summary of the Exposure Doses and Cancer Risks for Exposure Area 19 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	76	1.8E-05	8.6E-06	2.0E+00	4E-05	2E-05	5E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	76	4.1E-07	7.9E-07	1.0E+00	4E-07	8E-07	1E-06

Table 5-73

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 19 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	76	2.7E-05	1.3E-05	2.0E-05	1.3	0.64	2.0

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	76	2.2E-06	4.3E-06	2.0E-05	0.11	0.21	0.32

Table 5-74

Summary of the Exposure Doses and Cancer Risks for Exposure Area 20 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	28	6.6E-06	3.2E-06	2.0E+00	1E-05	6E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	28	1.5E-07	2.9E-07	1.0E+00	2E-07	3E-07	4E-07

Table 5-75

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 20 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	28	9.9E-06	4.7E-06	2.0E-05	0.49	0.24	0.73

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	28	8.2E-07	1.6E-06	2.0E-05	0.041	0.079	0.12

Table 5-76

Summary of the Exposure Doses and Cancer Risks for Exposure Area 21 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Farmer
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	1.2E-06	5.6E-07	2.0E+00	2E-06	1E-06	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	3.3E-08	6.3E-08	1.0E+00	3E-08	6E-08	1E-07

Table 5-77

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 21 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Farmer
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	1.3E-06	6.1E-07	2.0E-05	0.063	0.031	0.094

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	7.9E-08	1.5E-07	2.0E-05	0.0039	0.008	0.012

Table 5-78

Summary of the Exposure Doses and Cancer Risks for Exposure Areas 21 and 22

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child/Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	25	2.0E-05	7.8E-06	2.0E+00	4E-05	2E-05	6E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	25	6.8E-06	4.8E-06	1.0E+00	7E-06	5E-06	1E-05

Table 5-79

Summary of the Exposure Doses and Hazard Quotients for Exposure Areas 21 and 22

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	25	1.4E-04	4.5E-05	2.0E-05	6.8	2.2	9.1

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	25	6.8E-05	4.5E-05	2.0E-05	3.4	2.2	5.7

Table 5-80

Summary of the Exposure Doses and Hazard Quotients for Exposure Areas 21 and 22

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	25	1.5E-05	7.0E-06	2.0E-05	0.73	0.35	1.1

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	25	7.3E-06	7.0E-06	2.0E-05	0.37	0.35	0.72

Table 5-81

Summary of the Exposure Doses and Cancer Risks for Exposure Area 22 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	2.7E-06	1.0E-06	2.0E+00	5E-06	2E-06	7E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	2.3E-07	3.4E-07	1.0E+00	2E-07	3E-07	6E-07

Table 5-82

Summary of the Exposure Doses and Cancer Risks for Exposure Area 22 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	6.9E-06	3.3E-06	2.0E+00	1E-05	7E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	1.6E-07	3.0E-07	1.0E+00	2E-07	3E-07	5E-07

Table 5-83

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 22 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	1.6E-05	5.9E-06	2.0E-05	0.80	0.30	1.1

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	1.3E-06	2.0E-06	2.0E-05	0.066	0.099	0.16

Table 5-84

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 22 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	1.0E-05	4.9E-06	2.0E-05	0.51	0.24	0.75

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	8.5E-07	1.6E-06	2.0E-05	0.043	0.082	0.12

Table 5-85

Summary of the Exposure Doses and Cancer Risks for Exposure Area 22 - Subarea 22A

Exposure Medium: Soil
Exposure Scenario: ATV/Dirt Biker
Land Use: Current
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	61	1.2E-05	3.4E-06	2.0E+00	2E-05	7E-06	3E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	61	9.6E-07	1.2E-06	1.0E+00	1E-06	1E-06	2E-06

Table 5-86

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 22 - Subarea 22A

Exposure Medium: Soil
Exposure Scenario: ATV/Dirt Biker
Land Use: Current
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	61	6.7E-05	2.0E-05	2.0E-05	3.3	1.0	4.3

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	61	5.6E-06	6.7E-06	2.0E-05	0.28	0.34	0.61

Table 5-87

Summary of the Exposure Doses and Cancer Risks for Exposure Area 23 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	7.5E-07	2.8E-07	2.0E+00	2E-06	6E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	9.4E-08	1.4E-07	1.0E+00	9E-08	1E-07	2E-07

Table 5-88

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 23 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	4.4E-06	1.6E-06	2.0E-05	0.22	0.082	0.30

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	5.5E-07	8.1E-07	2.0E-05	0.027	0.041	0.068

Table 5-89

Summary of the Exposure Doses and Cancer Risks for Exposure Area 24 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	6.9E-06	3.3E-06	2.0E+00	1E-05	7E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	1.6E-07	3.0E-07	1.0E+00	2E-07	3E-07	5E-07

Table 5-90

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 24 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	1.0E-05	4.9E-06	2.0E-05	0.51	0.24	0.75

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	8.5E-07	1.6E-06	2.0E-05	0.043	0.082	0.12

Table 5-91

Summary of the Exposure Doses and Cancer Risks for Exposure Area 25 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	44	4.1E-06	1.5E-06	2.0E+00	8E-06	3E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	44	3.4E-07	5.1E-07	1.0E+00	3E-07	5E-07	9E-07

Table 5-92

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 25 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	44	2.4E-05	8.9E-06	2.0E-05	1.2	0.45	1.7

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	44	2.0E-06	3.0E-06	2.0E-05	0.10	0.15	0.25

Table 5-93

Summary of the Exposure Doses and Cancer Risks for Exposure Area 26 - Subarea 26A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	5.6E-07	2.1E-07	2.0E+00	1E-06	4E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	4.7E-08	7.0E-08	1.0E+00	5E-08	7E-08	1E-07

Table 5-94

Summary of the Exposure Doses and Cancer Risks for Exposure Area 26 - Subarea 26A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	6	1.4E-06	6.8E-07	2.0E+00	3E-06	1E-06	4E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	6	3.3E-08	6.2E-08	1.0E+00	3E-08	6E-08	9E-08

Table 5-95

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 26 - Subarea 26A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	3.3E-06	1.2E-06	2.0E-05	0.16	0.061	0.23

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	2.7E-07	4.1E-07	2.0E-05	0.014	0.020	0.034

Table 5-96

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 26 - Subarea 26A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	2.1E-06	1.0E-06	2.0E-05	0.11	0.051	0.16

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	1.8E-07	3.4E-07	2.0E-05	0.0088	0.017	0.026

Table 5-97

Summary of the Exposure Doses and Cancer Risks for Exposure Area 26 - Subarea 26B

Exposure Medium: Soil
Exposure Scenario: Farmer
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2	5.7E-07	2.8E-07	2.0E+00	1E-06	6E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2	1.6E-08	3.2E-08	1.0E+00	2E-08	3E-08	5E-08

Table 5-98

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 26 - Subarea 26B

Exposure Medium: Soil
Exposure Scenario: Farmer
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2	6.3E-07	3.0E-07	2.0E-05	0.031	0.015	0.047

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2	3.9E-08	7.6E-08	2.0E-05	0.0020	0.0038	0.0058

Table 5-99

Summary of the Exposure Doses and Cancer Risks for Exposure Area 26 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	4.9E-07	1.8E-07	2.0E+00	1E-06	4E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	4.1E-08	6.1E-08	1.0E+00	4E-08	6E-08	1E-07

Table 5-100

Summary of the Exposure Doses and Cancer Risks for Exposure Area 26 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	1.2E-06	5.9E-07	2.0E+00	2E-06	1E-06	4E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	2.9E-08	5.5E-08	1.0E+00	3E-08	5E-08	8E-08

Table 5-101

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 26 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	2.9E-06	1.1E-06	2.0E-05	0.14	0.054	0.20

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	2.4E-07	3.6E-07	2.0E-05	0.012	0.018	0.030

Table 5-102

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 26 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	1.9E-06	8.8E-07	2.0E-05	0.093	0.044	0.14

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	1.5E-07	2.9E-07	2.0E-05	0.0077	0.015	0.022

Table 5-103

Summary of the Exposure Doses and Cancer Risks for Exposure Area 27 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	5.6E-07	2.1E-07	2.0E+00	1E-06	4E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	4.7E-08	7.0E-08	1.0E+00	5E-08	7E-08	1E-07

Table 5-104

Summary of the Exposure Doses and Cancer Risks for Exposure Area 27 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	1.4E-06	6.8E-07	2.0E+00	3E-06	1E-06	4E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	3.3E-08	6.3E-08	1.0E+00	3E-08	6E-08	1E-07

Table 5-105

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 27 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	3.3E-06	1.2E-06	2.0E-05	0.16	0.061	0.23

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	2.7E-07	4.1E-07	2.0E-05	0.014	0.020	0.034

Table 5-106

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 27 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	2.1E-06	1.0E-06	2.0E-05	0.11	0.051	0.16

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	1.8E-07	3.4E-07	2.0E-05	0.0088	0.017	0.026

Table 5-107

Summary of the Exposure Doses and Cancer Risks for Exposure Area 27 - Subarea 27A

Exposure Medium: Soil
Exposure Scenario: ATV/Dirt Biker
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8.0	1.5E-06	4.5E-07	2.0E+00	3E-06	9E-07	4E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8.0	1.3E-07	1.5E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-108

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 27 - Subarea 27A

Exposure Medium: Soil
Exposure Scenario: ATV/Dirt Biker
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8.0	8.8E-06	2.7E-06	2.0E-05	0.44	0.13	0.57

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8.0	7.3E-07	8.8E-07	2.0E-05	0.037	0.044	0.081

Table 5-109

Summary of the Exposure Doses and Cancer Risks for Exposure Area 28 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40.4	1.9E-06	6.2E-07	2.0E+00	4E-06	1E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40.4	4.7E-07	6.2E-07	1.0E+00	5E-07	6E-07	1E-06

Table 5-110

Summary of the Exposure Doses and Cancer Risks for Exposure Area 28 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40.4	3.8E-06	1.4E-06	2.0E+00	8E-06	3E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40.4	3.2E-07	4.7E-07	1.0E+00	3E-07	5E-07	8E-07

Table 5-111

Summary of the Exposure Doses and Cancer Risks for Exposure Area 28 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

	Exposure	RME					
	Point	Exposure Dose (mg/kg-day)			Cancer Risk		
	Concentration	Incidental	Dermal	CSF	Incidental	Dermal	
Contaminant	**(mg/kg)**	**Ingestion**	**Contact**	**$(mg/kg\text{-}day)^{-1}$**	**Ingestion**	**Contact**	**Total**
tPCBs	40.4	9.6E-06	4.6E-06	2.0E+00	2E-05	9E-06	3E-05

	Exposure	CTE					
	Point	Exposure Dose (mg/kg-day)			Cancer Risk		
	Concentration	Incidental	Dermal	CSF	Incidental	Dermal	
Contaminant	**(mg/kg)**	**Ingestion**	**Contact**	**$(mg/kg\text{-}day)^{-1}$**	**Ingestion**	**Contact**	**Total**
tPCBs	40.4	2.2E-07	4.2E-07	1.0E+00	2E-07	4E-07	6E-07

Table 5-112

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 28 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40.4	2.2E-05	7.3E-06	2.0E-05	1.1	0.36	1.5

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40.4	5.5E-06	7.3E-06	2.0E-05	0.28	0.36	0.64

Table 5-113

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 28 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40.4	2.2E-05	8.2E-06	2.0E-05	1.1	0.41	1.5

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
PCBs, Total	40.4	1.8E-06	2.7E-06	2.0E-05	0.092	0.14	0.23

Table 5-114

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 28 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40.4	1.4E-05	6.8E-06	2.0E-05	0.71	0.34	1.0

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	40.4	1.2E-06	2.3E-06	2.0E-05	0.060	0.11	0.17

Table 5-115

Summary of the Exposure Doses and Cancer Risks for Exposure Area 28 - Subarea 28A

Exposure Medium: Soil
Exposure Scenario: ATV/Dirt Biker
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	4.3E-06	1.3E-06	2.0E+00	9E-06	3E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	3.6E-07	4.3E-07	1.0E+00	4E-07	4E-07	8E-07

Table 5-116

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 28 - Subarea 28A

Exposure Medium: Soil
Exposure Scenario: ATV/Dirt Biker
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	2.5E-05	7.6E-06	2.0E-05	1.3	0.38	1.6

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	2.1E-06	2.5E-06	2.0E-05	0.11	0.13	0.23

Table 5-117

Summary of the Exposure Doses and Cancer Risks for Exposure Area 29 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	28	8.8E-07	3.3E-07	2.0E+00	2E-06	7E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	28	1.1E-07	1.6E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-118

Summary of the Exposure Doses and Cancer Risks for Exposure Area 29 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	28	2.2E-06	1.1E-06	2.0E+00	4E-06	2E-06	7E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	28	7.6E-08	1.5E-07	1.0E+00	8E-08	1E-07	2E-07

Table 5-119

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 29 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	28	5.1E-06	1.9E-06	2.0E-05	0.26	0.095	0.35

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	28	6.4E-07	9.5E-07	2.0E-05	0.032	0.047	0.079

Table 5-120

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 29 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	28	3.3E-06	1.6E-06	2.0E-05	0.16	0.079	0.24

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	28	4.1E-07	7.9E-07	2.0E-05	0.021	0.039	0.060

Table 5-121A

Summary of the Exposure Doses and Cancer Risks for Exposure Area 30

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34.8	3.3E-06	1.2E-06	2.0E+00	7E-06	2E-06	9E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34.8	2.7E-07	4.0E-07	1.0E+00	3E-07	4E-07	7E-07

Table 5-121B

Summary of the Exposure Doses and Cancer Risks for Exposure Area 30

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34.8	8.2E-06	3.9E-06	2.0E+00	2E-05	8E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34.8	1.9E-07	3.6E-07	1.0E+00	2E-07	4E-07	6E-07

Table 5-122

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 30

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34.8	1.9E-05	7.1E-06	2.0E-05	0.96	0.35	1.3

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34.8	1.6E-06	2.4E-06	2.0E-05	0.080	0.12	0.20

Table 5-123

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 30

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34.8	1.2E-05	5.9E-06	2.0E-05	0.62	0.29	0.91

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34.8	1.0E-06	2.0E-06	2.0E-05	0.051	0.098	0.15

Table 5-124

Summary of the Exposure Doses and Cancer Risks for Exposure Area 31 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	2.2E-06	8.0E-07	2.0E+00	4E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	1.8E-07	2.7E-07	1.0E+00	2E-07	3E-07	4E-07

Table 5-125

Summary of the Exposure Doses and Cancer Risks for Exposure Area 31 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	5.4E-06	2.6E-06	2.0E+00	1E-05	5E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	1.3E-07	2.4E-07	1.0E+00	1E-07	2E-07	4E-07

Table 5-126

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 31 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	1.3E-05	4.7E-06	2.0E-05	0.63	0.23	0.86

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	1.1E-06	1.6E-06	2.0E-05	0.053	0.078	0.13

Table 5-127

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 31 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	8.1E-06	3.9E-06	2.0E-05	0.41	0.19	0.60

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	6.8E-07	1.3E-06	2.0E-05	0.034	0.065	0.098

Table 5-128

Summary of the Exposure Doses and Cancer Risks for Exposure Area 31 - Subarea 31A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.6	3.5E-06	1.3E-06	2.0E+00	7E-06	3E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.6	2.9E-07	4.4E-07	1.0E+00	3E-07	4E-07	7E-07

Table 5-129

Summary of the Exposure Doses and Cancer Risks for Exposure Area 31 - Subarea 31A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.6	8.9E-06	4.3E-06	2.0E+00	2E-05	9E-06	3E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.6	2.1E-07	3.9E-07	1.0E+00	2E-07	4E-07	6E-07

Table 5-130

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 31 - Subarea 31A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.6	2.1E-05	7.7E-06	2.0E-05	1.0	0.38	1.4

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.6	1.7E-06	2.6E-06	2.0E-05	0.086	0.13	0.21

Table 5-131

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 31 - Subarea 31A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.6	1.3E-05	6.3E-06	2.0E-05	0.66	0.32	0.98

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.6	1.1E-06	2.1E-06	2.0E-05	0.055	0.11	0.16

Table 5-132

Summary of the Exposure Doses and Cancer Risks for Exposure Area 32 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	5.4E-06	2.6E-06	2.0E+00	1E-05	5E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	1.3E-07	2.4E-07	1.0E+00	1E-07	2E-07	4E-07

Table 5-133

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 32 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	8.1E-06	3.9E-06	2.0E-05	0.41	0.19	0.60

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	6.8E-07	1.3E-06	2.0E-05	0.034	0.065	0.098

Table 5-134

Summary of the Exposure Doses and Cancer Risks for Exposure Area 33 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	(mg/kg-day)$^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	33	7.8E-06	3.7E-06	2.0E+00	2E-05	7E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	(mg/kg-day)$^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	33	1.8E-07	3.4E-07	1.0E+00	2E-07	3E-07	5E-07

Table 5-135

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 33 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	33	1.2E-05	5.6E-06	2.0E-05	0.58	0.28	0.86

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	33	9.7E-07	1.9E-06	2.0E-05	0.048	0.093	0.14

Table 5-136

Summary of the Exposure Doses and Cancer Risks for Exposure Area 34 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Farmer
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	CSF $(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	29	8.3E-06	4.0E-06	2.0E+00	2E-05	8E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	CSF $(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	29	2.4E-07	4.6E-07	1.0E+00	2E-07	5E-07	7E-07

Table 5-137

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 34 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Farmer
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	9.1E-06	4.4E-06	2.0E-05	0.45	0.22	0.67

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	5.7E-07	1.1E-06	2.0E-05	0.028	0.055	0.083

Table 5-138

Summary of the Exposure Doses and Cancer Risks for Exposure Area 34 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child/Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	2.3E-05	9.0E-06	2.0E+00	5E-05	2E-05	6E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	7.9E-06	5.5E-06	1.0E+00	8E-06	6E-06	1E-05

Table 5-139

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 34 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	1.6E-04	5.2E-05	2.0E-05	7.9	2.6	11

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	7.9E-05	5.2E-05	2.0E-05	4.0	2.6	6.6

Table 5-140

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 34 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	1.7E-05	8.1E-06	2.0E-05	0.85	0.41	1.3

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	8.5E-06	8.1E-06	2.0E-05	0.43	0.41	0.83

Table 5-141

Summary of the Exposure Doses and Cancer Risks for Exposure Area 35 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	2.1E-06	7.9E-07	2.0E+00	4E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	1.8E-07	2.6E-07	1.0E+00	2E-07	3E-07	4E-07

Table 5-142

Summary of the Exposure Doses and Cancer Risks for Exposure Area 35 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	5.4E-06	2.6E-06	2.0E+00	1E-05	5E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	1.2E-07	2.4E-07	1.0E+00	1E-07	2E-07	4E-07

Table 5-143

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 35 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	1.2E-05	4.6E-06	2.0E-05	0.62	0.23	0.85

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	1.0E-06	1.5E-06	2.0E-05	0.052	0.077	0.13

Table 5-144

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 35 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	8.0E-06	3.8E-06	2.0E-05	0.40	0.19	0.59

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	6.7E-07	1.3E-06	2.0E-05	0.033	0.064	0.097

Table 5-145

Summary of the Exposure Doses and Cancer Risks for Exposure Area 35 - Subarea 35A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	1.1E-06	4.2E-07	2.0E+00	2E-06	8E-07	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	9.4E-08	1.4E-07	1.0E+00	9E-08	1E-07	2E-07

Table 5-146

Summary of the Exposure Doses and Cancer Risks for Exposure Area 35 - Subarea 35A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	2.8E-06	1.4E-06	2.0E+00	6E-06	3E-06	8E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	6.5E-08	1.3E-07	1.0E+00	7E-08	1E-07	2E-07

Table 5-147

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 35 - Subarea 35A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	6.6E-06	2.4E-06	2.0E-05	0.33	0.12	0.45

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	5.5E-07	8.1E-07	2.0E-05	0.027	0.041	0.068

Table 5-148

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 35 - Subarea 35A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	4.2E-06	2.0E-06	2.0E-05	0.21	0.10	0.31

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	3.5E-07	6.7E-07	2.0E-05	0.018	0.034	0.051

Table 5-149

Summary of the Exposure Doses and Cancer Risks for Exposure Area 36 - Subarea 36A

Exposure Medium: Soil
Exposure Scenario: Groundskeeper
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	8.4E-07	2.9E-07	2.0E+00	2E-06	6E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	5.0E-08	7.0E-08	1.0E+00	5E-08	7E-08	1E-07

Table 5-150

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 36 - Subarea 36A

Exposure Medium: Soil
Exposure Scenario: Groundskeeper
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	2.4E-06	8.2E-07	2.0E-05	0.12	0.041	0.16

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	2.9E-07	4.1E-07	2.0E-05	0.015	0.020	0.035

Table 5-151

Summary of the Exposure Doses and Cancer Risks for Exposure Area 36 - Subarea 36B

Exposure Medium: Soil
Exposure Scenario: Farmer
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	8	2.2E-06	1.1E-06	2.0E+00	4E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	8	6.2E-08	1.2E-07	1.0E+00	6E-08	1E-07	2E-07

Table 5-152

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 36 - Subarea 36B

Exposure Medium: Soil
Exposure Scenario: Farmer
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8	2.4E-06	1.2E-06	2.0E-05	0.12	0.058	0.18

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8	1.5E-07	2.9E-07	2.0E-05	0.0075	0.014	0.022

Table 5-153

Summary of the Exposure Doses and Cancer Risks for Exposure Area 37 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	16	1.5E-06	5.7E-07	2.0E+00	3E-06	1E-06	4E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	16	1.3E-07	1.9E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-154

Summary of the Exposure Doses and Cancer Risks for Exposure Area 37 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	16	3.8E-06	1.8E-06	2.0E+00	8E-06	4E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	16	8.8E-08	1.7E-07	1.0E+00	9E-08	2E-07	3E-07

Table 5-155

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 37 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	16	8.9E-06	3.3E-06	2.0E-05	0.44	0.16	0.61

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	16	7.4E-07	1.1E-06	2.0E-05	0.037	0.055	0.092

Table 5-156

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 37 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	16	5.7E-06	2.7E-06	2.0E-05	0.29	0.14	0.42

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	16	4.8E-07	9.1E-07	2.0E-05	0.024	0.045	0.069

Table 5-157

Summary of the Exposure Doses and Cancer Risks for Exposure Area 37 - Subarea 37A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.1	1.7E-06	2.7E-06	2.0E+00	3E-06	5E-06	9E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.1	1.4E-07	9.1E-07	1.0E+00	1E-07	9E-07	1E-06

Table 5-158

Summary of the Exposure Doses and Cancer Risks for Exposure Area 37 - Subarea 37A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.1	3.5E-06	7.3E-06	2.0E+00	7E-06	1E-05	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.1	8.5E-08	7.0E-07	1.0E+00	8E-08	7E-07	8E-07

Table 5-159

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 37 - Subarea 37A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.1	1.0E-05	1.6E-05	2.0E-05	0.51	0.80	1.3

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.1	8.4E-07	5.3E-06	2.0E-05	0.042	0.27	0.31

Table 5-160

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 37 - Subarea 37A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.1	6.5E-06	1.3E-05	2.0E-05	0.32	0.67	0.99

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.1	5.4E-07	4.5E-06	2.0E-05	0.027	0.22	0.25

Table 5-161

Summary of the Exposure Doses and Cancer Risks for Exposure Area 37 - Subarea 37B

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	7	6.6E-07	2.4E-07	2.0E+00	1E-06	5E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	7	5.5E-08	8.1E-08	1.0E+00	5E-08	8E-08	1E-07

Table 5-162

Summary of the Exposure Doses and Cancer Risks for Exposure Area 37 - Subarea 37B

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	7	1.7E-06	7.9E-07	2.0E+00	3E-06	2E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	7	3.8E-08	7.3E-08	1.0E+00	4E-08	7E-08	1E-07

Table 5-163

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 37 - Subarea 37B

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	3.8E-06	1.4E-06	2.0E-05	0.19	0.071	0.26

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	3.2E-07	4.7E-07	2.0E-05	0.016	0.024	0.040

Table 5-164

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 37 - Subarea 37B

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	2.5E-06	1.2E-06	2.0E-05	0.12	0.059	0.18

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	2.1E-07	3.9E-07	2.0E-05	0.010	0.020	0.030

Table 5-165

Summary of the Exposure Doses and Cancer Risks for Exposure Area 38 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	6.9E-06	3.3E-06	2.0E+00	1E-05	7E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	1.6E-07	3.0E-07	1.0E+00	2E-07	3E-07	5E-07

Table 5-166

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 38 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	1.0E-05	4.9E-06	2.0E-05	0.51	0.24	0.75

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	29	8.5E-07	1.6E-06	2.0E-05	0.043	0.082	0.12

Table 5-167

Summary of the Exposure Doses and Cancer Risks for Exposure Area 38 - Subarea 38A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	83.3	2.6E-06	4.1E-06	2.0E+00	5E-06	8E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	83.3	2.2E-07	1.4E-06	1.0E+00	2E-07	1E-06	2E-06

Table 5-168

Summary of the Exposure Doses and Cancer Risks for Exposure Area 38 - Subarea 38A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	83.3	5.3E-06	1.1E-05	2.0E+00	1E-05	2E-05	3E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	83.3	1.3E-07	1.1E-06	1.0E+00	1E-07	1E-06	1E-06

Table 5-169

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 38 - Subarea 38A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	83.3	1.5E-05	2.4E-05	2.0E-05	0.76	1.2	2.0

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	83.3	1.3E-06	8.0E-06	2.0E-05	0.064	0.40	0.46

Table 5-170

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 38 - Subarea 38A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	83.3	9.8E-06	2.0E-05	2.0E-05	0.49	1.0	1.5

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	83.3	8.2E-07	6.7E-06	2.0E-05	0.041	0.34	0.38

Table 5-171

Summary of the Exposure Doses and Cancer Risks for Exposure Area 39 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Marathon Canoeist
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	2.4E-06	9.8E-06	2.0E+00	5E-06	2E-05	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	3.6E-07	3.0E-06	1.0E+00	4E-07	3E-06	3E-06

Table 5-172

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 39 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Marathon Canoeist
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	5.6E-06	2.3E-05	2.0E-05	0.28	1.2	1.4

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	1.7E-06	1.4E-05	2.0E-05	0.084	0.69	0.77

Table 5-173

Summary of the Exposure Doses and Cancer Risks for Exposure Area 39 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	19	6.0E-07	9.4E-07	2.0E+00	1E-06	2E-06	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	19	7.5E-08	4.7E-07	1.0E+00	7E-08	5E-07	5E-07

Table 5-174

Summary of the Exposure Doses and Cancer Risks for Exposure Area 39 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	2.6E-06	5.3E-06	2.0E+00	5E-06	1E-05	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	1.6E-07	1.3E-06	1.0E+00	2E-07	1E-06	1E-06

Table 5-175

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 39 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	3.5E-06	5.5E-06	2.0E-05	0.17	0.28	0.45

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	4.4E-07	2.8E-06	2.0E-05	0.022	0.14	0.16

Table 5-176

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 39 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	4.5E-06	9.3E-06	2.0E-05	0.22	0.46	0.69

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	5.6E-07	4.6E-06	2.0E-05	0.028	0.23	0.26

Table 5-177

Summary of the Exposure Doses and Cancer Risks for Exposure Area 40 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	4.1E-07	1.4E-07	2.0E+00	8E-07	3E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	1.0E-07	1.4E-07	1.0E+00	1E-07	1E-07	2E-07

Table 5-178

Summary of the Exposure Doses and Cancer Risks for Exposure Area 40 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	2.1E-06	9.9E-07	2.0E+00	4E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	4.8E-08	9.2E-08	1.0E+00	5E-08	9E-08	1E-07

Table 5-179

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 40 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	4.83E-06	1.58E-06	2.00E-05	0.24	0.079	0.32

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	1.21E-06	1.58E-06	2.00E-05	0.061	0.079	0.14

Table 5-180

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 40 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	3.1E-06	1.5E-06	2.0E-05	0.16	0.074	0.23

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	2.6E-07	4.9E-07	2.0E-05	0.013	0.025	0.038

Table 5-181

Summary of the Exposure Doses and Cancer Risks for Exposure Area 40 - Subarea 40A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	1.2E-06	1.8E-06	2.0E+00	2E-06	4E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	9.7E-08	6.1E-07	1.0E+00	1E-07	6E-07	7E-07

Table 5-182

Summary of the Exposure Doses and Cancer Risks for Exposure Area 40 - Subarea 40A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	2.4E-06	4.9E-06	2.0E+00	5E-06	1E-05	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	5.7E-08	4.7E-07	1.0E+00	6E-08	5E-07	5E-07

Table 5-183

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 40 - Subarea 40A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	6.8E-06	1.1E-05	2.0E-05	0.34	0.54	0.87

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	5.6E-07	3.6E-06	2.0E-05	0.028	0.18	0.21

Table 5-184

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 40 - Subarea 40A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	4.3E-06	9.0E-06	2.0E-05	0.22	0.45	0.67

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	3.6E-07	3.0E-06	2.0E-05	0.018	0.15	0.17

Table 5-185

Summary of the Exposure Doses and Cancer Risks for Exposure Area 40 - Subarea 40B

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	61.6	2.9E-06	9.5E-07	2.0E+00	6E-06	2E-06	8E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	61.6	7.2E-07	9.5E-07	1.0E+00	7E-07	9E-07	2E-06

Table 5-186

Summary of the Exposure Doses and Cancer Risks for Exposure Area 40 - Subarea 40B

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	61.6	1.5E-05	7.0E-06	2.0E+00	3E-05	1E-05	4E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	61.6	3.4E-07	6.4E-07	1.0E+00	3E-07	6E-07	1E-06

Table 5-187

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 40 - Subarea 40B

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	61.6	3.4E-05	1.1E-05	2.0E-05	1.7	0.56	2.2

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	61.6	8.4E-06	1.1E-05	2.0E-05	0.42	0.56	0.98

Table 5-188

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 40 - Subarea 40B

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	61.6	2.2E-05	1.0E-05	2.0E-05	1.1	0.52	1.6

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	61.6	1.8E-06	3.5E-06	2.0E-05	0.091	0.17	0.26

Table 5-189

Summary of the Exposure Doses and Cancer Risks for Exposure Area 41 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	18	2.8E-06	1.4E-06	2.0E+00	6E-06	3E-06	8E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	18	9.8E-08	1.9E-07	1.0E+00	1E-07	2E-07	2E-07

Table 5-190

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 41 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	18	4.2E-06	2.0E-06	2.0E-05	0.21	0.10	0.32

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	18	5.3E-07	1.0E-06	2.0E-05	0.026	0.050	0.076

Table 5-191

Summary of the Exposure Doses and Cancer Risks for Exposure Area 41 - Subarea 41A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.3	1.7E-06	2.7E-06	2.0E+00	3E-06	5E-06	9E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.3	1.4E-07	9.1E-07	1.0E+00	1E-07	9E-07	1E-06

Table 5-192

Summary of the Exposure Doses and Cancer Risks for Exposure Area 41 - Subarea 41A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.3	3.5E-06	7.3E-06	2.0E+00	7E-06	1E-05	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.3	8.5E-08	7.0E-07	1.0E+00	9E-08	7E-07	8E-07

Table 5-193

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 41 - Subarea 41A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.3	1.0E-05	1.6E-05	2.0E-05	0.51	0.80	1.3

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.3	8.4E-07	5.3E-06	2.0E-05	0.042	0.27	0.31

Table 5-194

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 41 - Subarea 41A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.3	6.5E-06	1.3E-05	2.0E-05	0.32	0.67	0.99

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	55.3	5.4E-07	4.5E-06	2.0E-05	0.027	0.22	0.25

Table 5-195

Summary of the Exposure Doses and Cancer Risks for Exposure Area 42 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	2.4E-06	1.1E-06	2.0E+00	5E-06	2E-06	7E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	8.2E-08	1.6E-07	1.0E+00	8E-08	2E-07	2E-07

Table 5-196

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 42 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	3.5E-06	1.7E-06	2.0E-05	0.18	0.084	0.26

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	4.4E-07	8.4E-07	2.0E-05	0.022	0.042	0.064

Table 5-197

Summary of the Exposure Doses and Cancer Risks for Exposure Area 42 - Subarea 42A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	51.1	1.6E-06	2.5E-06	2.0E+00	3E-06	5E-06	8E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	51.1	1.3E-07	8.4E-07	1.0E+00	1E-07	8E-07	1E-06

Table 5-198

Summary of the Exposure Doses and Cancer Risks for Exposure Area 42 - Subarea 42A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	51.1	3.3E-06	6.7E-06	2.0E+00	7E-06	1E-05	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	51.1	7.9E-08	6.5E-07	1.0E+00	8E-08	6E-07	7E-07

Table 5-199

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 42 - Subarea 42A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	51.1	9.3E-06	1.5E-05	2.0E-05	0.47	0.74	1.2

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	51.1	7.8E-07	4.9E-06	2.0E-05	0.039	0.25	0.28

Table 5-200

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 42 - Subarea 42A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	51.1	6.0E-06	1.2E-05	2.0E-05	0.30	0.62	0.92

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	51.1	5.0E-07	4.1E-06	2.0E-05	0.025	0.21	0.23

Table 5-201

Summary of the Exposure Doses and Cancer Risks for Exposure Area 43 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	2.7E-06	1.3E-06	2.0E+00	5E-06	3E-06	8E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	9.3E-08	1.8E-07	1.0E+00	9E-08	2E-07	3E-07

Table 5-202

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 43 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	4.0E-06	1.9E-06	2.0E-05	0.20	0.096	0.30

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	5.0E-07	9.5E-07	2.0E-05	0.025	0.048	0.073

Table 5-203

Summary of the Exposure Doses and Cancer Risks for Exposure Area 43 - Subarea 43A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	52.7	1.7E-06	2.6E-06	2.0E+00	3E-06	5E-06	9E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	52.7	1.4E-07	8.7E-07	1.0E+00	1E-07	9E-07	1E-06

Table 5-204

Summary of the Exposure Doses and Cancer Risks for Exposure Area 43 - Subarea 43A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	52.7	3.4E-06	7.0E-06	2.0E+00	7E-06	1E-05	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	52.7	8.1E-08	6.7E-07	1.0E+00	8E-08	7E-07	8E-07

Table 5-205

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 43 - Subarea 43A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	52.7	9.6E-06	1.5E-05	2.0E-05	0.48	0.76	1.2

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	52.7	8.0E-07	5.1E-06	2.0E-05	0.040	0.25	0.29

Table 5-206

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 43 - Subarea 43A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	52.7	6.2E-06	1.3E-05	2.0E-05	0.31	0.64	0.95

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	52.7	5.2E-07	4.3E-06	2.0E-05	0.026	0.21	0.24

Table 5-207

Summary of the Exposure Doses and Cancer Risks for Exposure Area 44 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	43	1.0E-05	4.9E-06	2.0E+00	2E-05	1E-05	3E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	43	2.3E-07	4.5E-07	1.0E+00	2E-07	4E-07	7E-07

Table 5-208

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 44 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	43	1.5E-05	7.2E-06	2.0E-05	0.76	0.36	1.1

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	43	1.3E-06	2.4E-06	2.0E-05	0.063	0.12	0.18

Table 5-209

Summary of the Exposure Doses and Cancer Risks for Exposure Area 45 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	1.7E-07	1.1E-07	2.0E+00	3E-07	2E-07	6E-07

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	4.2E-08	5.7E-08	1.0E+00	4E-08	6E-08	1E-07

Table 5-210

Summary of the Exposure Doses and Cancer Risks for Exposure Area 45 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	6.8E-07	5.9E-07	2.0E+00	1E-06	1E-06	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	1.1E-07	1.9E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-211

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 45 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	2.0E-06	1.3E-06	2.0E-05	0.10	0.067	0.16

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	4.9E-07	6.6E-07	2.0E-05	0.024	0.033	0.058

Table 5-212

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 45 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	1.3E-06	1.1E-06	2.0E-05	0.063	0.054	0.12

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	3.2E-07	5.4E-07	2.0E-05	0.016	0.027	0.043

Table 5-213

Summary of the Exposure Doses and Cancer Risks for Exposure Area 45 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	4.7E-06	2.3E-06	2.0E+00	9E-06	5E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	1.1E-07	2.1E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-214

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 45 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	20	7.0E-06	3.4E-06	2.0E-05	0.35	0.17	0.52

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	20	5.8E-07	1.1E-06	2.0E-05	0.029	0.056	0.085

Table 5-215

Summary of the Exposure Doses and Cancer Risks for Exposure Area 46 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	1.2E-07	8.3E-08	2.0E+00	2E-07	2E-07	4E-07

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	3.1E-08	4.1E-08	1.0E+00	3E-08	4E-08	7E-08

Table 5-216

Summary of the Exposure Doses and Cancer Risks for Exposure Area 46 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	5.0E-07	4.3E-07	2.0E+00	1E-06	9E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	8.2E-08	1.4E-07	1.0E+00	8E-08	1E-07	2E-07

Table 5-217

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 46 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	1.4E-06	9.7E-07	2.0E-05	0.072	0.048	0.12

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	3.6E-07	4.8E-07	2.0E-05	0.018	0.024	0.042

Table 5-218

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 46 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	9.2E-07	7.9E-07	2.0E-05	0.046	0.039	0.085

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	2.3E-07	3.9E-07	2.0E-05	0.011	0.020	0.031

Table 5-219

Summary of the Exposure Doses and Cancer Risks for Exposure Area 46 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11	2.6E-06	1.2E-06	2.0E+00	5E-06	2E-06	8E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11	6.0E-08	1.2E-07	1.0E+00	6E-08	1E-07	2E-07

Table 5-220

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 46 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11	3.9E-06	1.9E-06	2.0E-05	0.19	0.093	0.29

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11	3.2E-07	6.2E-07	2.0E-05	0.016	0.031	0.047

Table 5-221

Summary of the Exposure Doses and Cancer Risks for Exposure Area 47 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	8.5E-07	1.3E-06	2.0E+00	2E-06	3E-06	4E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	1.1E-07	6.7E-07	1.0E+00	1E-07	7E-07	8E-07

Table 5-222

Summary of the Exposure Doses and Cancer Risks for Exposure Area 47 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	3.6E-06	7.5E-06	2.0E+00	7E-06	1E-05	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	2.3E-07	1.9E-06	1.0E+00	2E-07	2E-06	2E-06

Table 5-223

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 47 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	4.9E-06	7.8E-06	2.0E-05	0.25	0.39	0.64

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	6.2E-07	3.9E-06	2.0E-05	0.031	0.19	0.23

Table 5-224

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 47 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	6.3E-06	1.3E-05	2.0E-05	0.32	0.66	0.97

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	7.9E-07	6.6E-06	2.0E-05	0.040	0.33	0.37

Table 5-225

Summary of the Exposure Doses and Cancer Risks for Exposure Area 47 - Expanded Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	4.4E-07	6.9E-07	2.0E+00	9E-07	1E-06	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	5.5E-08	3.5E-07	1.0E+00	5E-08	3E-07	4E-07

Table 5-226

Summary of the Exposure Doses and Cancer Risks for Exposure Area 47 - Expanded Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	1.9E-06	3.9E-06	2.0E+00	4E-06	8E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	1.2E-07	9.7E-07	1.0E+00	1E-07	1E-06	1E-06

Table 5-227

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 47 - Expanded Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	2.6E-06	4.0E-06	2.0E-05	0.13	0.20	0.33

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	3.2E-07	2.0E-06	2.0E-05	0.016	0.10	0.12

Table 5-228

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 47 - Expanded Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	3.3E-06	6.8E-06	2.0E-05	0.16	0.34	0.50

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	4.1E-07	3.4E-06	2.0E-05	0.021	0.17	0.19

Table 5-229

Summary of the Exposure Doses and Cancer Risks for Exposure Area 48 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	1.5E-07	9.9E-08	2.0E+00	3E-07	2E-07	5E-07

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	3.7E-08	5.0E-08	1.0E+00	4E-08	5E-08	9E-08

Table 5-230

Summary of the Exposure Doses and Cancer Risks for Exposure Area 48 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	6.0E-07	5.1E-07	2.0E+00	1E-06	1E-06	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	9.8E-08	1.7E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-231

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 48 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	1.7E-06	1.2E-06	2.0E-05	0.085	0.058	0.14

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	4.3E-07	5.8E-07	2.0E-05	0.021	0.029	0.050

Table 5-232

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 48 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	1.1E-06	9.4E-07	2.0E-05	0.055	0.047	0.10

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	20	2.7E-07	4.7E-07	2.0E-05	0.014	0.024	0.037

Table 5-233

Summary of the Exposure Doses and Cancer Risks for Exposure Area 48 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	1.0E-06	4.9E-07	2.0E+00	2E-06	1E-06	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	2.4E-08	4.5E-08	1.0E+00	2E-08	4E-08	7E-08

Table 5-234

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 48 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	1.5E-06	7.3E-07	2.0E-05	0.076	0.036	0.11

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	1.3E-07	2.4E-07	2.0E-05	0.0064	0.012	0.018

Table 5-235

Summary of the Exposure Doses and Cancer Risks for Exposure Area 49 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	47.4	3.5E-07	2.4E-07	2.0E+00	7E-07	5E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	47.4	8.7E-08	1.2E-07	1.0E+00	9E-08	1E-07	2E-07

Table 5-236

Summary of the Exposure Doses and Cancer Risks for Exposure Area 49 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	47.4	1.4E-06	1.2E-06	2.0E+00	3E-06	2E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	47.4	2.3E-07	4.0E-07	1.0E+00	2E-07	4E-07	6E-07

Table 5-237

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 49 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	47.4	4.0E-06	2.7E-06	2.0E-05	0.20	0.14	0.34

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	47.4	1.0E-06	1.4E-06	2.0E-05	0.051	0.069	0.12

Table 5-238

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 49 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	47.4	2.6E-06	2.2E-06	2.0E-05	0.13	0.11	0.24

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	47.4	6.5E-07	1.1E-06	2.0E-05	0.032	0.056	0.088

Table 5-239

Summary of the Exposure Doses and Cancer Risks for Exposure Area 49 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	26	2.1E-06	9.8E-07	2.0E+00	4E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	26	7.1E-08	1.4E-07	1.0E+00	7E-08	1E-07	2E-07

Table 5-240

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 49 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	26	3.1E-06	1.5E-06	2.0E-05	0.15	0.073	0.23

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	26	3.8E-07	7.3E-07	2.0E-05	0.019	0.036	0.056

Table 5-241

Summary of the Exposure Doses and Cancer Risks for Exposure Area 50 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	4.9E-07	2.3E-07	2.0E+00	1E-06	5E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	1.7E-08	3.2E-08	1.0E+00	2E-08	3E-08	5E-08

Table 5-242

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 50 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	7.3E-07	3.5E-07	2.0E-05	0.037	0.017	0.054

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	9.1E-08	1.7E-07	2.0E-05	0.0046	0.0087	0.013

Table 5-243

Summary of the Exposure Doses and Cancer Risks for Exposure Area 50 - Subarea 50A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	1.8E-07	1.2E-07	2.0E+00	4E-07	2E-07	6E-07

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	4.4E-08	5.9E-08	1.0E+00	4E-08	6E-08	1E-07

Table 5-244

Summary of the Exposure Doses and Cancer Risks for Exposure Area 50 - Subarea 50A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	7.1E-07	6.1E-07	2.0E+00	1E-06	1E-06	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	1.2E-07	2.0E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-245

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 50 - Subarea 50A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	2.1E-06	1.4E-06	2.0E-05	0.10	0.070	0.17

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	5.1E-07	6.9E-07	2.0E-05	0.026	0.035	0.060

Table 5-246

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 50 - Subarea 50A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	1.3E-06	1.1E-06	2.0E-05	0.066	0.057	0.12

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	3.3E-07	5.7E-07	2.0E-05	0.016	0.028	0.045

Table 5-247

Summary of the Exposure Doses and Cancer Risks for Exposure Area 51 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11	8.7E-07	4.1E-07	2.0E+00	2E-06	8E-07	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11	3.0E-08	5.7E-08	1.0E+00	3E-08	6E-08	9E-08

Table 5-248

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 51 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11	1.3E-06	6.2E-07	2.0E-05	0.065	0.031	0.095

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11	1.6E-07	3.1E-07	2.0E-05	0.0081	0.015	0.023

Table 5-249

Summary of the Exposure Doses and Cancer Risks for Exposure Area 51 - Subarea 51A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	1.3E-07	8.7E-08	2.0E+00	3E-07	2E-07	4E-07

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	3.2E-08	4.3E-08	1.0E+00	3E-08	4E-08	8E-08

Table 5-250

Summary of the Exposure Doses and Cancer Risks for Exposure Area 51 - Subarea 51A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	5.2E-07	4.5E-07	2.0E+00	1E-06	9E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	8.6E-08	1.5E-07	1.0E+00	9E-08	1E-07	2E-07

Table 5-251

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 51 - Subarea 51A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	1.5E-06	1.0E-06	2.0E-05	0.075	0.051	0.13

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	3.7E-07	5.1E-07	2.0E-05	0.019	0.025	0.044

Table 5-252

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 51 - Subarea 51A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	9.6E-07	8.2E-07	2.0E-05	0.048	0.041	0.089

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	2.4E-07	4.1E-07	2.0E-05	0.012	0.021	0.033

Table 5-253

Summary of the Exposure Doses and Cancer Risks for Exposure Area 52 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	1.1E-07	1.7E-07	2.0E+00	2E-07	3E-07	6E-07

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	1.3E-08	8.5E-08	1.0E+00	1E-08	8E-08	1E-07

Table 5-254

Summary of the Exposure Doses and Cancer Risks for Exposure Area 52 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	4.6E-07	9.5E-07	2.0E+00	9E-07	2E-06	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	2.9E-08	2.4E-07	1.0E+00	3E-08	2E-07	3E-07

Table 5-255

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 52 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	6.3E-07	9.9E-07	2.0E-05	0.031	0.050	0.081

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	7.8E-08	5.0E-07	2.0E-05	0.0039	0.025	0.029

Table 5-256

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 52 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	8.1E-07	1.7E-06	2.0E-05	0.040	0.084	0.12

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	1.0E-07	8.3E-07	2.0E-05	0.0051	0.042	0.047

Table 5-257

Summary of the Exposure Doses and Cancer Risks for Exposure Area 53 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME						
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	4.4E-07	6.9E-07	2.0E+00	9E-07	1E-06	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE						
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	5.5E-08	3.5E-07	1.0E+00	5E-08	3E-07	4E-07

Table 5-258

Summary of the Exposure Doses and Cancer Risks for Exposure Area 53 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	1.9E-06	3.9E-06	2.0E+00	4E-06	8E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	1.2E-07	9.7E-07	1.0E+00	1E-07	1E-06	1E-06

Table 5-259

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 53 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	2.6E-06	4.0E-06	2.0E-05	0.13	0.20	0.33

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	3.2E-07	2.0E-06	2.0E-05	0.016	0.10	0.12

Table 5-260

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 53 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	3.3E-06	6.8E-06	2.0E-05	0.16	0.34	0.50

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	14	4.1E-07	3.4E-06	2.0E-05	0.021	0.17	0.19

Table 5-261

Summary of the Exposure Doses and Cancer Risks for Exposure Area 54 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	2.7E-07	1.8E-07	2.0E+00	5E-07	4E-07	9E-07

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	6.8E-08	9.2E-08	1.0E+00	7E-08	9E-08	2E-07

Table 5-262

Summary of the Exposure Doses and Cancer Risks for Exposure Area 54 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	1.1E-06	9.5E-07	2.0E+00	2E-06	2E-06	4E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	1.8E-07	3.1E-07	1.0E+00	2E-07	3E-07	5E-07

Table 5-263

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 54 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	3.2E-06	2.1E-06	2.0E-05	0.16	0.11	0.26

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	7.9E-07	1.1E-06	2.0E-05	0.039	0.054	0.093

Table 5-264

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 54 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	2.0E-06	1.7E-06	2.0E-05	0.10	0.087	0.19

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37	5.1E-07	8.7E-07	2.0E-05	0.025	0.044	0.069

Table 5-265

Summary of the Exposure Doses and Cancer Risks for Exposure Area 54 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8	2.0E-06	9.5E-07	2.0E+00	4E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8	4.6E-08	8.7E-08	1.0E+00	5E-08	9E-08	1E-07

Table 5-266

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 54 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8	3.0E-06	1.4E-06	2.0E-05	0.15	0.071	0.22

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	8	2.5E-07	4.7E-07	2.0E-05	0.012	0.024	0.036

Table 5-267

Summary of the Exposure Doses and Cancer Risks for Exposure Area 55 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	21	9.9E-07	3.2E-07	2.0E+00	2E-06	6E-07	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	21	2.5E-07	3.2E-07	1.0E+00	2E-07	3E-07	6E-07

Table 5-268

Summary of the Exposure Doses and Cancer Risks for Exposure Area 55 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	21	5.0E-06	2.4E-06	2.0E+00	1E-05	5E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	21	1.1E-07	2.2E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-269

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 55 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	21	1.2E-05	3.8E-06	2.0E-05	0.58	0.19	0.76

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	21	2.9E-06	3.8E-06	2.0E-05	0.14	0.19	0.33

Table 5-270

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 55 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	21	7.4E-06	3.5E-06	2.0E-05	0.37	0.18	0.54

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	21	6.2E-07	1.2E-06	2.0E-05	0.031	0.059	0.090

Table 5-271

Summary of the Exposure Doses and Cancer Risks for Exposure Area 55 - Subarea 55A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	59	4.3E-07	2.9E-07	2.0E+00	9E-07	6E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF (mg/kg-day)$^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	59	1.1E-07	1.5E-07	1.0E+00	1E-07	1E-07	3E-07

Table 5-272

Summary of the Exposure Doses and Cancer Risks for Exposure Area 55 - Subarea 55A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	59	1.8E-06	1.5E-06	2.0E+00	4E-06	3E-06	7E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	59	2.9E-07	5.0E-07	1.0E+00	3E-07	5E-07	8E-07

Table 5-273

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 55 - Subarea 55A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	59	5.0E-06	3.4E-06	2.0E-05	0.25	0.17	0.42

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	59	1.3E-06	1.7E-06	2.0E-05	0.063	0.085	0.15

Table 5-274

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 55 - Subarea 55A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	59	3.2E-06	2.8E-06	2.0E-05	0.16	0.14	0.30

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	59	8.1E-07	1.4E-06	2.0E-05	0.040	0.070	0.11

Table 5-275

Summary of the Exposure Doses and Cancer Risks for Exposure Area 56 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	(mg/kg-day)$^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	44	2.8E-06	1.0E-06	2.0E+00	6E-06	2E-06	8E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	(mg/kg-day)$^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	44	3.4E-07	5.1E-07	1.0E+00	3E-07	5E-07	8E-07

Table 5-276

Summary of the Exposure Doses and Cancer Risks for Exposure Area 56 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	44	6.9E-06	3.3E-06	2.0E+00	1E-05	7E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	44	2.4E-07	4.6E-07	1.0E+00	2E-07	5E-07	6E-07

Table 5-277

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 56 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	44	1.6E-05	6.0E-06	2.0E-05	0.80	0.30	1.1

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	44	2.0E-06	3.0E-06	2.0E-05	0.10	0.15	0.24

Table 5-278

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 56 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	44	1.0E-05	4.9E-06	2.0E-05	0.52	0.25	0.76

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	44	1.3E-06	2.5E-06	2.0E-05	0.065	0.12	0.19

Table 5-279

Summary of the Exposure Doses and Cancer Risks for Exposure Area 56 - Subarea 56A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	117	8.6E-07	5.8E-07	2.0E+00	2E-06	1E-06	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	117	2.1E-07	2.9E-07	1.0E+00	2E-07	3E-07	5E-07

Table 5-280

Summary of the Exposure Doses and Cancer Risks for Exposure Area 56 - Subarea 56A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	117	3.5E-06	3.0E-06	2.0E+00	7E-06	6E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	117	5.7E-07	9.8E-07	1.0E+00	6E-07	1E-06	2E-06

Table 5-281

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 56 - Subarea 56A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	117	1.0E-05	6.8E-06	2.0E-05	0.50	0.34	0.84

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	117	2.5E-06	3.4E-06	2.0E-05	0.12	0.17	0.29

Table 5-282

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 56 - Subarea 56A

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	117	6.4E-06	5.5E-06	2.0E-05	0.32	0.28	0.60

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	117	1.6E-06	2.8E-06	2.0E-05	0.080	0.14	0.22

Table 5-283

Summary of the Exposure Doses and Cancer Risks for Exposure Area 57 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	22	1.6E-07	1.1E-07	2.0E+00	3E-07	2E-07	5E-07

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	22	4.0E-08	5.4E-08	1.0E+00	4E-08	5E-08	9E-08

Table 5-284

Summary of the Exposure Doses and Cancer Risks for Exposure Area 57 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	22	6.5E-07	5.6E-07	2.0E+00	1E-06	1E-06	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	22	1.1E-07	1.9E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-285

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 57 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	22	1.9E-06	1.3E-06	2.0E-05	0.094	0.064	0.16

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	22	4.7E-07	6.4E-07	2.0E-05	0.023	0.032	0.055

Table 5-286

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 57 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Waterfowl Hunter
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	22	1.2E-06	1.0E-06	2.0E-05	0.061	0.052	0.11

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	22	3.0E-07	5.2E-07	2.0E-05	0.015	0.026	0.041

Table 5-287

Summary of the Exposure Doses and Cancer Risks for Exposure Area 57 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	4.2E-07	1.4E-07	2.0E+00	8E-07	3E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	1.1E-07	1.4E-07	1.0E+00	1E-07	1E-07	2E-07

Table 5-288

Summary of the Exposure Doses and Cancer Risks for Exposure Area 57 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	2.1E-06	1.0E-06	2.0E+00	4E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	4.9E-08	9.4E-08	1.0E+00	5E-08	9E-08	1E-07

Table 5-289

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 57 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	4.9E-06	1.6E-06	2.0E-05	0.25	0.08	0.33

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	1.2E-06	1.6E-06	2.0E-05	0.062	0.081	0.14

Table 5-290

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 57 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	3.2E-06	1.5E-06	2.0E-05	0.16	0.076	0.23

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	9	2.6E-07	5.0E-07	2.0E-05	0.013	0.025	0.038

Table 5-291

Summary of the Exposure Doses and Cancer Risks for Exposure Area 58 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	8.5E-07	1.3E-06	2.0E+00	2E-06	3E-06	4E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	7.1E-08	4.5E-07	1.0E+00	7E-08	4E-07	5E-07

Table 5-292

Summary of the Exposure Doses and Cancer Risks for Exposure Area 58 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME Exposure Dose (mg/kg-day) Incidental Ingestion	RME Exposure Dose (mg/kg-day) Dermal Contact	CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk Incidental Ingestion	Cancer Risk Dermal Contact	Cancer Risk Total
tPCBs	27	1.7E-06	3.6E-06	2.0E+00	3E-06	7E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE Exposure Dose (mg/kg-day) Incidental Ingestion	CTE Exposure Dose (mg/kg-day) Dermal Contact	CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk Incidental Ingestion	Cancer Risk Dermal Contact	Cancer Risk Total
tPCBs	27	4.2E-08	3.4E-07	1.0E+00	4E-08	3E-07	4E-07

Table 5-293

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 58 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	4.9E-06	7.8E-06	2.0E-05	0.25	0.39	0.64

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	4.1E-07	2.6E-06	2.0E-05	0.021	0.13	0.15

Table 5-294

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 58 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	3.2E-06	6.6E-06	2.0E-05	0.16	0.33	0.49

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	2.6E-07	2.2E-06	2.0E-05	0.013	0.11	0.12

Table 5-295

Summary of the Exposure Doses and Cancer Risks for Exposure Area 58 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	6.4E-06	3.1E-06	2.0E+00	1E-05	6E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	1.5E-07	2.8E-07	1.0E+00	1E-07	3E-07	4E-07

Table 5-296

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 58 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	9.5E-06	4.5E-06	2.0E-05	0.48	0.23	0.70

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	27	7.9E-07	1.5E-06	2.0E-05	0.040	0.076	0.12

Table 5-297

Summary of the Exposure Doses and Cancer Risks for Exposure Area 59 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	32	1.5E-06	4.9E-07	2.0E+00	3E-06	1E-06	4E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	32	3.8E-07	4.9E-07	1.0E+00	4E-07	5E-07	9E-07

Table 5-298

Summary of the Exposure Doses and Cancer Risks for Exposure Area 59 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	7.6E-06	3.6E-06	2.0E+00	2E-05	7E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	1.7E-07	3.3E-07	1.0E+00	2E-07	3E-07	5E-07

Table 5-299

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 59 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	1.8E-05	5.8E-06	2.0E-05	0.88	0.29	1.2

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	4.4E-06	5.8E-06	2.0E-05	0.22	0.29	0.51

Table 5-300

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 59 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	1.1E-05	5.4E-06	2.0E-05	0.57	0.27	0.83

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	32	9.4E-07	1.8E-06	2.0E-05	0.047	0.090	0.14

Table 5-301

Summary of the Exposure Doses and Cancer Risks for Exposure Area 59 - Subarea 59A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	48	1.5E-06	2.4E-06	2.0E+00	3E-06	5E-06	8E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	48	1.3E-07	7.9E-07	1.0E+00	1E-07	8E-07	9E-07

Table 5-302

Summary of the Exposure Doses and Cancer Risks for Exposure Area 59 - Subarea 59A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	48	3.1E-06	6.3E-06	2.0E+00	6E-06	1E-05	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	48	7.4E-08	6.1E-07	1.0E+00	7E-08	6E-07	7E-07

Table 5-303

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 59 - Subarea 59A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	48	8.8E-06	1.4E-05	2.0E-05	0.44	0.69	1.1

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	48	7.3E-07	4.6E-06	2.0E-05	0.037	0.23	0.27

Table 5-304

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 59 - Subarea 59A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	48	5.6E-06	1.2E-05	2.0E-05	0.28	0.59	0.87

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	48	4.7E-07	3.9E-06	2.0E-05	0.024	0.19	0.22

Table 5-305

Summary of the Exposure Doses and Cancer Risks for Exposure Area 60 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	10	4.7E-07	1.5E-07	2.0E+00	9E-07	3E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	10	1.2E-07	1.5E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-306

Summary of the Exposure Doses and Cancer Risks for Exposure Area 60 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	10	2.4E-06	1.1E-06	2.0E+00	5E-06	2E-06	7E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	10	5.5E-08	1.0E-07	1.0E+00	5E-08	1E-07	2E-07

Table 5-307

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 60 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	10	5.5E-06	1.8E-06	2.0E-05	0.27	0.090	0.36

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	10	1.4E-06	1.8E-06	2.0E-05	0.069	0.090	0.16

Table 5-308

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 60 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	10	3.5E-06	1.7E-06	2.0E-05	0.18	0.084	0.26

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	10	2.9E-07	5.6E-07	2.0E-05	0.015	0.028	0.043

Table 5-309

Summary of the Exposure Doses and Cancer Risks for Exposure Area 60 - Subarea 60A

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	5.3E-07	8.4E-07	2.0E+00	1E-06	2E-06	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	6.7E-08	4.2E-07	1.0E+00	7E-08	4E-07	5E-07

Table 5-310

Summary of the Exposure Doses and Cancer Risks for Exposure Area 60 - Subarea 60A

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	2.3E-06	4.7E-06	2.0E+00	5E-06	9E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	1.4E-07	1.2E-06	1.0E+00	1E-07	1E-06	1E-06

Table 5-311

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 60 - Subarea 60A

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	3.1E-06	4.9E-06	2.0E-05	0.16	0.25	0.40

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	3.9E-07	2.5E-06	2.0E-05	0.019	0.12	0.14

Table 5-312

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 60 - Subarea 60A

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	4.0E-06	8.3E-06	2.0E-05	0.20	0.41	0.61

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17	5.0E-07	4.1E-06	2.0E-05	0.025	0.21	0.23

Table 5-313

Summary of the Exposure Doses and Cancer Risks for Exposure Area 61 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Utility Worker
Land Use: Current
Receptor Age: Adult

	Exposure	RME					
	Point	Exposure Dose (mg/kg-day)			Cancer Risk		
	Concentration	Incidental	Dermal	CSF	Incidental	Dermal	
Contaminant	(mg/kg)	Ingestion	Contact	$(mg/kg\text{-}day)^{-1}$	Ingestion	Contact	Total
tPCBs	59	1.4E-06	3.8E-07	2.0E+00	3E-06	8E-07	3E-06

	Exposure	CTE					
	Point	Exposure Dose (mg/kg-day)			Cancer Risk		
	Concentration	Incidental	Dermal	CSF	Incidental	Dermal	
Contaminant	(mg/kg)	Ingestion	Contact	$(mg/kg\text{-}day)^{-1}$	Ingestion	Contact	Total
tPCBs	59	9.9E-08	1.8E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-314

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 61 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Utility Worker
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	59	3.8E-06	1.1E-06	2.0E-05	0.19	0.054	0.24

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	59	5.8E-07	1.1E-06	2.0E-05	0.029	0.054	0.082

Table 5-315

Summary of the Exposure Doses and Cancer Risks for Exposure Area 62 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Utility Worker
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	121	2.8E-06	7.8E-07	2.0E+00	6E-06	2E-06	7E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	121	2.0E-07	3.8E-07	1.0E+00	2E-07	4E-07	6E-07

Table 5-316

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 62 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Utility Worker
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	121	7.8E-06	2.2E-06	2.0E-05	0.39	0.11	0.50

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	121	1.2E-06	2.2E-06	2.0E-05	0.060	0.11	0.17

Table 5-317

Summary of the Exposure Doses and Cancer Risks for Exposure Area 63 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Utility Worker
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	39	9.0E-07	2.5E-07	2.0E+00	2E-06	5E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	39	6.5E-08	1.2E-07	1.0E+00	7E-08	1E-07	2E-07

Table 5-318

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 63 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Utility Worker
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	39	2.5E-06	7.1E-07	2.0E-05	0.13	0.035	0.16

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	39	3.8E-07	7.1E-07	2.0E-05	0.019	0.035	0.054

Table 5-319

Summary of the Exposure Doses and Cancer Risks for Exposure Area 64 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Utility Worker
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.6	8.7E-07	2.4E-07	2.0E+00	2E-06	5E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.6	6.3E-08	1.2E-07	1.0E+00	6E-08	1E-07	2E-07

Table 5-320

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 64 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Utility Worker
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.6	2.4E-06	6.8E-07	2.0E-05	0.12	0.034	0.16

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.6	3.7E-07	6.8E-07	2.0E-05	0.018	0.034	0.052

Table 5-321

Summary of the Exposure Doses and Cancer Risks for Exposure Area 65 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Utility Worker
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	4.4E-07	1.2E-07	2.0E+00	9E-07	2E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	3.2E-08	5.9E-08	1.0E+00	3E-08	6E-08	9E-08

Table 5-322

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 65 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Utility Worker
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	1.2E-06	3.4E-07	2.0E-05	0.062	0.017	0.079

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19	1.9E-07	3.4E-07	2.0E-05	0.0093	0.017	0.027

Table 5-323

Summary of the Exposure Doses and Cancer Risks for Exposure Area 66 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Utility Worker
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	2.8E-07	7.9E-08	2.0E+00	6E-07	2E-07	7E-07

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	2.1E-08	3.8E-08	1.0E+00	2E-08	4E-08	6E-08

Table 5-324

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 66 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Utility Worker
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	7.9E-07	2.2E-07	2.0E-05	0.039	0.011	0.050

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	1.2E-07	2.2E-07	2.0E-05	0.0060	0.011	0.017

Table 5-325

Summary of the Cancer Risks and Hazard Indices from tPCBs for Soil Exposure in Exposure Areas and Subareas within Reach 7

Exposure Area	Scenario Evaluated	Receptor	Land Use	EPC (mg/kg)	RME Total Cancer Risk	RME Total Hazard Index	CTE Total Cancer Risk	CTE Total Hazard Index
67	General recreation (entire EA)	Adult	current/future	16	1E-05	0.42	3E-07	0.068
68	General recreation (entire EA)	Adult	current/future	5.5	4E-06	0.14	9E-08	0.024
69	Angler (entire EA)	Older child	current/future	12	2E-06	0.28	2E-07	0.067
		Adult			5E-06	0.22	2E-07	0.054
	General recreation (entire EA)	Adult	current/future		8E-06	0.31	2E-07	0.051
70	General recreation (entire EA)	Young child	current/future	12.5	9E-06	2.7	7E-07	0.40
		Adult			9E-06	0.33	2E-07	0.053
	Angler (subarea 70A)	Older child	current/future	5.9	1E-06	0.14	1E-07	0.033
		Adult			2E-06	0.11	8E-08	0.027
71	Angler (entire EA)	Older child	current/future	12	2E-06	0.28	2E-07	0.065
		Adult			5E-06	0.21	2E-07	0.053
	General recreation (entire EA)	Adult	current/future		3E-06	0.10	1E-07	0.026
72	Angler (entire EA)	Older child	current	34	5E-06	0.80	6E-07	0.19
		Adult			1E-05	0.61	5E-07	0.15
	Future residential (EAs 72 and 73)	Young child/Adult	future	34	8E-05	NA	2E-05	NA
		Young child			NA	12	NA	7.7
		Adult			NA	1.5	NA	0.98
73	General recreation (entire EA)	Adult	current	2.5	2E-06	0.065	4E-08	0.011
74	General recreation (entire EA)	Adult	current/future	17.9	1E-05	0.47	3E-07	0.076
75	General recreation (entire EA)	Adult	current/future	15	1E-05	0.39	2E-07	0.064
76	General recreation (entire EA)	Adult	current	2.2	2E-06	0.057	3E-08	0.0094
	Future residential (entire EA)	Young child/Adult	future		3E-06	NA	2E-07	NA
		Young child			NA	0.48	NA	0.10
		Adult			NA	0.057	NA	0.013
77	General recreation (entire EA)	Adult	current/future	2	2E-06	0.058	4E-08	0.0096
78	General Recreation (entire EA)	Older child	current	11.9	3E-06	0.45	2E-07	0.067
	Future residential (entire EA)	Young child/Adult	future		3E-05	NA	5E-06	NA
		Young child			NA	4.3	NA	2.7
		Adult			NA	0.51	NA	0.34
79	General recreation (entire EA)	Adult	current/future	5	3E-06	0.12	8E-08	0.021
80	Future residential (entire EA)	Young child/Adult	future	3	6E-06	NA	1E-06	NA
		Young child			NA	1.0	NA	0.64
		Adult			NA	0.12	NA	0.082
	General recreation (subarea 80A)	Adult	current	4.5	1E-06	0.039	4E-08	0.0096
	Farmer (subarea 80B)	Adult	current	3.0	3E-06	0.070	7E-08	0.0087
81	General recreation (entire EA)	Adult	current	3.7	9E-07	0.032	3E-08	0.0079
		Adult	future		3E-06	0.097	6E-08	0.016
82	General recreation (entire EA)	Adult	current	7	2E-06	0.060	5E-08	0.015
		Adult	future		5E-06	0.18	1E-07	0.029

Table 5-325

Summary of the Cancer Risks and Hazard Indices from tPCBs for Soil Exposure in Exposure Areas and Subareas within Reach 7

Exposure Area	Scenario Evaluated	Receptor	Land Use	EPC (mg/kg)	RME Total Cancer Risk	RME Total Hazard Index	CTE Total Cancer Risk	CTE Total Hazard Index
83	Groundskeeper (entire EA)	Adult	current	3	2E-06	0.11	2E-07	0.047
	Future residential (entire EA)	Young child/Adult	future		6E-06	NA	1E-06	NA
		Young child			NA	0.98	NA	0.61
		Adult			NA	0.12	NA	0.077
84	General recreation (entire EA)	Adult	current	7.4	2E-06	0.064	6E-08	0.016
		Adult	future		5E-06	0.19	1E-07	0.031
85	Recreational canoeist (subarea 85A)	Older child	current/future	4.8	8E-07	0.11	1E-07	0.040
		Adult			4E-06	0.17	4E-07	0.066
	General recreation (subarea 85B)	Older child	current/future	2.3	6E-07	0.086	4E-08	0.013
86	Groundskeeper (entire EA)	Adult	current	4	2E-06	0.15	2E-07	0.065
	Future residential (entire EA)	Young child/Adult	future		8E-06	NA	2E-06	NA
		Young child			NA	1.3	NA	0.84
		Adult			NA	0.16	NA	0.11
87	General recreation (entire EA)	Young child	current/future	24	2E-05	5.2	1E-06	0.76
		Adult			2E-05	0.62	4E-07	0.10
	Angler (subarea 87A)	Older child	current/future	3.5	6E-07	0.083	7E-08	0.020
		Adult			1E-06	0.064	5E-08	0.016
88	General recreation (entire EA)	Older child	current/future	12	2E-06	0.30	2E-07	0.068
89	General recreation (entire EA)	Adult	current/future	2	2E-06	0.063	4E-08	0.010
90	General recreation (entire EA)	Older child	current/future	19.1	5E-06	0.72	4E-07	0.11
		Adult			1E-05	0.50	3E-07	0.082

NA = not applicable.

Table 5-326

Summary of the Exposure Doses and Cancer Risks for Exposure Area 67 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	16	3.8E-06	1.8E-06	2.0E+00	8E-06	4E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	16	8.7E-08	1.7E-07	1.0E+00	9E-08	2E-07	3E-07

Table 5-327

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 67 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	16	5.6E-06	2.7E-06	2.0E-05	0.28	0.13	0.42

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	16	4.7E-07	9.0E-07	2.0E-05	0.024	0.045	0.068

Table 5-328

Summary of the Exposure Doses and Cancer Risks for Exposure Area 68 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5.5	1.3E-06	6.3E-07	2.0E+00	3E-06	1E-06	4E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5.5	3.0E-08	5.8E-08	1.0E+00	3E-08	6E-08	9E-08

Table 5-329

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 68 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5.5	2.0E-06	9.3E-07	2.0E-05	0.10	0.047	0.14

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5.5	1.6E-07	3.1E-07	2.0E-05	0.0082	0.016	0.024

Table 5-330

Summary of the Exposure Doses and Cancer Risks for Exposure Area 69 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	3.8E-07	5.9E-07	2.0E+00	8E-07	1E-06	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	3.1E-08	2.0E-07	1.0E+00	3E-08	2E-07	2E-07

Table 5-331

Summary of the Exposure Doses and Cancer Risks for Exposure Area 69 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	12	7.7E-07	1.6E-06	2.0E+00	2E-06	3E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	12	1.9E-08	1.5E-07	1.0E+00	2E-08	2E-07	2E-07

Table 5-332

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 69 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	12	2.2E-06	3.5E-06	2.0E-05	0.11	0.17	0.28

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	12	1.8E-07	1.2E-06	2.0E-05	0.0092	0.058	0.067

Table 5-333

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 69 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	1.4E-06	2.9E-06	2.0E-05	0.071	0.15	0.22

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	1.2E-07	9.7E-07	2.0E-05	0.0059	0.049	0.054

Table 5-334

Summary of the Exposure Doses and Cancer Risks for Exposure Area 69 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	(mg/kg-day)$^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	12	2.8E-06	1.4E-06	2.0E+00	6E-06	3E-06	8E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	(mg/kg-day)$^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	12	6.5E-08	1.3E-07	1.0E+00	7E-08	1E-07	2E-07

Table 5-335

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 69 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	4.2E-06	2.0E-06	2.0E-05	0.21	0.10	0.31

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	3.5E-07	6.7E-07	2.0E-05	0.018	0.034	0.051

Table 5-336

Summary of the Exposure Doses and Cancer Risks for Exposure Area 70 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12.5	3.5E-06	1.2E-06	2.0E+00	7E-06	2E-06	9E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12.5	2.9E-07	3.9E-07	1.0E+00	3E-07	4E-07	7E-07

Table 5-337

Summary of the Exposure Doses and Cancer Risks for Exposure Area 70 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12.5	3.0E-06	1.4E-06	2.0E+00	6E-06	3E-06	9E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12.5	6.8E-08	1.3E-07	1.0E+00	7E-08	1E-07	2E-07

Table 5-338

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 70 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12.5	4.1E-05	1.4E-05	2.0E-05	2.1	0.68	2.7

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12.5	3.4E-06	4.5E-06	2.0E-05	0.17	0.22	0.40

Table 5-339

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 70 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12.5	4.4E-06	2.1E-06	2.0E-05	0.22	0.11	0.33

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12.5	3.7E-07	7.0E-07	2.0E-05	0.018	0.035	0.053

Table 5-340

Summary of the Exposure Doses and Cancer Risks for Exposure Area 70 - Subarea 70A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5.9	1.9E-07	2.9E-07	2.0E+00	4E-07	6E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5.9	1.5E-08	9.7E-08	1.0E+00	2E-08	1E-07	1E-07

Table 5-341

Summary of the Exposure Doses and Cancer Risks for Exposure Area 70 - Subarea 70A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5.9	3.8E-07	7.8E-07	2.0E+00	8E-07	2E-06	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5.9	9.1E-09	7.5E-08	1.0E+00	9E-09	8E-08	8E-08

Table 5-342

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 70 - Subarea 70A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5.9	1.1E-06	1.7E-06	2.0E-05	0.054	0.085	0.14

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5.9	9.0E-08	5.7E-07	2.0E-05	0.0045	0.028	0.033

Table 5-343

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 70 - Subarea 70A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5.9	6.9E-07	1.4E-06	2.0E-05	0.035	0.072	0.11

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5.9	5.8E-08	4.8E-07	2.0E-05	0.0029	0.024	0.027

Table 5-344

Summary of the Exposure Doses and Cancer Risks for Exposure Area 71 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	3.7E-07	5.8E-07	2.0E+00	7E-07	1E-06	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	3.0E-08	1.9E-07	1.0E+00	3E-08	2E-07	2E-07

Table 5-345

Summary of the Exposure Doses and Cancer Risks for Exposure Area 71 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	7.4E-07	1.5E-06	2.0E+00	1E-06	3E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	1.8E-08	1.5E-07	1.0E+00	2E-08	1E-07	2E-07

Table 5-346

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 71 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	2.1E-06	3.4E-06	2.0E-05	0.11	0.17	0.28

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	1.8E-07	1.1E-06	2.0E-05	0.0089	0.056	0.065

Table 5-347

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 71 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	1.4E-06	2.8E-06	2.0E-05	0.069	0.14	0.21

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	1.1E-07	9.4E-07	2.0E-05	0.0057	0.047	0.053

Table 5-348

Summary of the Exposure Doses and Cancer Risks for Exposure Area 71 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	9.5E-07	4.5E-07	2.0E+00	2E-06	9E-07	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	3.3E-08	6.3E-08	1.0E+00	3E-08	6E-08	1E-07

Table 5-349

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 71 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	1.4E-06	6.7E-07	2.0E-05	0.071	0.034	0.10

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	1.8E-07	3.4E-07	2.0E-05	0.0088	0.017	0.026

Table 5-350

Summary of the Exposure Doses and Cancer Risks for Exposure Area 72 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34	1.1E-06	1.7E-06	2.0E+00	2E-06	3E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34	8.9E-08	5.6E-07	1.0E+00	9E-08	6E-07	6E-07

Table 5-351

Summary of the Exposure Doses and Cancer Risks for Exposure Area 72 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34	2.2E-06	4.5E-06	2.0E+00	4E-06	9E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34	5.2E-08	4.3E-07	1.0E+00	5E-08	4E-07	5E-07

Table 5-352

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 72 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34	6.2E-06	9.8E-06	2.0E-05	0.31	0.49	0.80

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34	5.2E-07	3.3E-06	2.0E-05	0.026	0.16	0.19

Table 5-353

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 72 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34	4.0E-06	8.3E-06	2.0E-05	0.20	0.41	0.61

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34	3.3E-07	2.8E-06	2.0E-05	0.017	0.14	0.15

Table 5-354

Summary of the Exposure Doses and Cancer Risks for Exposure Areas 72 and 73

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child/Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34	2.7E-05	1.1E-05	2.0E+00	5E-05	2E-05	8E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34	9.3E-06	6.5E-06	1.0E+00	9E-06	6E-06	2E-05

Table 5-355

Summary of the Exposure Doses and Hazard Quotients for Exposure Areas 72 and 73

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	34	1.9E-04	6.1E-05	2.0E-05	9.3	3.1	12

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	34	9.3E-05	6.1E-05	2.0E-05	4.7	3.1	7.7

Table 5-356

Summary of the Exposure Doses and Hazard Quotients for Exposure Areas 72 and 73

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34	2.0E-05	9.5E-06	2.0E-05	1.0	0.48	1.5

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	34	1.0E-05	9.5E-06	2.0E-05	0.50	0.48	0.98

Table 5-357

Summary of the Exposure Doses and Cancer Risks for Exposure Area 73 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.5	5.9E-07	2.8E-07	2.0E+00	1E-06	6E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.5	1.4E-08	2.6E-08	1.0E+00	1E-08	3E-08	4E-08

Table 5-358

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 73 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.5	8.8E-07	4.2E-07	2.0E-05	0.044	0.021	0.065

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.5	7.3E-08	1.4E-07	2.0E-05	0.0037	0.0070	0.011

Table 5-359

Summary of the Exposure Doses and Cancer Risks for Exposure Area 74 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	CSF $(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	17.9	4.2E-06	2.0E-06	2.0E+00	8E-06	4E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	CSF $(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	17.9	9.8E-08	1.9E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-360

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 74 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17.9	6.3E-06	3.0E-06	2.0E-05	0.32	0.15	0.47

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	17.9	5.3E-07	1.0E-06	2.0E-05	0.026	0.050	0.076

Table 5-361

Summary of the Exposure Doses and Cancer Risks for Exposure Area 75 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	15	3.6E-06	1.7E-06	2.0E+00	7E-06	3E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	15	8.2E-08	1.6E-07	1.0E+00	8E-08	2E-07	2E-07

Table 5-362

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 75 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	5.3E-06	2.5E-06	2.0E-05	0.26	0.13	0.39

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	15	4.4E-07	8.4E-07	2.0E-05	0.022	0.042	0.064

Table 5-363

Summary of the Exposure Doses and Cancer Risks for Exposure Area 76 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.2	5.2E-07	2.5E-07	2.0E+00	1E-06	5E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.2	1.2E-08	2.3E-08	1.0E+00	1E-08	2E-08	3E-08

Table 5-364

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 76 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.2	7.8E-07	3.7E-07	2.0E-05	0.039	0.019	0.057

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.2	6.5E-08	1.2E-07	2.0E-05	0.0032	0.0062	0.0094

Table 5-365

Summary of the Exposure Doses and Cancer Risks for Exposure Area 76 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child/Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.2	1.1E-06	4.1E-07	2.0E+00	2E-06	8E-07	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.2	1.2E-07	8.4E-08	1.0E+00	1E-07	8E-08	2E-07

Table 5-366

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 76 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	2.2	7.2E-06	2.4E-06	2.0E-05	0.36	0.12	0.48

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	2.2	1.2E-06	7.9E-07	2.0E-05	0.060	0.040	0.10

Table 5-367

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 76 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.2	7.7E-07	3.7E-07	2.0E-05	0.039	0.018	0.057

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.2	1.3E-07	1.2E-07	2.0E-05	0.0065	0.0062	0.013

Table 5-368

Summary of the Exposure Doses and Cancer Risks for Exposure Area 77 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	2	5.3E-07	2.5E-07	2.0E+00	1E-06	5E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	2	1.2E-08	2.3E-08	1.0E+00	1E-08	2E-08	4E-08

Table 5-369

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 77 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2	7.9E-07	3.8E-07	2.0E-05	0.040	0.019	0.058

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2	6.6E-08	1.3E-07	2.0E-05	0.0033	0.0063	0.0096

Table 5-370

Summary of the Exposure Doses and Cancer Risks for Exposure Area 78 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11.9	1.1E-06	4.2E-07	2.0E+00	2E-06	8E-07	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11.9	9.3E-08	1.4E-07	1.0E+00	9E-08	1E-07	2E-07

Table 5-371

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 78 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11.9	6.5E-06	2.4E-06	2.0E-05	0.33	0.12	0.45

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11.9	5.4E-07	8.1E-07	2.0E-05	0.027	0.040	0.067

Table 5-372

Summary of the Exposure Doses and Cancer Risks for Exposure Area 78 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child/Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11.9	9.4E-06	3.7E-06	2.0E+00	2E-05	7E-06	3E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11.9	3.2E-06	2.3E-06	1.0E+00	3E-06	2E-06	5E-06

Table 5-373

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 78 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11.9	6.5E-05	2.1E-05	2.0E-05	3.2	1.1	4.3

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11.9	3.2E-05	2.1E-05	2.0E-05	1.6	1.1	2.7

Table 5-374

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 78 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11.9	7.0E-06	3.3E-06	2.0E-05	0.35	0.17	0.51

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	11.9	3.5E-06	3.3E-06	2.0E-05	0.17	0.17	0.34

Table 5-375

Summary of the Exposure Doses and Cancer Risks for Exposure Area 79 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

	Exposure	RME					
	Point	Exposure Dose (mg/kg-day)			Cancer Risk		
Contaminant	Concentration (mg/kg)	Incidental Ingestion	Dermal Contact	CSF $(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	5	1.1E-06	5.4E-07	2.0E+00	2E-06	1E-06	3E-06

	Exposure	CTE					
	Point	Exposure Dose (mg/kg-day)			Cancer Risk		
Contaminant	Concentration (mg/kg)	Incidental Ingestion	Dermal Contact	CSF $(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	5	2.6E-08	5.0E-08	1.0E+00	3E-08	5E-08	8E-08

Table 5-376

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 79 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	1.7E-06	8.1E-07	2.0E-05	0.085	0.040	0.12

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	5	1.4E-07	2.7E-07	2.0E-05	0.0071	0.013	0.021

Table 5-377

Summary of the Exposure Doses and Cancer Risks for Exposure Area 80 - Subarea 80A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4.5	3.6E-07	1.7E-07	2.0E+00	7E-07	3E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4.5	1.2E-08	2.3E-08	1.0E+00	1E-08	2E-08	4E-08

Table 5-378

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 80 - Subarea 80A

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4.5	5.3E-07	2.5E-07	2.0E-05	0.026	0.013	0.039

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4.5	6.6E-08	1.3E-07	2.0E-05	0.0033	0.0063	0.0096

Table 5-379

Summary of the Exposure Doses and Cancer Risks for Exposure Area 80 - Subarea 80B

Exposure Medium: Soil
Exposure Scenario: Farmer
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	8.7E-07	4.2E-07	2.0E+00	2E-06	8E-07	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	2.5E-08	4.8E-08	1.0E+00	2E-08	5E-08	7E-08

Table 5-380

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 80 - Subarea 80B

Exposure Medium: Soil
Exposure Scenario: Farmer
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	9.5E-07	4.6E-07	2.0E-05	0.047	0.023	0.070

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	5.9E-08	1.2E-07	2.0E-05	0.0030	0.0058	0.0087

Table 5-381

Summary of the Exposure Doses and Cancer Risks for Exposure Area 80

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child/Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	2.3E-06	8.8E-07	2.0E+00	5E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	7.7E-07	5.4E-07	1.0E+00	8E-07	5E-07	1E-06

Table 5-382

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 80

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	1.6E-05	5.1E-06	2.0E-05	0.78	0.26	1.0

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	7.8E-06	5.1E-06	2.0E-05	0.39	0.26	0.64

Table 5-383

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 80

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	1.7E-06	8.0E-07	2.0E-05	0.083	0.040	0.12

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	8.3E-07	8.0E-07	2.0E-05	0.042	0.040	0.082

Table 5-384

Summary of the Exposure Doses and Cancer Risks for Exposure Area 81 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.7	2.9E-07	1.4E-07	2.0E+00	6E-07	3E-07	9E-07

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.7	1.0E-08	1.9E-08	1.0E+00	1E-08	2E-08	3E-08

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.7	8.8E-07	4.2E-07	2.0E+00	2E-06	8E-07	3E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.7	2.0E-08	3.9E-08	1.0E+00	2E-08	4E-08	6E-08

Table 5-385

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 81 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.7	4.4E-07	2.1E-07	2.0E-05	0.022	0.010	0.032

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.7	5.5E-08	1.0E-07	2.0E-05	0.0027	0.0052	0.0079

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.7	1.3E-06	6.3E-07	2.0E-05	0.066	0.031	0.097

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.7	1.1E-07	2.1E-07	2.0E-05	0.0055	0.010	0.016

Table 5-386

Summary of the Exposure Doses and Cancer Risks for Exposure Area 82 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	5.4E-07	2.6E-07	2.0E+00	1E-06	5E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	1.9E-08	3.6E-08	1.0E+00	2E-08	4E-08	5E-08

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	1.6E-06	7.8E-07	2.0E+00	3E-06	2E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	3.8E-08	7.2E-08	1.0E+00	4E-08	7E-08	1E-07

Table 5-387

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 82 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME Exposure Dose (mg/kg-day) Incidental Ingestion	RME Exposure Dose (mg/kg-day) Dermal Contact	RfD (mg/kg-day)	Hazard Quotient Incidental Ingestion	Hazard Quotient Dermal Contact	Hazard Quotient Total
tPCBs	7	8.1E-07	3.9E-07	2.0E-05	0.040	0.019	0.060

Contaminant	Exposure Point Concentration (mg/kg)	CTE Exposure Dose (mg/kg-day) Incidental Ingestion	CTE Exposure Dose (mg/kg-day) Dermal Contact	RfD (mg/kg-day)	Hazard Quotient Incidental Ingestion	Hazard Quotient Dermal Contact	Hazard Quotient Total
tPCBs	7	1.0E-07	1.9E-07	2.0E-05	0.0051	0.010	0.015

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME Exposure Dose (mg/kg-day) Incidental Ingestion	RME Exposure Dose (mg/kg-day) Dermal Contact	RfD (mg/kg-day)	Hazard Quotient Incidental Ingestion	Hazard Quotient Dermal Contact	Hazard Quotient Total
tPCBs	7	2.4E-06	1.2E-06	2.0E-05	0.12	0.058	0.18

Contaminant	Exposure Point Concentration (mg/kg)	CTE Exposure Dose (mg/kg-day) Incidental Ingestion	CTE Exposure Dose (mg/kg-day) Dermal Contact	RfD (mg/kg-day)	Hazard Quotient Incidental Ingestion	Hazard Quotient Dermal Contact	Hazard Quotient Total
tPCBs	7	2.0E-07	3.9E-07	2.0E-05	0.010	0.019	0.029

Table 5-388

Summary of the Exposure Doses and Cancer Risks for Exposure Area 83 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Groundskeeper
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	5.6E-07	2.0E-07	2.0E+00	1E-06	4E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	6.8E-08	9.4E-08	1.0E+00	7E-08	9E-08	2E-07

Table 5-389

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 83 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Groundskeeper
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	1.6E-06	5.5E-07	2.0E-05	0.079	0.027	0.11

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	4.0E-07	5.5E-07	2.0E-05	0.020	0.027	0.047

Table 5-390

Summary of the Exposure Doses and Cancer Risks for Exposure Area 83

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child/Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	2.1E-06	8.3E-07	2.0E+00	4E-06	2E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	7.3E-07	5.1E-07	1.0E+00	7E-07	5E-07	1E-06

Table 5-391

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 83

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	1.5E-05	4.8E-06	2.0E-05	0.74	0.24	0.98

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	7.4E-06	4.8E-06	2.0E-05	0.37	0.24	0.61

Table 5-392

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 83

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	1.6E-06	7.5E-07	2.0E-05	0.079	0.038	0.12

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3	7.9E-07	7.5E-07	2.0E-05	0.039	0.038	0.077

Table 5-393

Summary of the Exposure Doses and Cancer Risks for Exposure Area 84 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7.4	5.8E-07	2.8E-07	2.0E+00	1E-06	6E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7.4	2.0E-08	3.8E-08	1.0E+00	2E-08	4E-08	6E-08

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7.4	1.7E-06	8.3E-07	2.0E+00	3E-06	2E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7.4	4.0E-08	7.7E-08	1.0E+00	4E-08	8E-08	1E-07

Table 5-394

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 84 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7.4	8.6E-07	4.1E-07	2.0E-05	0.043	0.021	0.064

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7.4	1.1E-07	2.1E-07	2.0E-05	0.005	0.010	0.016

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7.4	2.6E-06	1.2E-06	2.0E-05	0.13	0.062	0.19

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7.4	2.2E-07	4.1E-07	2.0E-05	0.011	0.021	0.031

Table 5-395

Summary of the Exposure Doses and Cancer Risks for Exposure Area 85 - Subarea 85A

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4.8	1.5E-07	2.4E-07	2.0E+00	3E-07	5E-07	8E-07

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4.8	1.9E-08	1.2E-07	1.0E+00	2E-08	1E-07	1E-07

Table 5-396

Summary of the Exposure Doses and Cancer Risks for Exposure Area 85 - Subarea 85A

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4.8	6.4E-07	1.3E-06	2.0E+00	1E-06	3E-06	4E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4.8	4.0E-08	3.3E-07	1.0E+00	4E-08	3E-07	4E-07

Table 5-397

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 85 - Subarea 85A

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4.8	8.8E-07	1.4E-06	2.0E-05	0.044	0.069	0.11

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4.8	1.1E-07	6.9E-07	2.0E-05	0.0055	0.035	0.040

Table 5-398

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 85 - Subarea 85A

Exposure Medium: Soil
Exposure Scenario: Recreational Canoeist/Boater
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4.8	1.1E-06	2.3E-06	2.0E-05	0.057	0.12	0.17

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4.8	1.4E-07	1.2E-06	2.0E-05	0.0071	0.059	0.066

Table 5-399

Summary of the Exposure Doses and Cancer Risks for Exposure Area 85 - Subarea 85B

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	2.3	2.2E-07	8.0E-08	2.0E+00	4E-07	2E-07	6E-07

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	2.3	1.8E-08	2.7E-08	1.0E+00	2E-08	3E-08	4E-08

Table 5-400

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 85 - Subarea 85B

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.3	1.3E-06	4.7E-07	2.0E-05	0.063	0.023	0.086

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2.3	1.1E-07	1.6E-07	2.0E-05	0.0053	0.0078	0.013

Table 5-401

Summary of the Exposure Doses and Cancer Risks for Exposure Area 86 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Groundskeeper
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	7.7E-07	2.7E-07	2.0E+00	2E-06	5E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	9.3E-08	1.3E-07	1.0E+00	9E-08	1E-07	2E-07

Table 5-402

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 86 - Entire Area

Exposure Medium: Soil
Exposure Scenario: Groundskeeper
Land Use: Current
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	2.2E-06	7.5E-07	2.0E-05	0.11	0.038	0.15

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	5.4E-07	7.5E-07	2.0E-05	0.027	0.038	0.065

Table 5-403

Summary of the Exposure Doses and Cancer Risks for Exposure Area 86

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child/Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	2.9E-06	1.1E-06	2.0E+00	6E-06	2E-06	8E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	1.0E-06	7.0E-07	1.0E+00	1E-06	7E-07	2E-06

Table 5-404

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 86

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	2.0E-05	6.6E-06	2.0E-05	1.0	0.33	1.3

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	1.0E-05	6.6E-06	2.0E-05	0.51	0.33	0.84

Table 5-405

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 86

Exposure Medium: Soil
Exposure Scenario: Residential
Land Use: Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	2.2E-06	1.0E-06	2.0E-05	0.11	0.052	0.16

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	4	1.1E-06	1.0E-06	2.0E-05	0.054	0.052	0.11

Table 5-406

Summary of the Exposure Doses and Cancer Risks for Exposure Area 87 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	6.8E-06	2.2E-06	2.0E+00	1E-05	4E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	5.6E-07	7.4E-07	1.0E+00	6E-07	7E-07	1E-06

Table 5-407

Summary of the Exposure Doses and Cancer Risks for Exposure Area 87 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	5.7E-06	2.7E-06	2.0E+00	1E-05	5E-06	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	1.3E-07	2.5E-07	1.0E+00	1E-07	3E-07	4E-07

Table 5-408

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 87 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Young Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	7.9E-05	2.6E-05	2.0E-05	3.9	1.3	5.2

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	6.6E-06	8.6E-06	2.0E-05	0.33	0.43	0.76

Table 5-409

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 87 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	8.5E-06	4.0E-06	2.0E-05	0.42	0.20	0.62

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	7.1E-07	1.4E-06	2.0E-05	0.035	0.068	0.10

Table 5-410

Summary of the Exposure Doses and Cancer Risks for Exposure Area 87 - Subarea 87A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.5	1.1E-07	1.8E-07	2.0E+00	2E-07	4E-07	6E-07

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.5	9.2E-09	5.8E-08	1.0E+00	9E-09	6E-08	7E-08

Table 5-411

Summary of the Exposure Doses and Cancer Risks for Exposure Area 87 - Subarea 87A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.5	2.3E-07	4.7E-07	2.0E+00	5E-07	9E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.5	5.4E-09	4.5E-08	1.0E+00	5E-09	5E-08	5E-08

Table 5-412

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 87 - Subarea 87A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.5	6.5E-07	1.0E-06	2.0E-05	0.032	0.051	0.083

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.5	5.4E-08	3.4E-07	2.0E-05	0.0027	0.017	0.020

Table 5-413

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 87 - Subarea 87A

Exposure Medium: Soil
Exposure Scenario: Angler
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.5	4.2E-07	8.6E-07	2.0E-05	0.021	0.043	0.064

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	3.5	3.5E-08	2.9E-07	2.0E-05	0.0017	0.014	0.016

Table 5-414

Summary of the Exposure Doses and Cancer Risks for Exposure Area 88 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	7.5E-07	2.8E-07	2.0E+00	2E-06	6E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	9.4E-08	1.4E-07	1.0E+00	9E-08	1E-07	2E-07

Table 5-415

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 88 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	4.4E-06	1.6E-06	2.0E-05	0.22	0.082	0.30

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	12	5.5E-07	8.1E-07	2.0E-05	0.027	0.041	0.068

Table 5-416

Summary of the Exposure Doses and Cancer Risks for Exposure Area 89 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2	5.7E-07	2.7E-07	2.0E+00	1E-06	5E-07	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2	1.3E-08	2.5E-08	1.0E+00	1E-08	3E-08	4E-08

Table 5-417

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 89 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2	8.5E-07	4.1E-07	2.0E-05	0.043	0.020	0.063

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	2	7.1E-08	1.4E-07	2.0E-05	0.0036	0.0068	0.010

Table 5-418

Summary of the Exposure Doses and Cancer Risks for Exposure Area 90 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.1	1.8E-06	6.7E-07	2.0E+00	4E-06	1E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.1	1.5E-07	2.2E-07	1.0E+00	2E-07	2E-07	4E-07

Table 5-419

Summary of the Exposure Doses and Cancer Risks for Exposure Area 90 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.1	4.5E-06	2.2E-06	2.0E+00	9E-06	4E-06	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.1	1.0E-07	2.0E-07	1.0E+00	1E-07	2E-07	3E-07

Table 5-420

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 90 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.1	1.1E-05	3.9E-06	2.0E-05	0.53	0.19	0.72

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.1	8.7E-07	1.3E-06	2.0E-05	0.044	0.065	0.11

Table 5-421

Summary of the Exposure Doses and Hazard Quotients for Exposure Area 90 - Entire Area

Exposure Medium: Soil
Exposure Scenario: General Recreation
Land Use: Current/Future
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.1	6.7E-06	3.2E-06	2.0E-05	0.34	0.16	0.50

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.1	5.6E-07	1.1E-06	2.0E-05	0.028	0.054	0.082

Table 5-422

Summary of the Cancer Risks and Hazard Indices from tPCBs for Sediment Exposure

Sediment Exposure Area	Scenario Evaluated	Receptor	EPC (mg/kg)	RME		CTE	
				Total Cancer Risk	Total Hazard Index	Total Cancer Risk	Total Hazard Index
1	Sediment exposure	Older child	23	5E-06	0.74	6E-07	0.18
		Adult		2E-05	0.58	8E-07	0.15
2	Sediment exposure	Older child	24	5E-06	0.77	7E-07	0.19
		Adult		2E-05	0.60	9E-07	0.16
3	Sediment exposure	Older child	110	2E-05	3.5	3E-06	0.88
		Adult		8E-05	2.8	4E-06	0.72
4	Sediment exposure	Older child	19.2	4E-06	0.62	5E-07	0.15
		Adult		1E-05	0.48	7E-07	0.13
5	Sediment exposure	Older child	24.6	5E-06	0.79	7E-07	0.20
		Adult		2E-05	0.62	9E-07	0.16
6	Sediment exposure	Older child	7	2E-06	0.24	2E-07	0.060
		Adult		6E-06	0.19	3E-07	0.049
7	Sediment exposure	Older child	37.5	8E-06	1.2	1E-06	0.30
		Adult		3E-05	0.94	1E-06	0.25
8	Sediment exposure	Older child	6	1E-06	0.20	2E-07	0.051
		Adult		5E-06	0.16	2E-07	0.042

Table 5-423

Summary of the Exposure Doses and Cancer Risks for Sediment Area 1

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	8.6E-07	1.7E-06	2.0E+00	2E-06	3E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	7.2E-08	5.6E-07	1.0E+00	7E-08	6E-07	6E-07

Table 5-424

Summary of the Exposure Doses and Cancer Risks for Sediment Area 1

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	2.4E-06	6.1E-06	2.0E+00	5E-06	1E-05	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	7.3E-08	7.5E-07	1.0E+00	7E-08	7E-07	8E-07

Table 5-425

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 1

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	5.0E-06	9.8E-06	2.0E-05	0.25	0.49	0.74

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	4.2E-07	3.3E-06	2.0E-05	0.021	0.16	0.18

Table 5-426

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 1

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	3.2E-06	8.3E-06	2.0E-05	0.16	0.41	0.58

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	23	2.7E-07	2.8E-06	2.0E-05	0.014	0.14	0.15

Table 5-427

Summary of the Exposure Doses and Cancer Risks for Sediment Area 2

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	9.0E-07	1.8E-06	2.0E+00	2E-06	4E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	7.5E-08	5.8E-07	1.0E+00	8E-08	6E-07	7E-07

Table 5-428

Summary of the Exposure Doses and Cancer Risks for Sediment Area 2

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	2.5E-06	6.4E-06	2.0E+00	5E-06	1E-05	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	7.7E-08	7.8E-07	1.0E+00	8E-08	8E-07	9E-07

Table 5-429

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 2

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	5.3E-06	1.0E-05	2.0E-05	0.26	0.51	0.77

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	4.4E-07	3.4E-06	2.0E-05	0.022	0.17	0.19

Table 5-430

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 2

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	3.4E-06	8.6E-06	2.0E-05	0.17	0.43	0.60

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24	2.8E-07	2.9E-06	2.0E-05	0.014	0.14	0.16

Table 5-431

Summary of the Exposure Doses and Cancer Risks for Sediment Area 3

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	110	4.1E-06	8.0E-06	2.0E+00	8E-06	2E-05	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF	Cancer Risk		
		Incidental Ingestion	Dermal Contact	$(mg/kg\text{-}day)^{-1}$	Incidental Ingestion	Dermal Contact	Total
tPCBs	110	3.4E-07	2.7E-06	1.0E+00	3E-07	3E-06	3E-06

Table 5-432

Summary of the Exposure Doses and Cancer Risks for Sediment Area 3

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	110	1.2E-05	2.9E-05	2.0E+00	2E-05	6E-05	8E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	110	3.5E-07	3.6E-06	1.0E+00	4E-07	4E-06	4E-06

Table 5-433

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 3

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	110	2.4E-05	4.7E-05	2.0E-05	1.2	2.3	3.5

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	110	2.0E-06	1.6E-05	2.0E-05	0.10	0.78	0.88

Table 5-434

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 3

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	110	1.6E-05	4.0E-05	2.0E-05	0.78	2.0	2.8

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	110	1.3E-06	1.3E-05	2.0E-05	0.065	0.66	0.72

Table 5-435

Summary of the Exposure Doses and Cancer Risks for Sediment Area 4

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.2	7.2E-07	1.4E-06	2.0E+00	1E-06	3E-06	4E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.2	6.0E-08	4.7E-07	1.0E+00	6E-08	5E-07	5E-07

Table 5-436

Summary of the Exposure Doses and Cancer Risks for Sediment Area 4

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.2	2.0E-06	5.1E-06	2.0E+00	4E-06	1E-05	1E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.2	6.1E-08	6.2E-07	1.0E+00	6E-08	6E-07	7E-07

Table 5-437

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 4

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.2	4.2E-06	8.2E-06	2.0E-05	0.21	0.41	0.62

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.2	3.5E-07	2.7E-06	2.0E-05	0.018	0.14	0.15

Table 5-438

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 4

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.2	2.7E-06	6.9E-06	2.0E-05	0.14	0.35	0.48

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	19.2	2.3E-07	2.3E-06	2.0E-05	0.011	0.12	0.13

Table 5-439

Summary of the Exposure Doses and Cancer Risks for Sediment Area 5

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24.6	9.2E-07	1.8E-06	2.0E+00	2E-06	4E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24.6	7.7E-08	6.0E-07	1.0E+00	8E-08	6E-07	7E-07

Table 5-440

Summary of the Exposure Doses and Cancer Risks for Sediment Area 5

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24.6	2.6E-06	6.6E-06	2.0E+00	5E-06	1E-05	2E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24.6	7.8E-08	8.0E-07	1.0E+00	8E-08	8E-07	9E-07

Table 5-441

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 5

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24.6	5.4E-06	1.1E-05	2.0E-05	0.27	0.53	0.79

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24.6	4.5E-07	3.5E-06	2.0E-05	0.022	0.17	0.20

Table 5-442

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 5

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24.6	3.5E-06	8.8E-06	2.0E-05	0.17	0.44	0.62

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	24.6	2.9E-07	3.0E-06	2.0E-05	0.014	0.15	0.16

Table 5-443

Summary of the Exposure Doses and Cancer Risks for Sediment Area 6

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	2.8E-07	5.5E-07	2.0E+00	6E-07	1E-06	2E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	2.3E-08	1.8E-07	1.0E+00	2E-08	2E-07	2E-07

Table 5-444

Summary of the Exposure Doses and Cancer Risks for Sediment Area 6

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	7.8E-07	2.0E-06	2.0E+00	2E-06	4E-06	6E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	2.4E-08	2.4E-07	1.0E+00	2E-08	2E-07	3E-07

Table 5-445

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 6

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	1.6E-06	3.2E-06	2.0E-05	0.082	0.16	0.24

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	1.4E-07	1.1E-06	2.0E-05	0.007	0.053	0.060

Table 5-446

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 6

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	1.1E-06	2.7E-06	2.0E-05	0.053	0.13	0.19

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	7	8.8E-08	9.0E-07	2.0E-05	0.0044	0.045	0.049

Table 5-447

Summary of the Exposure Doses and Cancer Risks for Sediment Area 7

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.5	1.4E-06	2.7E-06	2.0E+00	3E-06	5E-06	8E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.5	1.2E-07	9.1E-07	1.0E+00	1E-07	9E-07	1E-06

Table 5-448

Summary of the Exposure Doses and Cancer Risks for Sediment Area 7

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.5	3.9E-06	1.0E-05	2.0E+00	8E-06	2E-05	3E-05

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	37.5	1.2E-07	1.2E-06	1.0E+00	1E-07	1E-06	1E-06

Table 5-449

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 7

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	37.5	8.2E-06	1.6E-05	2.0E-05	0.41	0.80	1.2

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	37.5	6.9E-07	5.3E-06	2.0E-05	0.034	0.27	0.30

Table 5-450

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 7

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	37.5	5.3E-06	1.4E-05	2.0E-05	0.26	0.68	0.94

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)			Hazard Quotient		
		Incidental Ingestion	Dermal Contact	RfD (mg/kg-day)	Incidental Ingestion	Dermal Contact	Total
tPCBs	37.5	4.4E-07	4.5E-06	2.0E-05	0.022	0.22	0.25

Table 5-451

Summary of the Exposure Doses and Cancer Risks for Sediment Area 8

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	2.4E-07	4.6E-07	2.0E+00	5E-07	9E-07	1E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	2.0E-08	1.5E-07	1.0E+00	2E-08	2E-07	2E-07

Table 5-452

Summary of the Exposure Doses and Cancer Risks for Sediment Area 8

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	6.6E-07	1.7E-06	2.0E+00	1E-06	3E-06	5E-06

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		CSF $(mg/kg\text{-}day)^{-1}$	Cancer Risk		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	2.0E-08	2.1E-07	1.0E+00	2E-08	2E-07	2E-07

Table 5-453

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 8

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Older Child

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	1.4E-06	2.7E-06	2.0E-05	0.070	0.13	0.20

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	1.2E-07	9.0E-07	2.0E-05	0.0058	0.045	0.051

Table 5-454

Summary of the Exposure Doses and Hazard Quotients for Sediment Area 8

Exposure Medium: Sediment
Exposure Scenario: Sediment Exposure
Receptor Age: Adult

Contaminant	Exposure Point Concentration (mg/kg)	RME					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	8.9E-07	2.3E-06	2.0E-05	0.045	0.11	0.16

Contaminant	Exposure Point Concentration (mg/kg)	CTE					
		Exposure Dose (mg/kg-day)		RfD (mg/kg-day)	Hazard Quotient		
		Incidental Ingestion	Dermal Contact		Incidental Ingestion	Dermal Contact	Total
tPCBs	6	7.4E-08	7.6E-07	2.0E-05	0.0037	0.038	0.042

6. PROBABILISTIC RISK CHARACTERIZATION

Probabilistic risk assessments (PRAs) were performed to assess risks due to total PCB (tPCB) exposure associated with direct contact recreational exposure pathways. The probabilistic approaches used for these analyses consisted of probability bounds analysis (PBA) and a semi-analytic method (i.e., analytic solution with discretization error) analogous to one-dimensional Monte Carlo analysis (MCA analog) performed using PBA. The latter approach is referred to as an MCA analog because MCA and PBA are not computationally identical. MCA is a simulation method based on random sampling. PBA does not employ sampling, but rather is a discretization method similar to that of Kaplan (1981). However, because PBA is a strict generalization of probability theory, it yields the same answers as Monte Carlo simulation if it is provided with the same inputs and assumptions (see Attachment 5 of HHRA Volume I).

This PRA used the same exposure model as the point estimate assessment described in Section 5. However, in the MCA analog, probability distributions were used for many of the exposure variables, rather than the single values (point estimates) presented in previous sections of this report. The MCA analyses were used to infer best estimates for probabilities of the risks of various magnitudes and to graphically illustrate these risks with probability distributions. The probability bounds analysis was used to assess the reliability of the estimated probabilities by accounting for sources of uncertainty such as the selection and parameterization of probability distributions, and relationships between input variables. Both approaches permit the graphical illustration of the variability and uncertainty in risk estimates, and provide a convenient yet comprehensive form of sensitivity analysis. Extensive guidance is available on the methodology and use of probabilistic analyses in human health risk assessments (EPA, 2001a). Attachment 5 of HHRA Volume I gives an overview of the basis for the probability bounds approach.

In PRA, the high end of the risk distribution, the 90th to 99.9th percentile, is generally used to represent the RME scenario, rather than a single RME risk value as in the point estimate approach. Because of the uncertainty in the probability distributions that define the input variables in this risk assessment, there is expected to be significant uncertainty in the estimate of the 99.9th percentile. Therefore, for this probabilistic analysis, the high end of the RME range was defined by the 99th percentile. The 95th percentile is EPA's recommended starting point for defining the RME (EPA, 2001a, p. 7-5). The CTE for the PRA was characterized as the 50th percentile.

This section is organized as follows:

- Section 6.1 describes the application of the tiered approach to probabilistic modeling used for the recreational risk assessment.
- Section 6.2 describes the target receptors and the models used to calculate exposure.
- Section 6.3 provides an explanation of the treatment of dependencies between input variables in the exposure models.
- Section 6.4 provides a brief introduction to the logic of probability bounds analysis.
- Section 6.5 presents the exposure assessment with details of the derivation of each input distribution.
- Section 6.6 presents the risk characterization.
- Section 6.7 presents the sensitivity analyses of the results.
- Section 6.8 details the sources of uncertainty.

6.1 TIERED APPROACH TO PROBABILISTIC RISK ASSESSMENT

EPA guidance (EPA, 2001a) outlines a sequential "tiered" approach to the application of probabilistic models in a risk assessment. Each tier is evaluated and the results are used in proceeding to the successive tiers. In this approach, increasingly complex models and data are applied to further quantify the effects of variability and/or uncertainty regarding risk model input variables on the risk assessment result.

Variability arises from natural stochasticity, environmental variation across space or through time, genetic heterogeneity among individuals, and other sources of randomness. Uncertainty arises from incomplete knowledge about the world. While uncertainty can in principle be reduced by focused empirical effort (e.g., additional sampling), such additional study can only better characterize, not reduce, variability. One aspect of the modeling efforts associated with each tier of the assessment is to conduct a sensitivity analysis that can be used to determine for which input variables, if any, a reduction in uncertainty or a better understanding of variability (or both) could lead to a substantially improved characterization of risk.

The recreational risk assessment comprises two tiers. The point estimate risk models represent the first tier of the risk assessment. These models describe input variables with point estimates, and address variability and uncertainty regarding inputs to the risk calculation in a qualitative fashion. The risk characterization based on this approach is presented in Section 5, and the qualitative uncertainty analysis in Section 7.

For the second tier of the risk assessment, the COPC dose received from direct contact with floodplain soil or sediment was calculated using a one-dimensional MCA analog analysis and a probability bounds analysis. The term "one-dimensional" refers to a probabilistic modeling approach that separates the characterization of variability and uncertainty. The one-dimensional MCA analog replaces point estimates used as inputs to the first-tier point estimate models with probability distributions that represent only variability, yielding a distribution of risk. The PBA uses intervals or p-boxes (see Section 6.5, and Attachment 5 of HHRA Volume I) to comprehensively bound the uncertainty in the distribution of risk in a manner generally analogous to a two-dimensional Monte Carlo simulation. The resulting second-tier risk analysis consists of a precise probability distribution of risk and a quantification of dependencies in variables, and uncertainty bounds on the risk distribution, for recreational exposure scenarios. EPA (2001a, Volume 3, Part A, Chapter 3, Section 3.4) discusses the application of one-dimensional and two-dimensional Monte Carlo simulations to the characterization of variability and uncertainty in exposure variables within the tiered approach. Attachment 5 of HHRA Volume I contains a more detailed technical discussion of PBA, variability, uncertainty, and the use of PBA within EPA's tiered approach framework.

6.1.1 Exposed Populations

The potentially exposed populations for the direct contact recreational exposure pathway are individuals engaged in the following activities in the Housatonic River and floodplain:

- General recreation (young child, older child, and adult)
- All terrain vehicle (ATV)/dirt and mountain bike riding (older child)
- Angler (older child and adult)
- Waterfowl hunter (older child and adult)
- Recreational canoeist/boater (older child and adult)
- Sediment exposure (older child and adult)

Models were used to assess cancer and noncancer risks for adults, older children, and young children. All of the scenarios considered soil exposures via ingestion and dermal contact, with the exception of the sediment exposure scenario, which considered sediment exposure via ingestion and dermal contact from a composite of recreational activities (e.g., wading, swimming, fishing, waterfowl hunting, canoeing, and other related activities).

The PRA for these receptors is not specific to any exposure area (EA); therefore, it does not include an assessment of variability and uncertainty in parcel-specific exposure point concentrations (EPCs), including use-weighting factors (see Section 4.4). Instead, variability and uncertainty in model inputs were examined at an assumed tPCB soil or sediment EPC of 1 mg/kg.

The results for an EPC of 1 mg/kg can be extrapolated to estimate risk for a particular soil or sediment concentration because the relationship between soil or sediment concentration and risk is linear. For example, if the risk associated with adult recreational exposure where the soil EPC equals 1 mg/kg is approximately 2E-06, then the risk associated with a soil EPC of 5 mg/kg is 5 times greater, or 1E-05.

6.2 EXPOSURE MODELS

For the second-tier analysis, the exposure to tPCBs due to direct contact with soil or sediment was calculated using the same models for dose calculations applied in the point estimate assessment. This means that the MCA analog and PBA models are straightforward generalizations of the models used in the first-tier point estimate approach, except that probability distributions, intervals, and p-boxes (see Section 6.5) are used in place of many of the point estimate inputs. The dose equations are shown in Tables 4-12, 4-13, and 4-15 through 4-18. Cancer risk and noncancer hazard equations are described in Sections 5.2 and 5.3, respectively.

In both tiers, exposures were calculated using a cancer and a noncancer model. For the noncancer model, separate analyses were run with parameters for children (ages 1 to 6) and adults. The equations used to calculate cancer risk and noncancer hazard were the same as those used for the point estimates, as described in Section 5, with the exception that in the noncancer model, ED and AT are equivalent and thus both canceled from the equation. The cancer model was constructed in the same manner as the noncancer model except that, for each scenario, cancer doses were computed as the sum of exposure during childhood and adulthood.

Monte Carlo analog analyses for cancer and noncancer calculations were performed using Risk Calc® (Ferson, 2002). Some variables were assumed mutually independent because there was no quantitative information that could be used to parameterize any correlation coefficients. Dependencies between variables were accounted for quantitatively using dependency bounds analysis (DBA) (see Section 6.3). DBA is a form of sensitivity analysis that accounts for all possible dependencies among input variables without requiring quantitative information needed to parameterize correlation coefficients. Exhibit 6-1 contains an example of the Risk Calc® (Ferson, 2002) code used for the MCA analog.

PBA was also performed for cancer and noncancer models. The results of the PBA are probability boxes (p-boxes) bounding all risk and HI distributions consistent with the uncertainty regarding the shapes, dependencies, and magnitudes of each variable distribution. Exhibit 6-2 includes an example of the Risk Calc® (Ferson, 2002) code used to run probability bounds analyses.

6.3 RELAXING INDEPENDENCE ASSUMPTIONS

Dependencies among body surface area, body weight, and dermal adherence factors were accounted for with the creation of a combined variable X, which is described in Section 6.5.1.9. The MCA analog assumed strict independence between other variables, not because this is likely in some cases, but because relevant data required to parameterize the model were not available.

DBA (Ferson and Long, 1995) was used to relax the assumptions of independence made in the MCA analog and to explore risks under other dependency assumptions. This is a sensitivity analysis that considers any and all possible dependencies that may exist between the variables and propagates them through the calculations. The results are plausible extreme bounds encompassing the set of risk distributions that could result from exposure, without making any assumptions about the dependence among the variables. Attachment 5 of HHRA Volume I contains details regarding DBA.

The PBA and DBA incorporate relaxed independence assumptions for the pairs of variables in Table 6-1 marked with an "x." Other variables were assumed to be mutually independent. IR is a function of X because the amount of soil or sediment that is ingested is a function of how much soil or sediment adheres to skin. X, ED, and BW are related in that they are functions of a receptor's age. ABS is the fraction of PCBs absorbed through the skin. This fraction might be dependent on the amount of soil or sediment adhering to skin, particularly when loadings exceed monolayer conditions.

6.4 PROBABILITY BOUNDS ANALYSIS

PBA is a combination of the methods of standard interval analysis (Moore, 1966; Neumaier, 1990) and classical probability theory (Feller, 1968; 1971). The concept of calculating bounds around probability distributions has a very long tradition in probability theory (e.g., Boole, 1854; Chebyshev, 1874; Markov, 1886; Fréchet, 1935). The methods of PBA were developed and made widely available over the last 20 years (Yager, 1986; Frank et al., 1987; Williamson and Downs, 1990; Ferson and Long, 1995; Ferson et al., 1997; Ferson, 2002; Berleant, 1993; 1996; Berleant and Cheng, 1998; Berleant and Goodman-Strauss, 1998). Examples of application of PBA to environmental risk assessments include Donald and Ferson (1997), Spencer et al. (1999; 2001), and Regan et al. (2002a; 2002b). In a PBA, the uncertainty surrounding the probability distributions for each input in a risk assessment is expressed in terms of bounds on the cumulative distribution function. These bounds form a "p-box" for each input variable. For example, the dermal absorption fraction for tPCBs is expressed in the first-tier point estimate analysis as a single point, but the exact value is uncertain. PBA provides an approach to evaluating this uncertainty by substituting an interval for the previously precisely specified point. The interval must be bounded below by a value that is known to be as low as the absorption fraction could possibly be, and above by a value that is known to be as high as the absorption fraction could possibly be. Given that, in many cases, it is not possible to be 100% certain of these bounds, p-box bounds in this assessment are characterized as reasonable upper and lower bounds. This interval represents a quantitative measure of uncertainty surrounding the actual absorption fraction value. The methods of PBA allow for that uncertainty to be modeled and analyzed in ways analogous to the single point estimate-based first-tier approach, drawing mathematically rigorous bounds around the risk result beyond which it is certain the risk distribution does not extend. PBA also provides the methods necessary to draw bounds around precisely specified input distributions, such as those used by Monte Carlo simulations, as well as methods that draw rigorous p-boxes in cases where even the shape of the underlying distribution is unknown. These p-boxes can be used as input variables to the exposure equation to obtain bounds around the resulting exposure distribution. The resulting estimate of exposure is also a p-box, and it reflects the overall uncertainty of the estimate.

With respect to distributions considered in this analysis, the p-box for exposure is known to be rigorous in the sense that it contains all distributions of exposure that could possibly result from combining the input distributions to the exposure model as long as they are within their respective p-boxes (Frank et al., 1987; Williamson and Downs, 1990). The p-box for exposure is also known to be best-possible or optimal in the sense that the bounds could not be any tighter and still contain all such resulting distributions (Williamson and Downs, 1990). Like any calculation, the guarantees of the answer are contingent on the assumptions, including those associated with the supporting data. Attachment 5 of HHRA Volume I provides a detailed explanation of the methods of PBA and several numerical examples.

PBA does not require the analyst to assume independence when it is not warranted or to specify the precise shapes of input distributions when they are difficult to estimate. Thus, results of p-bounds may in some cases provide useful information for risk managers to assess the impact on the risk distribution when the assumptions in the Monte Carlo approach are relaxed. In this recreational risk assessment, these two complementary approaches are used together.

6.5 EXPOSURE ASSESSMENT FOR RECREATIONAL EXPOSURE SCENARIOS

For each variable, a precise point estimate or a probability distribution was needed for the MCA analog and for the DBA. A precise point estimate, interval estimate, or p-box around the Monte Carlo input variable was selected for the PBA. Tables 6-1 through 6-15 summarize all of the inputs used in the MCA analog and the PBA.

The exposure dose was represented as the daily intake of a contaminant an individual receives through each exposure pathway (e.g., soil ingestion, dermal contact). Doses were calculated based on two different averaging times:

- Average daily doses (ADDs), in which the doses were averaged over the assumed exposure duration, were used to evaluate noncancer health effects.

- Lifetime average daily doses (LADDs), in which the doses were averaged over a 70-year lifetime, were used to evaluate potential cancer risks.

The ADDs and LADDs are expressed as either administered (oral) or absorbed (dermal) doses in milligrams of contaminant per kilogram of body weight per day (mg/kg-day). Cancer risks were calculated by multiplying LADDs by the Cancer Slope Factor (CSF) for tPCBs of 2 $(mg/kg\text{-}d)^{-1}$ (see Section 3.2.2). Noncancer hazard indices were calculated by dividing ADDs by the Reference Dose (RfD) for tPCBs of 0.00002 (2E-05) mg/kg-d (see Section 3.3.2).

The general equation for calculating a contaminant dose via any exposure pathway is shown in Table 4-5. This equation was modified to allow explicit treatment of variability and uncertainty in model inputs while accounting for known correlations among them:

$$Cancer\ Risk = CS \times \left(X \times ABS + \frac{IR \times FI}{bw} \right) \times \frac{EF \times ED \times CF \times CSF}{AT}$$, and

$$Hazard\ Index = CS \times \left(X \times ABS + \frac{IR \times FI}{bw} \right) \times \frac{EF \times CF}{RfD}$$

where:

ABS = dermal absorption factor (unitless)
AT = averaging time (days)
bw = body weight (kg)
CF = conversion factor (cancer: 10^{-6} kg/mg; noncancer: 10^{-6} kg/mg * 1 yr/365 days)
CS = contaminant concentration in soil (mg/kg)
CSF = cancer slope factor (unitless)
ED = exposure duration (years)
EF = exposure frequency (days/year)
FI = proportion of ingestion at the site (unitless)
IR = soil ingestion rate (mg/day)
RfD = reference dose (mg/kg)

X is a combined soil adherence factor weighted by exposed body parts, skin surface area, and body weight and is described in Section 6.5.1.9.

6.5.1 General Description of Inputs

This subsection provides a preliminary discussion of each of the exposure parameters that is relevant to all exposure scenarios, followed by a presentation of information specific to each scenario in Section 6.5.2.

6.5.1.1 Total PCB Exposure Point Concentration in Soil and Sediment

The floodplain soil exposure point concentration for all scenarios was assumed to be 1 mg/kg for the purpose of quantifying variability and uncertainty in cancer risk and noncancer hazard estimates for each of the recreational exposure scenarios.

This parameter will not be repeated in the subsequent scenario-specific discussions.

6.5.1.2 Averaging Time

The averaging time variable is addressed in both the cancer and noncancer models, but explicitly used only in the cancer model calculations. Averaging time was set at a point estimate of 70 years (25,550 d) in the cancer exposure model. In the noncancer model, AT was set equal to ED, and both canceled from the exposure equation. The exclusion of these inputs required the use of a conversion factor (i.e., one year/365 days).

This parameter will not be repeated in the subsequent scenario-specific discussions.

6.5.1.3 Exposure Frequency

Exposure frequency (EF) represents the number of days per year that a receptor (e.g., adult) was estimated to engage in a particular activity that could result in exposure. For all scenarios except the hunter, it was assumed that direct contact exposure occurs during 7 months (30 weeks) as was done in the point estimate risk assessment. EF for the hunter was limited to the hunting season. A variety of sources and professional judgment were used as the basis for EF values.

6.5.1.4 Exposure Duration

Exposure duration (ED) is the estimate of the total time of exposure (in years) that a particular receptor (e.g., adult) engages in a particular activity that could result in exposure. This input was used only in cancer model calculations.

In the MCA analog, the young child ED was assumed to be a uniform distribution from 1 to 6 years. In the PBA, it was assumed to be an interval ranging from 1 to 6 years. The older child was assumed to be exposed from ages 7 through 18 years for all scenarios except waterfowl hunting, where hunting regulations preclude children from hunting before the age of 12. In the MCA analog, the older child ED was assumed to be a uniform distribution from 1 to 12 years for all scenarios except the older child hunter for whom it was assumed to be a uniform distribution from 1 to 6 years. In the PBA, the older child EDs were defined as intervals instead of uniform distributions. Uniform distributions were used in the MCA analog and intervals were used in the PBA because insufficient data are available to refine the distribution for the young child and older child age groups. More information was available for adults, and these data were used to define adult EDs, which vary among scenarios and are described in the scenario-specific discussions.

6.5.1.5 Soil Ingestion Rate and Sediment Ingestion Rate

EPA (1997) provides guidance for defining soil ingestion rates. For sediment ingestion, EPA recommends using the same equation as that used for soil ingestion and, “unless more pathway-specific values can be found in the open literature, use as default variable values the same values as those used for ingestion of soil” (EPA, 1989). In the absence of more pathway-specific data, sediment ingestion rates were assumed to be the same as soil ingestion rates, as was assumed in the point estimate risk characterization. All MCA analog and PBA ingestion rate inputs were rounded to one significant figure given uncertainties involved in estimating these rates.

All soil and sediment ingestion rates reflect inadvertent ingestion as a result of recreational activities in the floodplain. They are not intended to reflect intentional soil ingestion by geophagic individuals. Limited data are available regarding the prevalence of geophagic adults and children and their soil ingestion rates, particularly chronic ingestion rates. Such intentional soil ingestion ideally should be modeled separately from inadvertent ingestion as it represents a different exposure scenario.

Rates for inadvertent soil and sediment ingestion were defined as triangular distributions in the MCA analog. For the more intensive exposure scenarios involving young children, hunters, and ATV/bikers, the minimum value was set to 50 mg/day, the mode was set to the CTE ingestion rate, and the maximum was set to the RME ingestion rate, except for the hunter, for whom the maximum was set to 200 mg/day instead of the 100 mg/day rate used to represent both the CTE and RME exposures in the point estimate risk assessment. For all other scenarios, the minimum was set to zero, the mode was set to the CTE ingestion rate, and the maximum was set to the RME ingestion rate.

In the PBA, ingestion rates were defined as p-boxes with a minimum, maximum, and mode. These p-boxes are wider than the triangular distributions used in the MCA analog. All minima were set to 0 mg/day, and all maxima were set to 300 mg/day. The upper bound of 300 mg/day was selected for older child and adult scenarios for the following reasons:

- EPA (1997) reviewed soil ingestion data for adults and primarily relied upon Calabrese et al. (1990) to recommend point estimate CTE and RME values of 50 and 100 mg/day. In this study, adult subjects ingested capsules containing known quantities of tracers in weeks two (300 mg/day) and three (1.5 g/day) of the study. Correcting the soil ingestion estimates for individual adults for each tracer by the percent recoveries for each tracer during the 300 mg/day ingestion period, the highest ingestion rate that can be estimated using reliable tracers (Al, Y, and Zr) from this study is 270 mg/day. The adults in this study were office workers. Therefore, this maximum rate is unlikely to be a reasonable upper bound soil ingestion rate for office workers, but it might be reasonable for contact-intensive recreational activities. Calabrese et al. (1997) subsequently used adults to validate a child soil ingestion rate study and concluded that the adults likely ingested 20 to 40 mg of soil per day in addition to the soil they consumed in capsule form.

- Simon (1998) reviewed soil ingestion rate data, and ingestion rates reported for non-geophagic adults are less than 300 mg/day.

Stanek et al. (1997), which was not included in the Simon (1998) review, published soil ingestion rate data for adults, including a 95th percentile soil ingestion rate of 331 mg/day Hawley et al. (1985) modeled a soil ingestion rate for adults of 480 mg/day assuming outdoor activities. However, Kissel et al. (1998) questioned the likelihood of such a high consumption rate among nonsmoking, nongeophagic adults based on adult volunteers reporting that the presence of roughly 10 mg of soil in the mouth is readily detected and unpleasant. Kissel et al. (1998) concluded that "high-end estimates of daily soil ingestion rates in the range of 500 mg/day would appear to be implausible, at least for non-smoking, non-geophagic adults" (Kissel et al., 1998).

The upper bound of 300 mg/day was used for young children based on data presented in EPA (1997). This rate is intended to represent an upper bound on a long-term average for the more highly exposed child, rather than the maximum amount of soil a child might ingest on any given day. Simon (1998) concluded that there are only four rigorously conducted empirical studies of soil ingestion rates among children: Binder et al. (1986), Calabrese et al. (1989), van Wijnen et al. (1990), and Davis et al. (1990). Mean and upper-bound soil ingestion rates from these four studies and also Stanek and Calabrese (1995a, 1995b) and Clausing et al. (1987) were summarized by EPA (1997, Table 4-22). The average of upper-bound rates forms the basis of EPA's recommended upper-bound soil ingestion rate of 400 mg/day. However, this average includes some upper-bound ingestion rates that are based on titanium as a tracer. As noted in Section 4.5.2.3, titanium is not a reliable tracer. If ingestion rate estimates based on titanium are excluded from the calculation of soil ingestion rate, a rate of 289 mg/day results.

Simon (1998) reviewed soil ingestion rate information for children and rarely reported soil ingestion rate measurements for children that were higher than 300 mg/day, although some studies reported upper-bound and maximum soil ingestion rates considerably higher than 300 mg/day. Some of these high rates are from studies that do not necessarily distinguish between inadvertent and intentional soil ingestion. Where they do represent inadvertent ingestion, use of these high rates as a maximum value in a p-box defined only by a minimum, maximum, and mode still might not provide a realistic representation of ingestion rates because this distribution shape would attribute too much probability to this extreme value over the short-term as well as the chronic exposure durations considered in this assessment. EPA (2002) recently fit soil ingestion rate data for young children to a highly skewed lognormal distribution truncated at 1,000 mg/day. In Section 7, results using this lognormal distribution are compared to the triangular distribution used in this assessment, and RME noncancer hazard and cancer risk results did not change significantly.

This parameter will not be repeated in the subsequent scenario-specific discussions.

6.5.1.6 Fraction Ingested

Fraction ingested (FI) is a unitless term that represents the fraction of the soil or sediment ingested from the contaminated source. A FI of 1.0 was used in the RME evaluation for all of the scenarios to represent a high-end exposure in which all soil or sediment ingested was assumed to be from the contaminated area. A factor of 0.5 was used in the CTE evaluation for all recreational scenarios. This range was used in the MCA analog analysis assuming a uniform distribution to represent variability in the amount of soil ingested from the contaminated area. The same range was used in the PBA, but defined as an interval rather than a precise uniform distribution to address uncertainty about selection of this distribution type.

This parameter will not be repeated in the subsequent scenario-specific discussions.

6.5.1.7 PCB Dermal Absorption Efficiency

The point estimate risk assessment incorporated a dermal absorption efficiency value of 14% for tPCBs. This value is from Wester et al. (1993) and is described in more detail in Section 4.5.1.4 of this volume and in Section 4.4.1.2 of Volume I. Wester et al. (1993) measured dermal absorption efficiencies of 14 ± 1% in monkeys exposed to PCB-contaminated soil. The standard deviation of 1% is a measure of uncertainty for this particular study, but it does not quantify the extent of uncertainty in extrapolating these laboratory results to exposure conditions in the floodplain. There are few data available to quantify the variability in dermal absorption efficiency of PCBs as a function of skin type, duration of exposure, properties of the PCB mixture in the floodplain, and soil characteristics such as organic carbon content. Therefore, a point estimate of 14% was used in the MCA analog because insufficient data are available to estimate variability.

In the PBA, an interval of 6% to 41% was used. The upper end of this interval is an estimate of the maximum amount of PCBs absorbed by monkeys (MDEP, 2001) in a more recent study of PCB dermal absorption efficiency using Housatonic River floodplain soil (Mayes et al., 2002). Because of limitations associated with the Mayes et al. (2002) study, which are described in

Section 4.4.1.2 of HHRA Volume I, the percent absorbed could be higher than 41% under some conditions, but insufficient information is available to define a higher upper bound. Under some conditions, dermal absorption of PCBs could be lower than 14%. Again, insufficient data are available to define this lower bound. Mayes et al. (2002) quantified dermal absorption efficiencies of about 3 to 4%, but the limitations of this study preclude use of these estimates as a lower bound because they might underestimate dermal absorption. Because Mayes et al. (2002) used site-specific soil and results are potentially biased low, the dermal absorption fraction applicable to conditions in the floodplain is not likely to be lower than 3 to 4%. EPA (1992) previously defined a PCB dermal absorption efficiency range of 0.6 to 6% (EPA, 1992), but this range was based on a study of a single PCB congener rather than a complex mixture as is present in floodplain soil. The upper end of this range is similar to Mayes et al. (2002) and was selected to represent the lower bound of the dermal absorption efficiency p-box. This interval of 6% to 41% might be too narrow a representation of uncertainty about PCB dermal absorption efficiency under the variety of field conditions and receptor characteristics, but insufficient information is available to widen this interval.

This parameter will not be repeated in the subsequent scenario-specific discussions.

6.5.1.8 Body Weight

Body weight distributions were developed using weighted data for body weight, height, gender and age from the National Center for Health Statistics Third National Health and Nutrition Examination Survey, 1988-1994, known as NHANES III (USDHHS, 1996). Distributions were developed for young child, older child, and adult scenario age groups (see Table 6-2). Data for between 2,800 and 14,000 individuals are available for each age range in this analysis. Data for all individuals between the ages of 12 and 71 months were used for the young child scenario, 144 and 227 months for the older child hunter scenario, 72 and 227 months for all other older child scenarios, and 228 to 851 months for all adult scenarios. Cumulative distribution functions for each of these age groups were developed using weighted data and defined at the minimum, maximum, and for each 5^{th} percentile. A more-detailed discussion of the distribution development method is provided in Addendum 6.1. This parameter will not be repeated in the subsequent scenario-specific discussions.

6.5.1.9 Soil/Sediment Adherence Factor Weighted By Exposed Body Parts, Skin Surface Areas, and Body Weight

Variables related to dermal exposure, including body part-specific soil adherence factors, body part exposure, surface areas of exposed body parts, and body weight were combined into a single variable, X:

$$X = \frac{1}{BW^*} \times \left[SA^*_{hands} \times AF_{hands} + \frac{1}{3} SA^*_{head} \times AF_{face} + \begin{pmatrix} SA^*_{lowerlegs} \times AF_{lowerlegs} + SA^*_{feet} \times AF_{feet} \\ + SA^*_{forearms} \times AF_{forearms} \end{pmatrix} \times S \right]$$

where:

AF_x	=	soil adherence factors for body parts (mg/cm^2),
BW^*	=	body weight (kg),
S	=	proportion of yearly exposure dressed for warm weather, and
SA^*_x	=	individual surface areas of body parts (cm^2).

These inputs were combined to account for correlations among some of them (obviously correlated variables are marked with asterisks), while simultaneously quantifying variability in the exposure model. The input for X to be used in the MCA analog analysis was estimated using true Monte Carlo simulation (MC simulation) with Crystal Ball®. Each iteration of the MC simulation resulted in X for a given individual in the receptor population. Body part surface areas were predicted from the individual's body weight using regression models as described in Section 6.5.1.9.4, thus accounting for correlation between body weight (and height for adults) and each body part surface area. Multiple iterations resulted in an estimate of the distribution of variability in X for each receptor population, and these distributions were used in the MCA analog analyses. MC simulations were run until the standard error in the mean and standard deviation was less than 1% at 95% confidence. The minimum, maximum and every 5^{th} percentile were used to define X distributions for each scenario. Inputs to this model are listed in Tables 6-4 through 6-15 and represent estimates of variability for the model inputs of body weight, height (height is required only for adult exposure scenarios), SA predictions, AF, and S. In estimating X distributions for use in the MCA analog analyses, AF was limited to data from the literature-based scenario that most closely approximates the site-specific scenario, and uncertainty associated with the regression models was not included. A wider range of AF values and uncertainty in regression models was accounted for in defining p-boxes for X in the probability bounds analyses.

To define upper and lower bounds of p-boxes for use in the PBA, the following assumptions were made:

- Uncertainty in the body weight distributions is small because measurement error is expected to be small and the data come from a large national study.
- Proportion of yearly exposure dressed for warm weather, S, represents variability rather than uncertainty (i.e., it is assumed that uncertainty in S is small compared to variability in S).
- Uncertainty in the regression models used to calculate body part surface area and in the applicability of AFs to the activities assumed in each scenario could be important and should be accounted for in defining the width of p-boxes.

Therefore, in defining p-boxes, uncertainty in AF was accounted for by including a wider range of values that correspond to all scenarios that might be applicable to the site-specific scenario. For example, AFs for "children playing in dry soil" were used in the young child scenario to define the MCA analog input for X. A broader range of AFs were used to define possible AFs for this scenario given uncertainty about this input, including AFs for "daycare children," "children playing in dry soil," and "children playing in wet soil." Also, uncertainty in SA was accounted for by including regression model error.

Two methods were compared for defining the width of p-boxes for use in the PBA:

1. *Method 1.* A two-dimensional Monte Carlo model was constructed to estimate uncertainty about each percentile of the MCA analog input distributions for X. This model differs from the one-dimensional model used to estimate the MCA analog input because it incorporates a second dimension of uncertainty. AF was defined as an uncertain input with a wider range of possible values than those used for the 1-dimensional MCA. Variables included to quantify uncertainty in the surface area regression model fits were also defined as uncertain inputs (see Addendum 6.1 for a more detailed discussion of the treatment of regression uncertainty). To observe the difference between accounting for uncertainty in regression model mean predictions and individual predictions at a specific X value, the approach was repeated twice for the child recreation scenario: once assuming uncertainty in regression model mean predictions (referred to as "P-box with Regression error (RE) on mean" in Figure 6-1), and once assuming uncertainty in regression model predictions at a specific x value (referred to as "P-box with RE on individual" in Figure 6-1). With this model, minimum and maximum values

for each percentile of the MCA analog input for X could be defined and used as a measure of uncertainty. Resulting X p-boxes could then be defined as the range at five points of the curve, the minimum, 25th percentile, 50th percentile, 75th percentile, and maximum. However, performing sufficient 2-dimensional Monte Carlo model runs proved to be time-consuming.

2. *Method 2.* A second option to defining p-box bounds was evaluated to address the issue of lengthy 2-D MCA runs. Reasonable upper and lower bounds of p-box percentiles were approximated. Lower bounds were approximated by estimating X from a 95th percentile body weight, 5th percentile AFs, minimum S, and a 95% lower confidence limit (95% LCL) on the regression prediction. Upper bounds were approximated by estimating X from the 5th percentile body weight, 95th percentile AFs, maximum S, and a 95% upper confidence limit (95% UCL) on the regression prediction. This approach provides identical approximations of uncertainty for the 25th, 50th, and 75th percentiles. The minimum and maximum value of X for each scenario was estimated using minimum and maximum body weight measurements, surface areas predicted from body weight, minimum and maximum adherence factors, and minimum and maximum S values.

Results from these two approaches are compared below using the young child and adult recreational scenarios as examples.

6.5.1.9.1 Young Child Recreational Scenario

A comparison of the two methods for defining the width of X p-boxes is provided for the young child recreational scenario in Figure 6-1. The upper and lower bounds based on 1,000 by 10,000 2-D MCA runs (referred to as “2D MCA” in Figure 6-1) were similar to upper and lower bounds calculated using the approximate but less time-consuming Method 2, regardless of how regression uncertainty was quantified (referred to as “P-box with RE on mean” and “P-box with RE on individual” in Figure 6-1). Therefore, Method 2 was used to define p-box bounds for all child scenarios.

6.5.1.9.2 Adult Recreational Scenario

A similar analysis was performed for the adult general recreation scenario. In this case, the upper and lower bounds based on 500 by 10,000 2-D MCA runs (referred to as “2D MCA” in Figure 6-2) were similar to upper and lower bounds calculated using the approximate but less time-consuming Method 2, regardless of whether regression uncertainty was quantified (referred to as “P-box with no RE” for the result without including regression error and “P-box with RE on individual” for the result including regression error associated with predictions at a specific X value). For all adult scenarios, the p-boxes were calculated using Method 2 described above, but did not include regression error because its inclusion involved lengthy computation time and would have little effect on p-box bounds (see sensitivity analyses in Section 6.7).

6.5.1.9.3 Body Weight

Body weight distributions included in "X" are those described in Section 6.5.1.8. For adults, separate male and female body weight distributions were used to allow for the use of gender-specific surface area equations (see Section 6.5.1.9.4). The body weight input was also used in the ingestion portion of the exposure model (see Section 6.5) as well as in the combined X variable, and this dependency was accounted for in the PBA and DBA using Risk Calc®.

This parameter will not be repeated in the subsequent scenario-specific discussions.

6.5.1.9.4 Exposed Skin Surface Area

The regression models in Table 6-1 of the Exposure Factors Handbook (EPA, 1997) were used to calculate the surface areas of body parts for adult scenarios using height and body weight distributions developed from the NHANES III data for both males and females (USDHHS, 1996). Body weight and height distributions were developed separately for males and females, and correlation coefficients were defined between height and weight for each gender (Table 6-2). Surface areas were calculated for each body weight realization for males and females within Crystal Ball®. Each gender was included in proportion to its weighted proportion of the NHANES III sample for adults (Table 6-2).

There are no analogous equations available for body part surface areas in children. Both children and adults were included in the regression model for total surface area developed by EPA (1985), and therefore, the total surface area model is applicable to children. However, EPA evaluated children and adults separately for body part surface areas, citing rapid changes in the relative proportions of body parts during childhood. While EPA developed regression models for adult body parts, they did not do so for children, citing limited data across the range of 1 to 18 years of age (EPA, 1997). The sample sizes for children's body parts range from 6 to 23 as compared to 6 to 52 for adult body parts used by EPA to develop regression models. Although these sample sizes are similar, there are insufficient data to determine whether separate models should be used for different ages under the age of 18.

MDEP used the limited data set for children to develop "median" surface areas for body parts in children by applying the average proportion measured for the surface area for each body part at each year of age to median total surface area at that age (MDEP, 1995). When no data were available for a year of age, data from younger years were used. Although this approach provides a central value for surface area, assuming that the population used to measure surface area is typical of the median contemporary population, it cannot be used to characterize variability over the entire population. The proportion of body part surface areas to total body surface area is not constant for a given age group, but is dependent on height and/or weight. Also, there is no convenient method to quantify the uncertainty associated with this approach.

All available data for surface area of body parts in children aged 1 to 18 (EPA, 1985) were regressed against body weight. For individual children with leg or arm surface area measurements but no forearm or lower leg measurements, forearm and lower leg surface areas were assumed to be a constant proportion of the whole arm and leg surface areas. The proportions were the mean proportions calculated for all children with both arm and forearm or both leg and lower leg measurements. There are no readily apparent differences in the relationship between weight and body part surface areas between male and female children or older and younger children. Therefore, one equation was derived for each body part and applied to all children irrespective of age or gender of the form, $SA_x = a_x * BW + b_x$, where x is the body part and a and b are the slope and intercept of each regression (see Addendum 6.1).

These regression models are subject to uncertainty, particularly given that the age range includes growing years. Therefore, uncertainty in the regression models was included in defining p-box bounds. The sample size used to determine regression error for children is the actual number of measurements available for each body part, not including those calculated from larger proportions of the body. Regressions of surface area data against height were also performed and in every case the r^2 value was higher for the body weight regressions (see Addendum 6.1). Bivariate regressions did not provide substantially better results for any body part.

This parameter will not be repeated in the subsequent scenario-specific discussions.

6.5.1.9.5 Proportion of Year Dressed for Warm Weather

The soil adherence factors for forearms, lower legs, and feet were weighted by the proportion of the yearly exposure that an individual would be assumed to be dressed for warm weather. For all scenarios other than hunter and sediment, it was assumed that direct contact exposure occurs during the 7 months (30 weeks) of the year when the ground is not typically snow covered or frozen. Consequently, the proportion of this time dressed for warm weather (S) was incorporated into the MCA analog and PBA analyses. In the MCA analog, S was defined as a triangular distribution with a minimum of 2/7, a mode of 5/7, and a maximum of 1 for all age groups. In the PBA, S was defined as a p-box with the same minimum, maximum, and mode as the triangular distribution. These input values are based on the assumption that receptors are dressed for warm weather at least 2 out of 7 months each year, assuming that they are equally likely to visit the area during warmer and cooler weather. Some receptors may preferentially visit the site on days when they are dressed for warm weather; therefore the maximum value of S is 1. For the hunter scenario, S was set to zero because hunting season does not occur during warmer months. For the sediment exposure scenario, S was set to 1 because exposure is assumed to occur only during warmer months.

This parameter will not be repeated in the subsequent scenario-specific discussions.

6.5.1.9.6 Dermal Adherence Factor

Dermal adherence factors are available from field studies of children and adults engaged in a variety of activities:

Adults
- Groundskeeping
- Gardening
- Pipe laying
- Construction
- Heavy equipment operation
- Utility work
- Farming
- Archaeology
- Tae kwon do
- Reed gathering
- Irrigation system installation

Children
- Playing in wet soil
- Playing in dry soil
- Playing at daycare facilities
- Playing indoors
- Playing in mud
- Soccer
- Rugby

For example, AFs for "children playing in dry soil" were used in the young child scenario to define the MCA analog input for X. A broader range of AFs were used to define possible AFs for this scenario given uncertainty about this input, including AFs for "daycare children," "children playing in dry soil," and "children playing in wet soil."

EPA (2001b) summarized sets of body part-specific AFs associated with each of these activities. It is expected that there is variability in the amount of skin covered by clothing between individuals and with variability in weather conditions throughout the year. Therefore, as in the point estimate risk characterization, two levels of clothing coverage were selected, roughly corresponding to warmer and cooler weather. During cooler weather, receptors are expected to wear long pants and long sleeves, leaving only the face and hands exposed. During warmer weather, receptors are assumed to wear short pants and sleeves, with shoes dependent on the scenario, leaving the face, hands, forearms, lower legs and (in certain scenarios) feet exposed. This assessment incorporates the assumptions about exposed body parts that were used in the point estimate risk characterization.

Sets of AFs for one or two activities summarized by EPA (2001b) were selected to represent "best estimate" AFs for each scenario, based on their similarity with respect to type of activity and intensity of exposure. Variation within these sets of AFs defines the variability in adherence factors for a single scenario using an empirical distribution function within Crystal Ball®. Uncertainty in AF was accounted for by including a wider range of AFs that correspond to all scenarios that might be applicable to the scenario. Specifically, the minimum, 5^{th} percentile, 95^{th} percentile, and maximum were used to define uncertainty in AFs as described in Section 6.5.1.9. The AFs selected for each scenario are described below.

6.5.2 Scenario-Specific Input Values

6.5.2.1 Exposure Inputs for the General Recreational Scenario

The general recreation exposure scenario consists of children (both the young and older groups) and adults who might come into contact with soil during general recreational activities such as walking, hiking, running, horseback riding, bird watching, upland hunting (not including waterfowl hunting), wild crop gathering, camping, educational field trips, ball playing, and other activities in the floodplain (e.g., adolescent gatherings).

6.5.2.1.1 Dermal Adherence Factor

The general recreational scenario represents a broad range of activities. AFs for soccer and rugby were selected to represent a best estimate of soil exposure for adults and older children. AFs for groundskeepers and gardeners were selected for the PBA. Of the limited number of activities for which AF data are available, the soccer and rugby players most closely simulate soil contact that might occur during general recreation activities. People can engage in an even wider range of activities, some of which might involve more intensive soil exposures. Therefore, AFs for groundskeepers and gardeners were selected for use in the PBA to account for this uncertainty. These AFs are possible but less likely than the soccer and rugby player AFs.

Although groundskeepers and gardeners engage in different activities than would be expected for general recreation in the floodplain, they are representative of activities with similar intensities of soil exposure, such as hiking, wild crop gathering, and other activities. For the young child scenario, AFs for children playing in dry soil were selected as the best estimate of soil exposure, but this activity does not include AFs for feet. Therefore, AFs for feet were estimated using AFs for children in day care, which includes time spent outdoors. AFs for children playing in dry soil, in wet soil, and at day care centers with part of the time spent outdoors were included in the PBA for all body parts except feet. AFs for feet for children playing at day care centers and reed gatherers were used in the PBA.

6.5.2.1.2 Exposure Frequency

The EFs for the general recreation exposure scenario were EA-specific and were based on field observations by EPA, the results of the GE Housatonic River Floodplain User Survey (TER, 2003), nonresidential wildlife watching frequencies (USFWS, 2001) and/or professional judgment. This generic assessment of variability and uncertainty incorporates the high-use EFs defined in Section 4. In the MCA analog, EFs for the adult, older child, and young child general recreation scenarios were defined as triangular distributions, with a minimum of 1, a mode of 30 days per year, and a maximum of 90 days per year. This mode and maximum represent the CTE and RME high-use EFs, respectively. For the PBA, EFs were defined as a p-box with a minimum of 1, mode of 30, and maximum of 120 days per year. The maximum assumes that the receptor engages in general recreation activities 4 days per week instead of the 3-day-per-week assumption upon which the RME EF is based.

This upper bound for the p-box of 120 days per year is reasonable given results from a U.S. Fish and Wildlife Service national survey (USFWS, 2001) that quantifies participation in wildlife-associated recreation including hunting, fishing, and wildlife watching to determine demand for wildlife-associated recreation. The 2001 Survey provides data for the Commonwealth of Massachusetts as a whole, including estimates of the number of Massachusetts residents (older than 16) who fish, hunt, and engage in nonconsumptive wildlife-associated activities such as observing, feeding, and photographing birds and other animals. The average Massachusetts wildlife watcher participates in this activity 27 days per year at locations more than 1 mile from their home. Those who observe wild birds around their homes (within 1 mile of their residence) typically do so 130 days/year.

6.5.2.1.3 Exposure Duration

The exposure duration input variable was used only in the cancer exposure model calculations. Young child and older child EDs were described previously in Section 6.5.1.4. As part of the Housatonic River Area PCB Exposure Assessment Study, MDPH (1997, 2001) asked participants "Can you estimate how long you have lived in the Housatonic River Area?" MDPH reported the summary statistics of the 1,882 respondents to this question as follows (rounded to the nearest whole number of years):

mean = 31
25th percentile = 12
50th percentile (median) = 29
75th percentile = 48
90th percentile = 65
95th percentile = 73
maximum = 95 (MDPH, 2001)

These data were used to define adult ED in the MCA analog analysis after fitting to an exponential distribution as shown in Figure 6-3, and truncating at 52 years so that the total exposure duration from childhood to adulthood does not exceed 70 years. The data fit the exponential distribution reasonably well, and this distribution is often used to describe events occurring at random in time (Cullen and Frey, 1999), such as time living in one area. In the

PBA, the same exponential distribution was used, but with the mean defined by a 95% confidence interval.

6.5.2.2 Exposure Inputs for the All Terrain Vehicle (ATV)/Dirt and Mountain Bike Riding Scenario

The ATV/dirt and mountain bike riding exposure scenario consists of older children who come into contact with floodplain soil while riding ATVs, dirt bikes, or mountain bikes.

6.5.2.2.1 Dermal Adherence Factor

The ATV older child was assumed to wear shoes during both warm and cool weather, so that there is no exposure to feet. Relatively high levels of soil exposure are expected for this scenario; therefore, AFs for construction work were selected to represent a best estimate of soil exposure. AFs for heavy equipment operation were selected for use in the PBA, including AFs specific to face, hands, and forearms.

6.5.2.2.2 Exposure Frequency

The older child was assumed to ride ATVs, dirt, and/or mountain bikes 90 days/year for the RME case and 30 days/year for the CTE. The RME and CTE EFs equate to 3 days/week and 1 day/week, respectively, for the 30-week period. These EFs for the ATV/dirt and mountain bike riders were based on professional judgment. In the MCA analog analysis, EF was defined with a triangular distribution with a minimum of 1, mode of 30, and maximum of 90. In the PBA, EF was defined more broadly as a p-box with a minimum of 1, mode of 30, and maximum of 120 to reflect a maximum EF of 4 times per week for 30 weeks.

6.5.2.3 Exposure Inputs for the Angler Scenario

The angler scenario evaluated older children and adults who fish from certain areas along the riverbank. It was assumed that the angler comes into contact with soil, and that a 6-meter-wide area of floodplain along the riverbank was the area most routinely contacted by anglers.

6.5.2.3.1 Dermal Adherence Factor

Anglers were assumed to wear sandals or no footwear during warm weather, so that their feet are exposed. Relatively high levels of soil exposure are expected for this scenario due to wet conditions. AFs for children playing in wet soil were selected to represent a best estimate of soil exposure for adults and older child exposed on their faces, hands, forearms, and lower legs. AFs for gardeners and reed gatherers were combined for a best estimate of exposure to feet. AFs for gardeners and reed gatherers were also selected for use in the PBA for the remaining body parts.

6.5.2.3.2 Exposure Frequency

The Maine Angler Study (Ebert et al., 1993) provided frequency of fishing trips to rivers and streams based on 1-year recall period. These data were used to define EFs for adult and older child anglers. Percentiles and summary statistics for this distribution are provided in Table 6-8. In the MCA analog, EF was defined as a precise distribution with the listed percentile values. In the PBA, each percentile of this EF distribution was widened by ±10% to approximate uncertainty due to measurement error and extrapolation from Maine to Massachusetts anglers.

6.5.2.3.3 Exposure Duration

The exposure duration input variable was used only in the cancer exposure model calculations. The exposure duration inputs for adult anglers were derived from studies and data presented in Section 4.5.2.6 of HHRA Volume IV. In the PBA, a p-box was defined with the minimum, maximum, and 95% confidence intervals around the mean and standard deviation. The p-box was truncated at 52 years given the 70-year averaging time used in the cancer model, per EPA guidance (EPA, 2001a), assuming an adult age range of 18 to 70 years. Confidence intervals for the mean were calculated using the central limit theorem method, and confidence limits around the standard deviation were calculated using the method of shortest unbiased confidence intervals (Sokal and Rohlf, 1981). For the MCA analog analysis, a lognormal distribution was derived from data provided by the MDPH (2001) on exposure duration for respondents who had ever consumed freshwater fish from the Housatonic and truncated at 52 years.

6.5.2.4 Exposure Inputs for the Waterfowl Hunter Scenario

The waterfowl hunter scenario evaluated older children and adults who hunt ducks and other waterfowl. It was assumed that the waterfowl hunter comes into contact with soil, and that a 6-meter-wide area of floodplain along the riverbank and the areas near duck blinds were the areas most routinely contacted by waterfowl hunters.

6.5.2.4.1 Dermal Adherence Factor

Waterfowl hunters were assumed to wear waders and long sleeves, so that only their face and hands are exposed. Relatively high levels of soil exposure are expected for this scenario due to wet conditions. AFs for children playing in wet soil were selected to represent a best estimate of soil exposure for both adults and older children exposure of face and hands. AFs for gardeners and reed gatherers were also selected for use in the PBA.

6.5.2.4.2 Exposure Frequency

Exposure frequencies for waterfowl hunters are based on data from the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (USFWS, 2001). In this survey, migratory bird hunters reported hunting 7 days per year on average, with a 95th percentile and maximum EF of 14 days per year. These data were used to define EF for adult and older child wildlife hunters. In the MCA analog, EF was defined with percentile data from USFWS (2001). In the PBA, EF was defined as a p-box with a minimum of 1, mode of 7, and maximum of 14.

6.5.2.4.3 Exposure Duration

The exposure duration input variable was used only in the cancer exposure model calculations. Exposure duration distributions and p-boxes used for the waterfowl exposure assessment were identical to those used in the angler scenario (see Section 6.5.2.3.3).

6.5.2.5 Exposure Inputs for the Recreational Canoeist/Boater Scenario

The recreational canoeist/boater exposure scenario consists of adults and older children who use certain areas along the river as launching points for recreational outings.

6.5.2.5.1 Dermal Adherence Factor

Recreational canoeist/boaters were assumed to wear sandals or no footwear during warm weather, so that their feet are exposed. Relatively high levels of soil exposure are expected for this scenario due to wet conditions. AFs for children playing in wet soil were selected to represent a best estimate of soil exposure for both adults and older children for exposure of face, hands, forearms, and lower legs. AFs for gardeners and reed gatherers were combined for a best estimate of exposure to feet. AFs for gardeners and reed gatherers were also selected for use in the PBA for the remaining body parts.

6.5.2.5.2 Exposure Frequency

In the MCA analog, EFs for the adult and older child canoeist/boater were defined as triangular distributions, with a minimum of 1, a mode of 30 days per year, and a maximum of 60 days per year. This mode and maximum represent the CTE and RME high use EFs, respectively. For the PBA, EFs were defined as a p-box with a minimum of 1, mode of 30, and maximum of 90 days per year. The maximum assumes that the receptor engages in general recreation activities 3 days per week instead of the 2-day-per-week assumption upon which the RME EF is based.

6.5.2.5.3 Exposure Duration

The canoeist/boater ED was set equal to the ED for general recreation (see Section 6.5.2.1.3).

6.5.2.6 Exposure Inputs for the Sediment Exposure Scenario

A single sediment exposure scenario was developed to evaluate sediment exposure from a variety of different activities that could result in contact with sediment such as launching canoes, wading, swimming, fishing, waterfowl hunting, and other related activities.

6.5.2.6.1 Dermal Adherence Factor

Adults and children exposed to sediment were assumed to wear sandals or no footwear during warm weather, so that their feet are exposed. Relatively high levels of soil exposure are expected for this scenario due to wet conditions. AFs for children playing in wet soil were selected to represent a best estimate of soil exposure for both adults and older children for exposure of face, hands, forearms, and lower legs. AFs for gardeners and reed gatherers were combined for a best estimate of exposure to feet. AFs for gardeners and reed gatherers were also selected for use in the PBA for the remaining body parts.

6.5.2.6.2 Exposure Frequency

Exposure occurs only during the warmest 3 months of the year. In the MCA analog, EFs for the adult and older child canoeist/boater were defined as triangular distributions, with a minimum of 1, a mode of 12 days per year, and a maximum of 36 days per year. This mode and maximum represent the CTE and RME high use EFs, respectively. For the PBA, EFs were defined as a p-box with a minimum of 1, mode of 12, and maximum of 48 days per year. The maximum assumes that the receptor engages in general recreation activities 4 days per week instead of the 3-day-per-week assumption upon which the RME EF is based.

6.5.2.6.3 Exposure Duration

The canoeist/boater ED was set equal to the ED for general recreation (see Section 6.5.2.1.3).

6.6 RISK CHARACTERIZATION

Cancer risk and noncancer hazard results are summarized in tabular format in Tables 6-16 and 6-17, and each risk distribution is presented in figures. The RME, or highest exposure reasonably likely to occur (EPA, 1989), is generally between the 90^{th} and 99.9^{th} percentile of the probabilistic risk distribution. Three percentiles, 90^{th}, 95^{th} and 99^{th}, in this RME range are presented in Tables 6-16 and 6-17.

6.6.1 Cancer Risks for Recreational Exposure Scenarios

Cancer risks were calculated for the MCA analog analysis by multiplying exposure distributions by the Cancer Slope Factor (CSF). The CSF used for tPCBs was 2 $(mg/kg\text{-}d)^{-1}$. As in the first-tier point estimate approach, the cancer risks that result from this calculation are unitless, and represent excess (greater than background) cancer risks over a 70-year lifetime.

Table 6-16 shows cancer risks by selected percentiles. Each cell of the table shows the results of the MCA analog analysis (MCA), dependency bounds analysis (DBA, in brackets), and probability bounds analysis (PBA, in brackets). For example, for the 95th percentile adult angler, the MCA analog analysis resulted in a cancer risk of 6E-07, the DBA resulted in a cancer risk in the interval [1E-07, 2E-06], and the PBA resulted in a cancer risk in the interval [9E-10, 2E-05]. The DBA indicates the range of possible cancer risk values given any of the possible dependencies between variables in the risk model noted in Table 6-1. The PBA indicates the range of possible cancer risk values given both the dependencies allowed for by the dependency bounds analysis and the uncertainty regarding the magnitudes and precise distributional shapes of the various input distributions.

Cancer risk is better displayed graphically because all percentiles can be shown. Figures 6-4 through 6-15 show the cancer risks from tPCBs in cumulative exceedance form for the 12 recreational scenarios. Because exceedance probabilities are presented as a complementary cumulative plot, the risk percentiles greater than or equal to the 90th percentile are found by following a horizontal line from 0.1 on the y-axis to the MCA risk distribution or probability bounds line and reading the corresponding risk on the x-axis. In Figure 6-4, for example, the probability bounds around the risk at the 90th percentile (0.1 on the y-axis) range from about 2E-09 to 2E-05. This means that 10% of the population is exposed to risks between 2E-09 and 2E-05. Section 8, Figure 8-1, in Appendix C (Volume IV) and the accompanying text provide a more detailed discussion of interpreting exposure and risk figures.

The figures show distributions for exposure calculated with the MCA analog (gray line), the DBA (narrow black line), and the PBA (thick black line). The MCA analog provides an estimate of one of the exposure distributions that is possible. The dependency bounds are upper and lower bounds on all exposure distributions that could result from relaxing the assumption of strict independence between input variables incorporated in the MCA analog analyses. The PBA relaxes these same dependency assumptions and allows for uncertainty regarding the precise magnitude and distributional form of the input distributions. Any exposure distribution that can be plotted between the probability bounds is consistent with the input data.

6.6.2 Noncancer Hazard Indices for Recreational Exposure Scenarios

Hazard indices (HIs) for tPCBs were calculated for the MCA analog and PBA by dividing the exposure distributions or p-boxes by the Reference Dose (RfD). An RfD of 0.00002 (2E-05) mg/kg-d was used. Table 6-17 gives the resulting HIs for selected percentiles. Each cell of the table shows the results of the MCA analog analysis (MCA), dependency bounds analysis (DBA, in brackets), and probability bounds analysis (PBA, in brackets). The PBA indicates the range of values that the HIs could take given the uncertainty regarding the magnitudes and precise distributional shapes of the various input distributions. Figures 6-16 through 6-27 show HI distributions for the 12 recreational scenarios.

6.7 SENSITIVITY ANALYSES

Analyses of the sensitivity of results to variability and uncertainty in MCA analog and PBA model inputs are presented below for the general recreation scenarios. These scenarios were chosen for the sensitivity analysis because the older child and adult general recreational receptors were the most frequently evaluated receptors in the point estimate risk characterization. Given the nature of the areas, the types of recreational activities, and the location of many of the exposure areas, the young child was only included at those areas where there are well-defined trails that are frequently used, such as designated nature areas and parks, or where young children were observed by EPA and/or GE personnel. The adult was most frequently evaluated under the general recreation scenario because the exposure potential at the majority of the exposure areas (EAs) results from activities in which adults are more likely to participate than children.

An input variable contributes significantly to uncertainty in the output risk distribution if it is both highly uncertain and its uncertainty propagates through the algebraic risk equation to the model output (i.e., risk estimate). Changes to the distribution or to the characterization of the uncertainty for a variable with a high sensitivity could have a large impact on the risk estimate, whereas even large changes to the variability or uncertainty of a variable with low sensitivity may have a minimal impact on the final result. Information from sensitivity analysis can be important when interpreting the reliability of model results and making risk management decisions. EPA guidance on conducting probabilistic risk assessments (EPA, 2001a, Appendix

A) and Attachment 5 of HHRA Volume I include more-detailed discussions of sensitivity analyses.

For the PBA, to ascertain the effect of uncertainty in a variable on the overall uncertainty in the model, each variable containing uncertainty was “pinched,” in turn, to the precise probability distribution used in the MC analog analysis. The area between the resulting probability bounds (a measure of uncertainty) was divided by the area between the probability bounds from the un-pinched (“base case,” see Attachment 5 of HHRA Volume I) model result to determine the proportional effect of uncertainty in each variable on the model. Because many of the variables in the probability bounds analysis contain both variability and uncertainty, each variable in the probability bounds analysis was next replaced, in turn, by a point estimate, and the ratio of the areas between the bounds was again calculated. For each of these relative uncertainty analyses, the results were expressed as 1 minus the computed ratio and converted to a percentage. This allows the value to be interpreted as a measure of the importance of the uncertainty and variability of each variable to the uncertainty in result. Attachment 5 of the HHRA discusses these probability bounds sensitivity analysis methods in more detail and provides several numerical examples.

The results of the sensitivity analyses are presented in Tables 6-18 and 6-19 for the cancer and noncancer models, respectively. Sensitivity analyses were conducted assuming a tPCB concentration of 1 mg/kg in soil or sediment. When each variable was “pinched” to a point estimate, CTE values were used. Also, “high use” exposure frequency was assumed. The contribution of each variable to uncertainty is expressed to percentages; however, the percentages for all of the variables on each table need not sum to 100%. Rather, the percentages represent the relative contribution of each variable to uncertainty or uncertainty and variability.

The combined variable X, representing body part-specific soil adherence factors, body part exposure, surface areas of exposed body parts, and body weight, is the largest contributor to variability and uncertainty in both cancer and noncancer results. For the adult general recreation scenario, exposure duration is the next highest contributor to variability and uncertainty. Exposure frequency and dermal absorption factor are also large contributors to variability and uncertainty for all general recreation scenarios.

Sensitivity analyses for the inputs that make up "X" were performed for the general recreation scenarios by calculating rank correlation coefficients using Crystal Ball® software. Figure 6-28 shows the results of the sensitivity analyses for variability in the MCAs for each age group. In this figure, inputs are designated as follows:

- $AF_{body\ part}$ – body part-specific dermal adherence factor
- S - proportion of the year dressed for warmer weather
- BW - body weight (followed by F or M to represent male or female, respectively)
- Gender – male or female

The AF for lower legs was the greatest contributor to variability in "X" for all three age groups. AFs for body parts other than the face and for the proportion of time dressed for warm weather (S) were also important contributors to variability for all age groups. Note that not all parameters listed in Figure 6-28 are applicable to all age groups. For adults, surface area was calculated using both body weight and height separately for each gender. For children, surface area was calculated from one unisex body weight distribution.

Figure 6-29 shows the results of the sensitivity analyses for variability plus uncertainty for each age group. The AFs are based on the data from the wider range of field studies for each scenario. The AF for hands was the greatest contributor to variability plus uncertainty in "X" for all three age groups. AFs for body parts other than the face and the proportion of time dressed for warm weather (S) were also important contributors to variability plus uncertainty for all age groups. Regression error (RE) associated with estimating surface area for different body parts had little influence on results. Note that not all parameters listed in Figure 6-29 are applicable to all age groups. For adults, surface area was calculated using both body weight and height separately for each gender. For children, surface area was calculated from one unisex body weight distribution.

6.8 SOURCES OF UNCERTAINTY

Tables 6-20 through 6-21 summarize the major assumptions leading to uncertainty in the risk and hazard distribution results used by the MCA analog and PBA analyses for recreational exposure scenarios. The assumptions marked with an "O" are expected to be optimistic or nonprotective assumptions. This means that such an assumption could lead to exposures and risk estimates that are likely to be no larger than the true exposures to the receptor populations, and may be lower. In the case of the bounding analyses, it means that the uncertainty is, if anything, understated. The assumptions in the table marked with a "C" are expected to be conservative or protective. Such an assumption could overestimate risks or the uncertainty about the risks. Those assumptions marked with a "?" have mixed or uncertain bias consequences for the analyses. In light of the sensitivity analyses presented in the previous section, assumptions related to the adherence factors (AF), exposure frequency (EF), exposure duration (ED) and dermal absorption (ABS) are of particular interest.

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SECTION 6

TABLES

Table 6-1

Dependencies Modeled with Dependency Bounds Analysis

	X	ABS	IR	FI	EF	ED	BW	AT
X	x	x	x			x	x	
ABS	x	x						
IR	x		x					
FI				x				
EF					X			
ED	x					x		
BW	x						x	
AT								x

X – variable that incorporates body surface area (SA), adherence factor (AF), body weight (BW), and the proportion of the year dressed for warm weather (S) to account for correlations among these inputs.

ABS – dermal absorption efficiency

IR – soil or sediment ingestion rate

FI – fraction of exposure from the floodplain

EF – exposure frequency

ED – exposure duration

BW – body weight

AT – averaging time

Table 6-2

Summary of Body Weight and Height Distributions[a]

Percentile	Young Child	Older Child		Adult (51.5% Female)				
		Hunter	All others	Combined	Female (r=0.44) [b]		Male (r=0.24) [b]	
	BW (kg)	BW (kg)	BW (kg)	BW (kg)	Height (cm)	BW (kg)	Height (cm)	BW (kg)
Min	7.1	26.8	16.3	34.8	132	34.8	142	38.4
0.01	9.1	33.9	20.3	45.0	147	42.9	159	53.9
0.05	10.3	40.1	23.4	50.9	152	48.4	164	60.0
0.10	11.2	44.1	26.4	54.8	154	51.2	167	63.8
0.15	11.9	46.8	28.8	57.7	156	53.5	169	66.4
0.20	12.5	48.9	31.2	60.0	157	55.6	170	68.6
0.25	13.1	50.7	33.8	62.6	158	57.3	171	71.1
0.30	13.7	52.1	36.4	64.8	159	58.8	172	73.2
0.35	14.4	53.6	39.9	67.2	160	60.5	173	74.9
0.40	15.0	54.8	43.3	69.3	161	62.4	174	76.6
0.45	15.5	56.7	46.2	71.7	161	64.2	175	78.4
0.50	16.0	58.1	48.9	74.1	162	65.9	176	80.1
0.55	16.7	60.1	51.1	76.1	163	68.1	177	82.0
0.60	17.3	62.1	53.3	78.1	164	70.4	178	83.7
0.65	17.9	64.1	55.4	80.4	165	72.9	179	85.8
0.70	18.6	66.1	58.1	83.0	166	75.6	180	88.2
0.75	19.4	68.8	61.1	86.1	167	78.4	181	91.1
0.80	20.3	71.1	64.5	89.6	168	81.9	182	94.4
0.85	21.3	75.1	68.5	94.0	170	87.3	183	98.1
0.90	22.8	80.2	73.5	99.5	171	93.4	186	102.9
0.95	25.3	89.0	81.6	107.2	174	103.5	188	111.2
0.99	35.2	115.3	106.9	132.6	178	126.1	192	138.7
Max	65.6	169.2	169.2	241.8	189	213.5	207	241.8

Notes

[a]Body weight and height distributions were developed using weighted body weight and height data from the NHANES III dataset.

[b]Correlation coefficients (r) between height and body weight for females and males were included in the Monte Carlo simulations for the purpose of calculating body part surface areas. Correlation coefficients of the statistically weighted height and body weight data were calculated using Statistica software.

Reference:

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Table 6-3
Monte Carlo Analysis Analog and Probability Bounds Analysis Inputs for the Combined Variable X

		0%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Adult Recreation	PBA	0.02 - 35					0.21 - 35					0.21 - 35					0.21 - 35					0.21 - 104
	MCA	0.14	0.94	1.30	1.67	2.03	2.37	2.73	3.11	3.54	4.03	4.54	5.12	5.71	6.31	6.95	7.71	8.69	10.07	12.31	16.25	44.70
Older Child Recreation	PBA	0.04 - 52					0.32 - 52					0.32 - 52					0.32 - 52					0.32 - 121
	MCA	0.19	1.55	2.12	2.67	3.21	3.70	4.20	4.74	5.38	6.09	6.88	7.78	8.67	9.57	10.51	11.60	12.98	15.00	18.24	24.06	64.96
Young Child Recreation	PBA	0.42 - 245					0.73 - 245					0.73 - 245					0.73 - 245					0.73 - 245
	MCA	0.82	2.93	3.93	4.55	5.02	5.46	5.85	6.23	6.62	7.02	7.44	7.87	8.37	8.94	9.63	10.58	12.05	14.60	17.23	19.91	33.31
Older Child ATV + Bike	PBA	3.1 - 35					3.3 - 35					3.3 - 35					3.3 - 35					3.3 - 50
	MCA	4.14	6.06	6.63	7.04	7.38	7.74	8.05	8.35	8.67	8.99	9.33	9.67	10.01	10.39	10.81	11.25	11.72	12.30	12.96	13.92	19.41
Adult Angler	PBA	0.34 - 172					0.89 - 172					0.89 - 172					0.89 - 172					0.89 - 311
	MCA	0.77	4.36	6.52	8.72	10.88	13.05	15.23	17.53	19.89	22.41	25.66	29.92	36.25	45.24	54.43	61.05	66.36	72.02	79.94	95.46	215.92
Older Child Angler	PBA	0.95 - 262					1.4 - 262					1.4 - 262					1.4 - 262					1.4 - 350
	MCA	1.13	6.64	10.06	13.67	17.05	20.35	23.78	27.24	30.59	34.38	39.27	45.71	54.91	70.27	86.62	95.09	102.08	110.03	121.02	143.39	288.67
Adult Hunter	PBA	0.23 - 68					0.66 - 68					0.66 - 68					0.66 - 68					0.66 - 94
	MCA	0.25	0.51	1.55	1.82	2.16	3.09	3.58	3.91	6.34	7.64	8.76	10.67	12.83	16.38	18.07	19.96	51.19	56.80	61.05	65.63	92.64
Older Child Hunter	PBA	0.62 - 107					0.97 - 107					0.97 - 107					0.97 - 107					0.97 - 127
	MCA	0.62	0.76	2.38	2.57	3.12	5.04	5.28	5.49	10.29	10.88	12.71	16.76	17.76	25.35	26.05	26.85	79.72	84.84	89.03	92.11	107.07
Adult Canoer	PBA	0.34 - 172					0.89 - 172					0.89 - 172					0.89 - 172					0.89 - 311
	MCA	0.77	4.36	6.52	8.72	10.88	13.05	15.23	17.53	19.89	22.41	25.66	29.92	36.25	45.24	54.43	61.05	66.36	72.02	79.94	95.46	215.92
Older Child Canoer	PBA	0.95 - 262					1.4 - 262					1.4 - 262					1.4 - 262					1.4 - 350
	MCA	1.13	6.64	10.06	13.67	17.05	20.35	23.78	27.24	30.59	34.38	39.27	45.71	54.91	70.27	86.62	95.09	102.08	110.03	121.02	143.39	288.67
Adult Sediment	PBA	0.60 - 172					1.5 - 172					1.5 - 172					1.5 - 172					1.5 - 311
	MCA	1.05	5.55	8.73	11.26	14.17	17.10	19.61	22.18	25.09	28.97	33.72	40.39	50.18	58.74	65.01	71.53	78.58	86.09	97.00	117.88	226.46
Older Child Sediment	PBA	1.8 - 262					2.3 - 262					2.3 - 262					2.3 - 262					2.3 - 350
	MCA	1.86	8.31	13.40	17.20	21.46	26.84	30.32	34.14	38.27	43.43	50.77	60.78	74.79	90.64	100.23	110.97	122.44	132.94	148.66	180.57	313.27

Notes:
PBA - probability bounds analysis
MCA - monte carlo analysis

Table 6-4

Summary of Inputs for the General Adult Recreation Exposure Assessment

			Monte Carlo Analog		Probability Bounds Analysis	
Inputs to Exposure Pathways	**Symbol**	**Units**	**Distribution Type**	**Values**	**Distribution Type**	**Values**
General Exposure Inputs						
Averaging Time (Cancer)	AT	days	Point Estimate	25,500	Point Estimate	25,500
Conversion Factor						
Cancer	CF_c	kg/mg	-	10^{-6}	-	10^{-6}
Non-cancer	CF_{nc}	(kg-yr)/(mg-day)	-	$10^{-6}/365$	-	$10^{-6}/365$
Contaminant concentration in soil	CS	mg/kg	Point Estimate	1 (assumed)	Point Estimate	1 (assumed)
Exposure Duration (Cancer)	ED	year	Truncated Exponential	mean = 31; truncated at 52 (i.e. 70-18)	Pbox (truncated exponential)	exponential with 95% confidence interval for mean, truncated at 52
Exposure Frequency	EF	days/year	Triangular	1, 30, 90	Pbox (minmaxmode)	1, 30, 120
Dermal Pathway Inputs						
Dermal absorption factor	ABS	unitless	Point Estimate	0.14	Pbox (interval)	0.06; 0.41
Soil adherence factor weighted by exposed body parts, skin surface areas, and body weight	X	mg/kg-day	Percentiles	Determined Using Crystal Ball	Pbox (interval)	P-bounds determined using estimated minimum and maximum values
Ingestion Pathway Inputs						
Body weight	bw	kg	Percentiles	see Table 6-2	Percentiles	see Table 6-2
Proportion of Ingestion from the floodplain	FI	unitless	Uniform	0.5; 1	Pbox (interval)	0.5; 1
Soil Ingestion Rate	IR	mg/day	Triangular	0, 50, 100	Pbox (minmaxmode)	0, 50, 300
Inputs for X						
Body weight	BW*	kg	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Height	H*	cm	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Proportion of yearly exposure dressed for warm weather	S	unitless	Triangular	2/7; 5/7;1	NA	2/7; 1
Soil Adherence Factor for body part	AF_x	-	-	Field Studies	-	Field Studies
Face	AF_{face}	mg/cm^2	Empirical	Soccer; Rugby; all data (range: 0.006 to 0.2)	NA	Groundskeeper; Soccer; Rugby; Gardener; (min 0.001; 5%-tile 0.002; 95%-tile 0.091; max 0.2)
Hands	AF_{hands}	mg/cm^2	Empirical	Soccer; Rugby; all data (range: 0.001 to 1.1)	NA	Groundskeeper; Soccer; Rugby; Gardener; (min 0.001; 5%-tile 0.01; 95%-tile 0.45; max 2.1)
Forearms	$AF_{forearms}$	mg/cm^2	Empirical	Soccer; Rugby; data (range: 0.002 to 0.45)	NA	Groundskeeper; Soccer; Rugby; Gardener; (min 0.001; 5%-tile 0.002; 95%-tile 0.38; max 0.45)
Lower legs	$AF_{lowerlegs}$	mg/cm^2	Empirical	Soccer; Rugby; all data (range: 0.003 to 0.73)	NA	Groundskeeper; Soccer; Rugby; Gardener; (min 0.0003; 5%-tile 0.001; 95%-tile 0.35; max 0.73)
Feet	AF_{feet}	mg/cm^2	Empirical	No Exposure	NA	Groundskeeper; Soccer; Rugby; Gardener; (min 0; 5%-tile 0.007; 95%-tile 0.39; max 0.44)
Surface areas of body parts	SA^*_x	cm^2	-	Calculated for each body weight and height realization: $SA^*_x = aBW^bH^c$	-	same as Monte Carlo Analog
Head	SA^*_{head}	cm^2	NA	female (a=0.0256, b=0.124, c=0.189); male (a=0.0492, b=0.339, c=-0.095)	NA	same as Monte Carlo Analog
Hands	SA^*_{hands}	cm^2	NA	female (a=0.131, b=0.412, c=0.0274); male (a=0.0257, b=0.573, c= -0.218)	NA	same as Monte Carlo Analog
Forearms	$SA^*_{forearms}$	cm^2	NA	unisex (a=0.326, b=0.858, c=-0.895)	NA	same as Monte Carlo Analog
Lower legs	$SA^*_{lowerlegs}$	cm^2	NA	unisex (a=0.000276, b=0.416, c=0.973)	NA	same as Monte Carlo Analog
Feet	SA^*_{feet}	cm^2	NA	unisex (a=0.000618, b=0.372, c=0.725)	NA	same as Monte Carlo Analog

Table 6-5

Summary of Inputs for the General Older Child Recreation Exposure Assessment

			Monte Carlo Analog		Probability Bounds Analysis	
Inputs to Exposure Pathways	**Symbol**	**Units**	**Distribution Type**	**Values**	**Distribution Type**	**Values**
General Exposure Inputs						
Averaging Time (Cancer)	AT	days	Point Estimate	25,500	Point Estimate	25,500
Conversion Factor						
Cancer	CF_c	kg/mg	-	10^{-6}	-	10^{-6}
Non-cancer	CF_{nc}	(kg-yr)/(mg-day)	-	10^{-6}/365	-	10^{-6}/365
Contaminant concentration in soil	CS	mg/kg	Point Estimate	1 (assumed)	Point Estimate	1 (assumed)
Exposure Duration (Cancer)	ED	year	Uniform	1; 12	Pbox (interval)	1; 12
Exposure Frequency	EF	days/year	Triangular	1, 30, 90	Pbox (minmaxmode)	1, 30, 120
Dermal Pathway Inputs						
Dermal absorption factor	ABS	unitless	Point Estimate	0.14	Pbox (interval)	.06; .41
Soil adherence factor weighted by exposed body parts, skin surface areas, and body weight	X	mg/kg-day	Percentiles	Determined Using Crystal Ball	Pbox (interval)	P-bounds determined using estimated minimum and maximum values
Ingestion Pathway Inputs						
Body weight	bw	kg	Percentiles	see Table 6-2	Percentiles	see Table 6-2
Proportion of Ingestion from the floodplain	FI	unitless	Uniform	0.5; 1	Pbox (interval)	0.5; 1
Soil Ingestion Rate	IR	mg/day	Triangular	0,50,100	Pbox (minmaxmode)	0,50,300
Inputs for X						
Body weight	BW*	kg	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Proportion of yearly exposure dressed for warm weather	S	unitless	Triangular	2/7; 5/7;1	NA	2/7; 1
Soil Adherence Factor for body part	AF_x	-	-	Field Studies	-	Field Studies
Face	AF_{face}	mg/cm^2	Empirical	Soccer; Rugby; all data (range: 0.006 to 0.2)	NA	Groundskeeper; Soccer; Rugby; Gardener; (min 0.001; 5%-tile 0.002; 95%-tile 0.091; max 0.2)
Hands	AF_{hands}	mg/cm^2	Empirical	Soccer; Rugby; all data (range: 0.001 to 1.1)	NA	Groundskeeper; Soccer; Rugby; Gardener; (min 0.001; 5%-tile 0.01; 95%-tile 0.45; max 2.1)
Forearms	$AF_{forearms}$	mg/cm^2	Empirical	Soccer; Rugby; data (range: 0.002 to 0.45)	NA	Groundskeeper; Soccer; Rugby; Gardener; (min 0.001; 5%-tile 0.002; 95%-tile 0.38; max 0.45)
Lower legs	$AF_{lowerlegs}$	mg/cm^2	Empirical	Soccer; Rugby; all data (range: 0.003 to 0.73)	NA	Groundskeeper; Soccer; Rugby; Gardener; (min 0.0003; 5%-tile 0.001; 95%-tile 0.35; max 0.73)
Feet	AF_{feet}	mg/cm^2	Empirical	No Exposure	NA	Groundskeeper; Soccer; Rugby; Gardener; (min 0; 5%-tile 0.007; 95%-tile 0.39; max 0.44)
Surface areas of body parts	SA^*_x	cm^2	-	Calculated for each body weight realization: SA*x = aW + b	-	Calculated for each body weight including error on each regression
Head	SA^*_{head}	cm^2	NA	a=0.003047, b=0.047501	NA	see Addendum 6.1
Hands	SA^*_{hands}	cm^2	NA	a=0.001611, b=0.014558	NA	see Addendum 6.1
Forearms	$SA^*_{forearms}$	cm^2	NA	a=0.002489, b=0.004356	NA	see Addendum 6.1
Lower legs	$SA^*_{lowerlegs}$	cm^2	NA	a=0.004602, b=0.008679	NA	see Addendum 6.1
Feet	SA^*_{feet}	cm^2	NA	a=0.002404, b=0.013192	NA	see Addendum 6.1

Table 6-6

Summary of Inputs for the General Young Child Recreation Exposure Assessment

			Monte Carlo Analog		Probability Bounds Analysis	
Inputs to Exposure Pathways	**Symbol**	**Units**	**Distribution Type**	**Values**	**Distribution Type**	**Values**
General Exposure Inputs						
Averaging Time (Cancer)	AT	days	Point Estimate	25,500	Point Estimate	25,500
Conversion Factor						
Cancer	CF_c	kg/mg	-	10^{-6}	-	10^{-6}
Non-cancer	CF_{nc}	(kg-yr)/(mg-day)	-	10^{-6}/365	-	10^{-6}/365
Contaminant concentration in soil	CS	mg/kg	Point Estimate	1 (assumed)	Point Estimate	1 (assumed)
Exposure Duration (Cancer)	ED	year	Uniform	1; 6	Pbox (interval)	1; 6
Exposure Frequency	EF	days/year	Triangular	1, 30, 90	Pbox (minmaxmode)	1, 30, 120
Dermal Pathway Inputs						
Dermal absorption factor	ABS	unitless	Point Estimate	0.14	Pbox (interval)	.06; .41
Soil adherence factor weighted by exposed body parts, skin surface areas, and body weight	X	mg/kg-day	Percentiles	Determined using Crystal Ball	Pbox	P-bounds determined using estimated minimim and maximum values
Ingestion Pathway Inputs						
Body weight	bw	kg	Percentiles	see Table 6-2	Percentiles	see Table 6-2
Proportion of Ingestion from the floodplain	FI	unitless	Uniform	0.5; 1	Pbox (interval)	0.5; 1
Soil Ingestion Rate	IR	mg/day	Triangular	50; 100; 200	Pbox (minmaxmode)	0; 100; 300
Crystal Ball Inputs						
Inputs for X	BW*	kg	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Proportion of yearly exposure dressed for warm weather	S	unitless	Triangular	2/7; 5/7;1	NA	2/7; 1
Soil Adherence Factor for body part	AF_x	-	-	Field Studies	-	Field Studies
Face	AF_{face}	mg/cm^2	Custom	Dry soil; all data (range: 0.002 to 0.022)	NA	Day Care; Dry Soil; Wet Soil; min 0.001; 5%-tile 0.001; 95%-tile 0.014; max 0.022
Hands	AF_{hands}	mg/cm^2	Empirical	Dry soil; all data (range: 0.021 to 0.193)	NA	Day Care; Dry Soil; Wet Soil; min 0.021; 5%-tile 0.029; 95%-tile 4.5; max 5.0
Forearms	$AF_{forearms}$	mg/cm^2	Empirical	Dry soil; all data (range 0.002 to 0.095)	NA	Day Care; Dry Soil; Wet Soil; min 0.002; 5%-tile 0.004; 95%-tile 0.088; max 0.10
Lower legs	$AF_{lowerlegs}$	mg/cm^2	Empirical	Dry soil; all data (range: 0.017 to 0.336)	NA	Day Care; Dry Soil; Wet Soil; min 0; 5%-tile 0.001; 95%-tile 0.71; max 1.3
Feet	AF_{feet}	mg/cm^2	Empirical	Day Care; all indoor/outdoor data (range: 0.005 to 0.21)	NA	Day Care; Reed Gatherer; min 0.0005; 5%-tile 0.008; 95%-tile 1.2; max 4.5
Surface areas of body parts	SA^*_x	cm^2	Empirical	Calculated for each body weight realization: SA*x = aW + b	-	Calculated for each body weight including error on each regression
Head	SA^*_{head}	cm^2	NA	a=0.003047, b=0.047501	NA	see Addendum 6.1
Hands	SA^*_{hands}	cm^2	NA	a=0.001611, b=0.014558	NA	see Addendum 6.1
Forearms	$SA^*_{forearms}$	cm^2	NA	a=0.002489, b=0.004356	NA	see Addendum 6.1
Lower legs	$SA^*_{lowerlegs}$	cm^2	NA	a=0.004602, b=0.008679	NA	see Addendum 6.1
Feet	SA^*_{feet}	cm^2	NA	a=0.002404, b=0.013192	NA	see Addendum 6.1

Table 6-7

Summary of Inputs for the Older Child on ATV/Dirt/Mountain Bike Exposure Assessment

			Monte Carlo Analog		Probability Bounds Analysis	
Inputs to Exposure Pathways	**Symbol**	**Units**	**Distribution Type**	**Values**	**Distribution Type**	**Values**
General Exposure Inputs						
Averaging Time (Cancer)	AT	days	Point Estimate	25,500	Point Estimate	25,500
Conversion Factor						
Cancer	CF_c	kg/mg	-	10^{-6}	-	10^{-6}
Non-cancer	CF_{nc}	(kg-yr)/(mg-day)	-	10^{-6}/365	-	10^{-6}/365
Contaminant concentration in soil	CS	mg/kg	Point Estimate	1 (assumed)	Point Estimate	1 (assumed)
Exposure Duration (Cancer)	ED	year	Uniform	1; 12	Pbox (interval)	1; 12
Exposure Frequency	EF	days/year	Triangular	1, 30, 90	Pbox (minmaxmode)	1, 30, 120
Dermal Pathway Inputs						
Dermal absorption factor	ABS	unitless	Point Estimate	0.14	Pbox (interval)	.06; .41
Soil adherence factor weighted by exposed body parts, skin surface areas, and body weight	X	mg/kg-day	Percentiles	Determined Using Crystal Ball	Pbox (interval)	P-bounds determined using estimated minimim and maximum values
Ingestion Pathway Inputs						
Body weight	bw	kg	Percentiles	see Table 6-2	Percentiles	see Table 6-2
Proportion of Ingestion from the floodplain	FI	unitless	Uniform	0.5; 1	Pbox (interval)	0.5; 1
Soil Ingestion Rate	IR	mg/day	Triangular	50; 100; 200	Pbox (minmaxmode)	0; 100; 300
Inputs for X						
Body weight	BW*	kg	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Proportion of yearly exposure dressed for warm weather	S	unitless	Triangular	2/7; 5/7;1	NA	2/7; 1
Soil Adherence Factor for body part	AF_x	-	-	Field Studies	-	Field Studies
Face	AF_{face}	mg/cm^2	Empirical	Construction worker; all data (range: 0.013 to 0.058)	NA	Construction Worker; Heavy equipment operator; min 0.013; 5%-tile 0.019; 95%-tile 0.28; max 0.5
Hands	AF_{hands}	mg/cm^2	Empirical	Construction worker; all data (range 0.14 to 0.44)	NA	Construction Worker; Heavy equipment operator; min 0.012; 5%-tile 0.14; 95%-tile 0.61; max 0.94
Forearms	$AF_{forearms}$	mg/cm^2	Empirical	Construction worker; all data (range 0.044 to 0.13)	NA	Construction Worker; Heavy equipment operator; min 0.044; 5%-tile 0.051; 95%-tile 0.35; max 0.36
Lower legs	$AF_{lowerlegs}$	mg/cm^2	Empirical	Construction worker; all data (range: 0.046 to 0.13)	NA	Construction Worker; min 0.046; 5%-tile 0.05; 95%-tile 0.12; max 0.13
Feet	AF_{feet}	mg/cm^2	Empirical	No exposure	NA	No exposure
Surface areas of body parts	SA^*_x	cm^2	-	Calculated for each body weight realization: SA*x = aW + b	-	Calculated for each body weight including error on each regression
Head	SA^*_{head}	cm^2	NA	a=0.003047, b=0.047501	NA	see Addendum 6.1
Hands	SA^*_{hands}	cm^2	NA	a=0.001611, b=0.014558	NA	see Addendum 6.1
Forearms	$SA^*_{forearms}$	cm^2	NA	a=0.002489, b=0.004356	NA	see Addendum 6.1
Lower legs	$SA^*_{lowerlegs}$	cm^2	NA	a=0.004602, b=0.008679	NA	see Addendum 6.1
Feet	SA^*_{feet}	cm^2	NA	a=0.002404, b=0.013192	NA	see Addendum 6.1

Table 6-8

Summary of Inputs for the Adult Angler Exposure Assessment

			Monte Carlo		P-Bounds	
Inputs to Exposure Pathways	**Symbol**	**Units**	**Distribution Type**	**Values**	**Distribution Type**	**Values**
General Exposure Inputs						
Averaging Time (Cancer)	AT	days	Point Estimate	25,500	Point Estimate	25,500
Conversion Factor						
Cancer	CF_c	kg/mg	-	10^{-6}	-	10^{-6}
Non-cancer	CF_{nc}	(kg-yr)/(mg-day)	-	10^{-6}/365	-	10^{-6}/365
Contaminant concentration in soil	CS	mg/kg	Point Estimate	1 (assumed)	Point Estimate	1 (assumed)
Exposure Duration (Cancer)	ED	year	Lognormal	mean = 28.63, stdev = 20.34	Pbox (mmms)	min = 1, max = 52, mean = [25, 32], stdev = [18, 24]
Exposure Frequency	EF	days/year	Percentiles	min=1; 5th=1; 10th, 15th=2; 20th, 25th=3; 30th, 35th=4; 40th, 45th=5; 50th=6; 55th=7; 60th=8, 65th, 70th=10; 75th=12, 80th=15; 85th, 90th=20; 95th=30; max=180	Pbox (percentiles)	Percentiles fattened by +/- 10%
Dermal Pathway Inputs						
Dermal absorption factor	ABS	unitless	Point Estimate	0.14	Pbox (interval)	.06; .41
Soil adherence factor weighted by exposed body parts, skin surface areas, and body weight	X	mg/kg-day	Percentiles	Determined Using Crystal Ball	Pbox (interval)	P-bounds determined using estimated minimum and maximum values
Ingestion Pathway Inputs						
Body weight	bw	kg	Percentiles	see Table 6-2	Percentiles	see Table 6-2
Proportion of Ingestion from the floodplain	FI	unitless	Uniform	0.5; 1	Pbox (interval)	0.5; 1
Soil Ingestion Rate	IR	mg/day	Triangular	0; 50; 100	Pbox (minmaxmode)	0; 50; 300
Inputs for X						
Body weight	BW	kg	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Height	H*	cm	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Proportion of yearly exposure dressed for warm weather	S	unitless	Triangular	2/7; 5/7;1	NA	2/7; 1
Soil Adherence Factor for body part	AF_x	-	-	Field Studies	-	Field Studies
Face	AF_{face}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.001 to 0.013)	NA	Gardener; Wet Soil; min 0.001; 5%-tile 0.001; 95%-tile 0.092; max 0.097
Hands	AF_{hands}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.036 to 4.969)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.036; 5%-tile 0.058; 95%-tile 4.5; max 5.0
Forearms	$AF_{forearms}$	mg/cm^2	Empirical	Wet Soil; all data (range: 0.003 to 0.101)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.003; 5%-tile 0.005; 95%-tile 0.18; max 0.41
Lower legs	$AF_{lowerlegs}$	mg/cm^2	Empirical	Wet Soil; all data (range: 0 to 1.32)	NA	Gardener; Wet Soil; Reed Gatherer; min 0; 5%-tile 0.001; 95%-tile 0.82; max 1.3
Feet	AF_{feet}	mg/cm^2	Empirical	Gardener; Reed Gatherer; all data (range 0.041 to 4.5)	NA	Gardener; Reed Gatherer; min 0.041; 5%-tile 0.049; 95%-tile 3.5; max 4.5
Surface areas of body parts	SA^*_x	cm^2	-	Calculated for each body weight and height realization: $SA^*_x = aBW^bH^c$	-	same as Monte Carlo Analog
Head	SA^*_{head}	cm^2	NA	female (a=0.0256, b=0.124, c=0.189); male (a=0.0492, b=0.339, c=-0.095)	NA	same as Monte Carlo Analog
Hands	SA^*_{hands}	cm^2	NA	female (a=0.131, b=0.412, c=0.0274); male (a=0.0257, b=0.573, c= -0.218)	NA	same as Monte Carlo Analog
Forearms	$SA^*_{forearms}$	cm^2	NA	unisex (a=0.326, b=0.858, c=-0.895)	NA	same as Monte Carlo Analog
Lower legs	$SA^*_{lowerlegs}$	cm^2	NA	unisex (a=0.000276, b=0.416, c=0.973)	NA	same as Monte Carlo Analog
Feet	SA^*_{feet}	cm^2	NA	unisex (a=0.000618, b=0.372, c=0.725)	NA	same as Monte Carlo Analog

Table 6-9

Summary of Inputs for the Older Child Angler Exposure Assessment

			Monte Carlo		P-Bounds	
Inputs to Exposure Pathways	**Symbol**	**Units**	**Distribution Type**	**Values**	**Distribution Type**	**Values**
General Exposure Inputs						
Averaging Time (Cancer)	AT	days	Point Estimate	25,500	Point Estimate	25,500
Conversion Factor						
Cancer	CF_c	kg/mg	-	10^{-6}	-	10^{-6}
Non-cancer	CF_{nc}	(kg-yr)/(mg-day)	-	10^{-6}/365	-	10^{-6}/365
Contaminant concentration in soil	CS	mg/kg	Point Estimate	1 (assumed)	Point Estimate	1 (assumed)
Exposure Duration (Cancer)	ED	year	Uniform	1; 12	Pbox (interval)	1; 12
Exposure Frequency	EF	days/year	Percentiles	5th=1; 10th, 15th=2; 20th, 25th=3; 30th, 35th=4; 40th, 45th=5; 50th=6; 55th=7; 60th=8, 65th, 70th=10; 75th=12, 80th=15; 85th, 90th=20; 95th=30; max=180	Pbox (percentiles)	Percentiles fattened by +/- 10%
Dermal Pathway Inputs						
Dermal absorption factor	ABS	unitless	Point Estimate	0.14	Pbox (interval)	.06; .41
Soil adherence factor weighted by exposed body parts, skin surface areas, and body weight	X	mg/kg-day	Percentiles	Determined Using Crystal Ball	Pbox (interval)	P-bounds determined using estimated minimim and maximum values
Ingestion Pathway Inputs						
Body weight	bw	kg	Percentiles	see Table 6-2	Percentiles	see Table 6-2
Proportion of Ingestion from the floodplain	FI	unitless	Uniform	0.5; 1	Pbox (interval)	0.5; 1
Soil Ingestion Rate	IR	mg/day	Triangular	0; 50; 100	Pbox (minmaxmode)	0; 50; 300
Inputs for X						
Body weight	BW	kg	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Proportion of yearly exposure dressed for warm weather	S	unitless	Triangular	2/7; 5/7;1	NA	2/7; 1
Soil Adherence Factor for body part	AF_x	-	-	Field Studies	-	Field Studies
Face	AF_{face}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.001 to 0.013)	NA	Gardener; Wet Soil; min 0.001; 5%-tile 0.001; 95%-tile 0.092; max 0.097
Hands	AF_{hands}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.036 to 4.969)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.036; 5%-tile 0.058; 95%-tile 4.5; max 5.0
Forearms	$AF_{forearms}$	mg/cm^2	Empirical	Wet Soil; all data (range: 0.003 to 0.101)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.003; 5%-tile 0.005; 95%-tile 0.18; max 0.41
Lower legs	$AF_{lowerlegs}$	mg/cm^2	Empirical	Wet Soil; all data (range: 0 to 1.32)	NA	Gardener; Wet Soil; Reed Gatherer; min 0; 5%-tile 0.001; 95%-tile 0.82; max 1.3
Feet	AF_{feet}	mg/cm^2	Empirical	Gardener; Reed Gatherer; all data (range 0.041 to 4.5)	NA	Gardener; Reed Gatherer; min 0.041; 5%-tile 0.049; 95%-tile 3.5; max 4.5
Surface areas of body parts	$SA*_x$	cm^2	-	Calculated for each body weight realization: SA*x = aW + b	-	Calculated for each body weight including error on each regression
Head	$SA*_{head}$	cm^2	NA	a=0.003047, b=0.047501)	NA	see Addendum 6.1
Hands	$SA*_{hands}$	cm^2	NA	a=0.001611, b=0.014558	NA	see Addendum 6.1
Forearms	$SA*_{forearms}$	cm^2	NA	a=0.002489, b=0.004356	NA	see Addendum 6.1
Lower legs	$SA*_{lowerlegs}$	cm^2	NA	a=0.004602, b=0.008679	NA	see Addendum 6.1
Feet	$SA*_{feet}$	cm^2	NA	a=0.002404, b=0.013192	NA	see Addendum 6.1

Table 6-10

Summary of Inputs for the Adult Waterfowl Hunter Exposure Assessment

			Monte Carlo		P-Bounds	
Inputs to Exposure Pathways	**Symbol**	**Units**	**Distribution Type**	**Values**	**Distribution Type**	**Values**
General Exposure Inputs						
Averaging Time (Cancer)	AT	days	Point Estimate	25,500	Point Estimate	25,500
Conversion Factor						
Cancer	CF_c	kg/mg	-	10^{-6}	-	10^{-6}
Non-cancer	CF_{nc}	(kg-yr)/(mg-day)	-	10^{-6}/365	-	10^{-6}/365
Contaminant concentration in soil	CS	mg/kg	Point Estimate	1 (assumed)	Point Estimate	1 (assumed)
Exposure Duration (Cancer)	ED	year	Lognormal	mean = 28.63, stdev = 20.34	Pbox (mmms)	min = 1, max = 52, mean = [25, 32], stdev = [18, 24]
Exposure Frequency	EF	days/year	Percentiles	min=1; 5th=1; 10th, 15th, 20th=2; 25th=3; 30th=4; 35th, 40th, 45th, 50th=5; 55th=7; 60th=8; 65th, 70th=9; 75th=10; 80th=11; 85th=12; 90th=13; 95th=14; max=14	Pbox (minmaxmode)	1, 7, 14
Dermal Pathway Inputs						
Dermal absorption factor	ABS	unitless	Point Estimate	0.14	Pbox (interval)	.06; .41
Soil adherence factor weighted by exposed body parts, skin surface areas, and body weight	X	mg/kg-day	Percentiles	Determined Using Crystal Ball	Pbox (interval)	P-bounds determined using estimated minimum and maximum values
Ingestion Pathway Inputs						
Body weight	bw	kg	Percentiles	see Table 6-2	Percentiles	see Table 6-2
Proportion of Ingestion from the floodplain	FI	unitless	Uniform	0.5; 1	Pbox (interval)	0.5; 1
Soil Ingestion Rate	IR	mg/day	Triangular	50; 100; 200	Pbox (minmaxmode)	0; 100; 300
Inputs for X						
Body weight	BW	kg	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Height	H*	cm	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Proportion of yearly exposure dressed for warm weather	S	unitless	Point Estimate	0	NA	0
Soil Adherence Factor for body part	AF_x	-	-	Field Studies	-	Field Studies
Face	AF_{face}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.001 to 0.013)	NA	Gardener; Wet Soil; min 0.001; 5%-tile 0.001; 95%-tile 0.092; max 0.097
Hands	AF_{hands}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.036 to 4.969)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.036; 5%-tile 0.058; 95%-tile 4.5; max 5.0
Forearms	$AF_{forearms}$	mg/cm^2	Empirical	No exposure	NA	No exposure
Lower legs	$AF_{lowerlegs}$	mg/cm^2	Empirical	No exposure	NA	No exposure
Feet	AF_{feet}	mg/cm^2	Empirical	No exposure	NA	No exposure
Surface areas of body parts	SA^*_x	cm^2	-	Calculated for each body weight and height realization: $SA^*_x = aBW^bH^c$	-	same as Monte Carlo Analog
Head	SA^*_{head}	cm^2	NA	female (a=0.0256, b=0.124, c=0.189); male (a=0.0492, b=0.339, c=-0.095)	NA	same as Monte Carlo Analog
Hands	SA^*_{hands}	cm^2	NA	female (a=0.131, b=0.412, c=0.0274); male (a=0.0257, b=0.573, c= -0.218)	NA	same as Monte Carlo Analog
Forearms	$SA^*_{forearms}$	cm^2	NA	unisex (a=0.326, b=0.858, c=-0.895)	NA	same as Monte Carlo Analog
Lower legs	$SA^*_{lowerlegs}$	cm^2	NA	unisex (a=0.000276, b=0.416, c=0.973)	NA	same as Monte Carlo Analog
Feet	SA^*_{feet}	cm^2	NA	unisex (a=0.000618, b=0.372, c=0.725)	NA	same as Monte Carlo Analog

Table 6-11

Summary of Inputs for the Older Child Waterfowl Hunter Exposure Assessment

			Monte Carlo Analog		Probability Bounds Analysis	
Inputs to Exposure Pathways	**Symbol**	**Units**	**Distribution Type**	**Values**	**Distribution Type**	**Values**
General Exposure Inputs						
Averaging Time (Cancer)	AT	days	Point Estimate	25,500	Point Estimate	25,500
Conversion Factor						
Cancer	CF_c	kg/mg	-	10^{-6}	-	10^{-6}
Non-cancer	CF_{nc}	(kg-yr)/(mg-day)	-	10^{-6}/365	-	10^{-6}/365
Contaminant concentration in soil	CS	mg/kg	Point Estimate	1 (assumed)	Point Estimate	1 (assumed)
Exposure Duration (Cancer)	ED	year	Uniform	1; 6	Pbox (interval)	1; 6
Exposure Frequency	EF	days/year	Percentiles	5th=1; 10th, 15th, 20th=2; 25th=3; 30th=4; 35th, 40th, 45th, 50th=5; 55th=7; 60th=8; 65th, 70th=9; 75th=10; 80th=11; 85th=12; 90th=13; 95th=14; max=14	Pbox (minmaxmode)	1, 7, 14
Dermal Pathway Inputs						
Dermal absorption factor	ABS	unitless	Point Estimate	0.14	Pbox (interval)	.06; .41
Soil adherence factor weighted by exposed body parts, skin surface areas, and body weight	X	mg/kg-day	Percentiles	Determined Using Crystal Ball	Pbox (interval)	P-bounds determined using estimated minimim and maximum values
Ingestion Pathway Inputs						
Body weight	bw	kg	Percentiles	see Table 6-2	Percentiles	see Table 6-2
Proportion of Ingestion from the floodplain	FI	unitless	Uniform	0.5; 1	Pbox (interval)	0.5; 1
Soil Ingestion Rate	IR	mg/day	Triangular	50; 100; 200	Pbox (minmaxmode)	0; 100; 300
Inputs for X						
Body weight	BW*	kg	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Proportion of yearly exposure dressed for warm weather	S	unitless	Point Estimate	0	NA	0
Soil Adherence Factor for body part	AF_x	-	-	Field Studies	-	Field Studies
Face	AF_{face}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.001 to 0.013)	NA	Gardener; Wet Soil; min 0.001; 5%-tile 0.001; 95%-tile 0.092; max 0.097
Hands	AF_{hands}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.036 to 4.969)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.036; 5%-tile 0.058; 95%-tile 4.5; max 5.0
Forearms	$AF_{forearms}$	mg/cm^2	Empirical	No exposure	NA	No exposure
Lower legs	$AF_{lowerlegs}$	mg/cm^2	Empirical	No exposure	NA	No exposure
Feet	AF_{feet}	mg/cm^2	Empirical	No exposure	NA	No exposure
Surface areas of body parts	SA^*_x	cm^2	-	Calculated for each body weight realization: SA*x = aW + b	-	Calculated for each body weight including error on each regression
Head	SA^*_{head}	cm^2	NA	a=0.003047, b=0.047501)	NA	see Addendum 6.1
Hands	SA^*_{hands}	cm^2	NA	a=0.001611, b=0.014558	NA	see Addendum 6.1
Forearms	$SA^*_{forearms}$	cm^2	NA	a=0.002489, b=0.004356	NA	see Addendum 6.1
Lower legs	$SA^*_{lowerlegs}$	cm^2	NA	a=0.004602, b=0.008679	NA	see Addendum 6.1
Feet	SA^*_{feet}	cm^2	NA	a=0.002404, b=0.013192	NA	see Addendum 6.1

Table 6-12

Summary of Inputs for the Adult Canoeist/Boater Exposure Assessment

			Monte Carlo Analog		Probability Bounds Analysis	
Inputs to Exposure Pathways	**Symbol**	**Units**	**Distribution Type**	**Values**	**Distribution Type**	**Values**
General Exposure Inputs						
Averaging Time (Cancer)	AT	days	Point Estimate	25,500	Point Estimate	25,500
Conversion Factor						
Cancer	CF_c	kg/mg	-	10^{-6}	-	10^{-6}
Non-cancer	CF_{nc}	(kg-yr)/(mg-day)	-	10^{-6}/365	-	10^{-6}/365
Contaminant concentration in soil	CS	mg/kg	Point Estimate	1 (assumed)	Point Estimate	1 (assumed)
Exposure Duration (Cancer)	ED	year	Truncated Exponential	mean = 31; truncated at 52 (i.e. 70-18)	Pbox (truncated exponential)	exponential with 95% confidence interval for mean, truncated at 52
Exposure Frequency	EF	days/year	Triangular	1, 30, 60	Pbox (minmaxmode)	1, 30, 90
Dermal Pathway Inputs						
Dermal absorption factor	ABS	unitless	Point Estimate	0.14	Pbox (interval)	.06; .41
Soil adherence factor weighted by exposed body parts, skin surface areas, and body weight	X	mg/kg-day	Percentiles	Determined Using Crystal Ball	Pbox (interval)	P-bounds determined using estimated minimum and maximum values
Ingestion Pathway Inputs						
Body weight	bw	kg	Percentiles	see Table 6-2	Percentiles	see Table 6-2
Proportion of Ingestion from the floodplain	FI	unitless	Uniform	0.5; 1	Pbox (interval)	0.5; 1
Soil Ingestion Rate	IR	mg/day	Triangular	0; 50; 100	Pbox (minmaxmode)	0; 50; 300
Inputs for X						
Body weight	BW*	kg	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Height	H*	cm	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Proportion of yearly exposure dressed for warm weather	S	unitless	Triangular	2/7; 5/7;1	NA	2/7; 1
Soil Adherence Factor for body part	AF_x	-	-	Field Studies	-	Field Studies
Face	AF_{face}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.001 to 0.013)	NA	Gardener; Wet Soil; min 0.001; 5%-tile 0.001; 95%-tile 0.092; max 0.097
Hands	AF_{hands}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.036 to 4.969)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.036; 5%-tile 0.058; 95%-tile 4.5; max 5.0
Forearms	$AF_{forearms}$	mg/cm^2	Empirical	Wet Soil; all data (range: 0.003 to 0.101)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.003; 5%-tile 0.005; 95%-tile 0.18; max 0.41
Lower legs	$AF_{lowerlegs}$	mg/cm^2	Empirical	Wet Soil; all data (range: 0 to 1.32)	NA	Gardener; Wet Soil; Reed Gatherer; min 0; 5%-tile 0.001; 95%-tile 0.82; max 1.3
Feet	AF_{feet}	mg/cm^2	Empirical	Gardener; Reed Gatherer; all data (range: 0.041 to 4.5)	NA	Gardener; Reed Gatherer; min 0.041; 5%-tile 0.049; 95%-tile 3.5; max 4.5
Surface areas of body parts	SA^*_x	cm^2	-	Calculated for each body weight and height realization: $SA^*_x = aBW^bH^c$	-	same as Monte Carlo Analog
Head	SA^*_{head}	cm^2	NA	female (a=0.0256, b=0.124, c=0.189); male (a=0.0492, b=0.339, c=-0.095)	NA	same as Monte Carlo Analog
Hands	SA^*_{hands}	cm^2	NA	female (a=0.131, b=0.412, c=0.0274); male (a=0.0257, b=0.573, c= -0.218)	NA	same as Monte Carlo Analog
Forearms	$SA^*_{forearms}$	cm^2	NA	unisex (a=0.326, b=0.858, c=-0.895)	NA	same as Monte Carlo Analog
Lower legs	$SA^*_{lowerlegs}$	cm^2	NA	unisex (a=0.000276, b=0.416, c=0.973)	NA	same as Monte Carlo Analog
Feet	SA^*_{feet}	cm^2	NA	unisex (a=0.000618, b=0.372, c=0.725)	NA	same as Monte Carlo Analog

Table 6-13

Summary of Inputs for the Older Child Canoeist/Boater Exposure Assessment

			Monte Carlo Analog		Probability Bounds Analysis	
Inputs to Exposure Pathways	**Symbol**	**Units**	**Distribution Type**	**Values**	**Distribution Type**	**Values**
General Exposure Inputs						
Averaging Time (Cancer)	AT	days	Point Estimate	25,500	Point Estimate	25,500
Conversion Factor						
Cancer	CF_c	kg/mg	-	10^{-6}	-	10^{-6}
Non-cancer	CF_{nc}	(kg-yr)/(mg-day)	-	10^{-6}/365	-	10^{-6}/365
Contaminant concentration in soil	CS	mg/kg	Point Estimate	1 (assumed)	Point Estimate	1 (assumed)
Exposure Duration (Cancer)	ED	year	Uniform	1; 12	Pbox (interval)	1; 12
Exposure Frequency	EF	days/year	Triangular	1, 30, 60	Pbox (minmaxmode)	1, 30, 90
Dermal Pathway Inputs						
Dermal absorption factor	ABS	unitless	Point Estimate	0.14	Pbox (interval)	.06; .41
Soil adherence factor weighted by exposed body parts, skin surface areas, and body weight	X	mg/kg-day	Percentiles	Determined Using Crystal Ball	Pbox (interval)	P-bounds determined using estimated minimim and maximum values
				10^{-6}/365		
Ingestion Pathway Inputs						
Body weight	bw	kg	Percentiles	see Table 6-2	Percentiles	see Table 6-2
Proportion of Ingestion from the floodplain	FI	unitless	Uniform	0.5; 1	Pbox (interval)	0.5; 1
Soil Ingestion Rate	IR	mg/day	Triangular	0; 50; 100	Pbox (minmaxmode)	0; 50; 300
Inputs for X						
Body weight	BW*	kg	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Proportion of yearly exposure dressed for warm weather	S	unitless	Triangular	2/7; 5/7;1	NA	2/7; 1
Soil Adherence Factor for body part	AF_x	-	-	Field Studies	-	Field Studies
Face	AF_{face}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.001 to 0.013)	NA	Gardener; Wet Soil; min 0.001; 5%-tile 0.001; 95%-tile 0.092; max 0.097
Hands	AF_{hands}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.036 to 4.969)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.036; 5%-tile 0.058; 95%-tile 4.5; max 5.0
Forearms	$AF_{forearms}$	mg/cm^2	Empirical	Wet Soil; all data (range: 0.003 to 0.101)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.003; 5%-tile 0.005; 95%-tile 0.18; max 0.41
Lower legs	$AF_{lowerlegs}$	mg/cm^2	Empirical	Wet Soil; all data (range: 0 to 1.32)	NA	Gardener; Wet Soil; Reed Gatherer; min 0; 5%-tile 0.001; 95%-tile 0.82; max 1.3
Feet	AF_{feet}	mg/cm^2	Empirical	Gardener; Reed Gatherer; all data (range: 0.041 to 4.5)	NA	Gardener; Reed Gatherer; min 0.041; 5%-tile 0.049; 95%-tile 3.5; max 4.5
Surface areas of body parts	SA^*_x	cm^2	-	Calculated for each body weight realization: SA*x = aW + b	-	Calculated for each body weight including error on each regression
Head	SA^*_{head}	cm^2	NA	a=0.003047, b=0.047501	NA	see Addendum 6.1
Hands	SA^*_{hands}	cm^2	NA	a=0.001611, b=0.014558	NA	see Addendum 6.1
Forearms	$SA^*_{forearms}$	cm^2	NA	a=0.002489, b=0.004356	NA	see Addendum 6.1
Lower legs	$SA^*_{lowerlegs}$	cm^2	NA	a=0.004602, b=0.008679	NA	see Addendum 6.1
Feet	SA^*_{feet}	cm^2	NA	a=0.002404, b=0.013192	NA	see Addendum 6.1

Table 6-14

Summary of Inputs for the Adult Sediment Exposure Assessment

Inputs to Exposure Pathways	Symbol	Units	Monte Carlo Analog: Distribution Type	Monte Carlo Analog: Values	Probability Bounds Analysis: Distribution Type	Probability Bounds Analysis: Values
General Exposure Inputs						
Averaging Time (Cancer)	AT	days	Point Estimate	25,500	Point Estimate	25,500
Conversion Factor						
Cancer	CF_c	kg/mg	-	10^{-6}	-	10^{-6}
Non-cancer	CF_{nc}	(kg-yr)/(mg-day)	-	10^{-6}/365	-	10^{-6}/365
Contaminant concentration in soil	CS	mg/kg	Point Estimate	1 (assumed)	Point Estimate	1 (assumed)
Exposure Duration (Cancer)	ED	year	Truncated Exponential	mean = 31; truncated at 52 (i.e. 70-18)	Pbox (truncated exponential)	exponential with 95% confidence interval for mean, truncated at 52
Exposure Frequency	EF	days/year	Triangular	1, 12, 36	Pbox (minmaxmode)	1, 12, 48
Dermal Pathway Inputs						
Dermal absorption factor	ABS	unitless	Point Estimate	0.14	Pbox (interval)	.06; .41
Soil adherence factor weighted by exposed body parts, skin surface areas, and body weight	X	mg/kg-day	Percentiles	Determined Using Crystal Ball	Pbox (interval)	P-bounds determined using estimated minimum and maximum values
Ingestion Pathway Inputs						
Body weight	bw	kg	Percentiles	see Table 6-2	Percentiles	see Table 6-2
Proportion of Ingestion from the floodplain	FI	unitless	Uniform	0.5; 1	Pbox (interval)	0.5; 1
Soil Ingestion Rate	IR	mg/day	Triangular	0; 50; 100	Pbox (minmaxmode)	0; 50; 300
Inputs for X						
Body weight	BW*	kg	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Height	H*	cm	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Proportion of yearly exposure dressed for warm weather	S	unitless	Point Estimate	1	NA	1
Soil Adherence Factor for body part	AF_x	-	-	Field Studies	-	Field Studies
Face	AF_{face}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.001 to 0.013)	NA	Gardener; Wet Soil; min 0.001; 5%-tile 0.001; 95%-tile 0.092; max 0.097
Hands	AF_{hands}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.036 to 4.969)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.036; 5%-tile 0.058; 95%-tile 4.5; max 5.0
Forearms	$AF_{forearms}$	mg/cm^2	Empirical	Wet Soil; all data (range: 0.003 to 0.101)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.003; 5%-tile 0.005; 95%-tile 0.18; max 0.41
Lower legs	$AF_{lowerlegs}$	mg/cm^2	Empirical	Wet Soil; all data (range: 0 to 1.32)	NA	Gardener; Wet Soil; Reed Gatherer; min 0; 5%-tile 0.001; 95%-tile 0.82; max 1.3
Feet	AF_{feet}	mg/cm^2	Empirical	Gardener; Reed Gatherer; all data (range: 0.041 to 4.5)	NA	Gardener; Reed Gatherer; min 0.041; 5%-tile 0.049; 95%-tile 3.5; max 4.5
Surface areas of body parts	SA^*_x	cm^2	-	Calculated for each body weight and height realization: $SA^*_x = aBW^bH^c$	-	same as Monte Carlo Analog
Head	SA^*_{head}	cm^2	NA	female (a=0.0256, b=0.124, c=0.189); male (a=0.0492, b=0.339, c=-0.095)	NA	same as Monte Carlo Analog
Hands	SA^*_{hands}	cm^2	NA	female (a=0.131, b=0.412, c=0.0274); male (a=0.0257, b=0.573, c= -0.218)	NA	same as Monte Carlo Analog
Forearms	$SA^*_{forearms}$	cm^2	NA	unisex (a=0.326, b=0.858, c=-0.895)	NA	same as Monte Carlo Analog
Lower legs	$SA^*_{lowerlegs}$	cm^2	NA	unisex (a=0.000276, b=0.416, c=0.973)	NA	same as Monte Carlo Analog
Feet	SA^*_{feet}	cm^2	NA	unisex (a=0.000618, b=0.372, c=0.725)	NA	same as Monte Carlo Analog

Table 6-15

Summary of Inputs for the Older Child Sediment Exposure Assessment

			Monte Carlo Analog		Probability Bounds Analysis	
Inputs to Exposure Pathways	**Symbol**	**Units**	**Distribution Type**	**Values**	**Distribution Type**	**Values**
General Exposure Inputs						
Averaging Time (Cancer)	AT	days	Point Estimate	25,500	Point Estimate	25,500
Conversion Factor						
Cancer	CF_c	kg/mg	-	10^{-6}	-	10^{-6}
Non-cancer	CF_{nc}	(kg-yr)/(mg-day)	-	10^{-6}/365	-	10^{-6}/365
Contaminant concentration in soil	CS	mg/kg	Point Estimate	1 (assumed)	Point Estimate	1 (assumed)
Exposure Duration (Cancer)	ED	year	Uniform	1; 12	Pbox (interval)	1; 12
Exposure Frequency	EF	days/year	Triangular	1, 12, 36	Pbox (minmaxmode)	1, 12, 48
Dermal Pathway Inputs						
Dermal absorption factor	ABS	unitless	Point Estimate	0.14	Pbox (interval)	.06; .41
Soil adherence factor weighted by exposed body parts, skin surface areas, and body weight	X	mg/kg-day	Percentiles	Determined Using Crystal Ball	Pbox (interval)	P-bounds determined using estimated minimim and maximum values
				10^{-6}/365		
Ingestion Pathway Inputs						
Body weight	bw	kg	Percentiles	see Table 6-2	Percentiles	see Table 6-2
Proportion of Ingestion from the floodplain	FI	unitless	Uniform	0.5; 1	Pbox (interval)	0.5; 1
Soil Ingestion Rate	IR	mg/day	Triangular	0; 50; 100	Pbox (minmaxmode)	0; 50; 300
Inputs for X						
Body weight	BW*	kg	Percentiles	see Table 6.2	NA	min; 5%-tile; 95%-tile; max (see table 6.2)
Proportion of yearly exposure dressed for warm weather	S	unitless	Point Estimate	1	NA	1
Soil Adherence Factor for body part	AF_x	-	-	Field Studies	-	Field Studies
Face	AF_{face}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.001 to 0.013)	NA	Gardener; Wet Soil; min 0.001; 5%-tile 0.001; 95%-tile 0.092; max 0.097
Hands	AF_{hands}	mg/cm^2	Empirical	Wet Soil; all data (range: 0.036 to 4.969)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.036; 5%-tile 0.058; 95%-tile 4.5; max 5.0
Forearms	$AF_{forearms}$	mg/cm^2	Empirical	Wet Soil; all data (range: 0.003 to 0.101)	NA	Gardener; Wet Soil; Reed Gatherer; min 0.003; 5%-tile 0.005; 95%-tile 0.18; max 0.41
Lower legs	$AF_{lowerlegs}$	mg/cm^2	Empirical	Wet Soil; all data (range: 0 to 1.32)	NA	Gardener; Wet Soil; Reed Gatherer; min 0; 5%-tile 0.001; 95%-tile 0.82; max 1.3
Feet	AF_{feet}	mg/cm^2	Empirical	Gardener; Reed Gatherer; all data (range: 0.041 to 4.5)	NA	Gardener; Reed Gatherer; min 0.041; 5%-tile 0.049; 95%-tile 3.5; max 4.5
Surface areas of body parts	SA^*_x	cm^2	-	Calculated for each body weight realization: SA*x = aW + b	-	Calculated for each body weight including error on each regression
Head	SA^*_{head}	cm^2	NA	a=0.003047, b=0.047501	NA	see Addendum 6.1
Hands	SA^*_{hands}	cm^2	NA	a=0.001611, b=0.014558	NA	see Addendum 6.1
Forearms	$SA^*_{forearms}$	cm^2	NA	a=0.002489, b=0.004356	NA	see Addendum 6.1
Lower legs	$SA^*_{lowerlegs}$	cm^2	NA	a=0.004602, b=0.008679	NA	see Addendum 6.1
Feet	SA^*_{feet}	cm^2	NA	a=0.002404, b=0.013192	NA	see Addendum 6.1

Table 6-16

Cancer Risk Results of the Probability Bounds Risk Analysis, One-Dimensional Monte Carlo Analog Analysis and Dependency Bounds (at assumed tPCB EPC of 1 mg/kg)

Exposure Scenario	Receptor	Analysis	Cancer risk percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
General Recreation	Young Child	MCA	3E-08	6E-08	1E-07	2E-07	2E-07	3E-07
		DBA	[8E-09, 1E-07]	[2E-08, 2E-07]	[3E-08, 3E-07]	[4E-08, 4E-07]	[5E-08, 5E-07]	[6E-08, 7E-07]
		PBA	[3E-10, 3E-06]	[8E-10, 4E-06]	[2E-09, 6E-06]	[3E-09, 6E-06]	[3E-09, 7E-06]	[4E-09, 7E-06]
	Older Child	MCA	1E-08	3E-08	6E-08	1E-07	1E-07	2E-07
		DBA	[2E-09, 8E-08]	[5E-09, 1E-07]	[1E-08, 2E-07]	[2E-08, 3E-07]	[2E-08, 4E-07]	[3E-08, 7E-07]
		PBA	[4E-11, 2E-06]	[1E-10, 2E-06]	[3E-10, 3E-06]	[4E-10, 5E-06]	[5E-10, 6E-06]	[6E-10, 7E-06]
	Adult	MCA	2E-08	6E-08	1E-07	3E-07	4E-07	7E-07
		DBA	[2E-09, 1E-07]	[8E-09, 3E-07]	[2E-08, 5E-07]	[4E-08, 8E-07]	[5E-08, 1E-06]	[6E-08, 2E-06]
		PBA	[7E-11, 2E-06]	[3E-10, 5E-06]	[1E-09, 9E-06]	[2E-09, 2E-05]	[3E-09, 2E-05]	[4E-09, 2E-05]
ATV/Dirt and Mountain Biker	Older Child	MCA	3E-08	5E-08	9E-08	1E-07	2E-07	3E-07
		DBA	[8E-09, 1E-07]	[2E-08, 2E-07]	[3E-08, 3E-07]	[5E-08, 4E-07]	[5E-08, 5E-07]	[7E-08, 7E-07]
		PBA	[2E-10, 1E-06]	[5E-10, 2E-06]	[8E-10, 2E-06]	[1E-09, 3E-06]	[1E-09, 3E-06]	[2E-09, 4E-06]
Angler	Older Child	MCA	7E-09	2E-08	5E-08	1E-07	2E-07	7E-07
		DBA	[1E-09, 3E-08]	[4E-09, 6E-08]	[1E-08, 1E-07]	[3E-08, 3E-07]	[4E-08, 6E-07]	[9E-08, 2E-06]
		PBA	[3E-11, 4E-07]	[7E-11, 8E-07]	[2E-10, 2E-06]	[3E-10, 3E-06]	[5E-10, 5E-06]	[1E-09, 2E-05]
	Adult	MCA	2E-08	5E-08	1E-07	3E-07	6E-07	2E-06
		DBA	[4E-09, 7E-08]	[1E-08, 2E-07]	[3E-08, 4E-07]	[8E-08, 9E-07]	[1E-07, 2E-06]	[3E-07, 6E-06]
		PBA	[2E-11, 1E-06]	[6E-11, 2E-06]	[2E-10, 5E-06]	[5E-10, 9E-06]	[9E-10, 2E-05]	[2E-09, 6E-05]
Waterfowl Hunter	Older Child	MCA	2E-09	5E-09	1E-08	2E-08	4E-08	6E-08
		DBA	[4E-10, 9E-09]	[1E-09, 2E-08]	[3E-09, 3E-08]	[7E-09, 6E-08]	[1E-08, 9E-08]	[2E-08, 1E-07]
		PBA	[3E-11, 2E-07]	[7E-11, 3E-07]	[1E-10, 3E-07]	[2E-10, 3E-07]	[2E-10, 4E-07]	[3E-10, 4E-07]
	Adult	MCA	1E-08	3E-08	6E-08	1E-07	2E-07	4E-07
		DBA	[2E-09, 5E-08]	[5E-09, 1E-07]	[1E-08, 2E-07]	[3E-08, 4E-07]	[5E-08, 6E-07]	[7E-08, 8E-07]
		PBA	[2E-11, 1E-06]	[6E-11, 1E-06]	[1E-10, 2E-06]	[4E-10, 2E-06]	[5E-10, 2E-06]	[8E-10, 2E-06]
Recreational Canoeist/Boater	Older Child	MCA	4E-08	8E-08	2E-07	3E-07	5E-07	8E-07
		DBA	[7E-09, 2E-07]	[2E-08, 3E-07]	[5E-08, 5E-07]	[8E-08, 8E-07]	[1E-07, 9E-07]	[1E-07, 2E-06]
		PBA	[9E-11, 5E-06]	[2E-10, 7E-06]	[3E-10, 9E-06]	[5E-10, 1E-05]	[6E-10, 1E-05]	[7E-10, 1E-05]
	Adult	MCA	6E-08	2E-07	4E-07	9E-07	1E-06	2E-06
		DBA	[8E-09, 3E-07]	[3E-08, 7E-07]	[8E-08, 1E-06]	[1E-07, 2E-06]	[2E-07, 3E-06]	[2E-07, 4E-06]
		PBA	[1E-10, 6E-06]	[5E-10, 1E-05]	[1E-09, 2E-05]	[3E-09, 4E-05]	[4E-09, 4E-05]	[5E-09, 5E-05]
Sediment	Older Child	MCA	2E-08	5E-08	1E-07	2E-07	3E-07	5E-07
		DBA	[5E-09, 1E-07]	[1E-08, 2E-07]	[3E-08, 3E-07]	[6E-08, 5E-07]	[7E-08, 6E-07]	[1E-07, 9E-07]
		PBA	[6E-11, 2E-06]	[1E-10, 3E-06]	[2E-10, 5E-06]	[2E-10, 5E-06]	[3E-10, 6E-06]	[3E-10, 7E-06]
	Adult	MCA	4E-08	1E-07	3E-07	6E-07	9E-07	1E-06
		DBA	[6E-09, 2E-07]	[2E-08, 4E-07]	[6E-08, 8E-07]	[1E-07, 1E-06]	[1E-07, 2E-06]	[2E-07, 3E-06]
		PBA	[1E-10, 3E-06]	[3E-10, 6E-06]	[8E-10, 1E-05]	[1E-09, 2E-05]	[2E-09, 2E-05]	[2E-09, 3E-05]

Table 6-17

Noncancer Hazard Results of the Probability Bounds Risk Analysis, One-Dimensional Monte Carlo Analog Analysis and Dependency Bounds (at assumed tPCB EPC of 1 mg/kg)

Exposure Scenario	Receptor	Analysis	25%	50%	75%	90%	95%	99%
			Noncancer hazard percentiles			RME range		
General Recreation	Young Child	MCA	0.021	0.033	0.050	0.070	0.084	0.12
		DBA	[0.010, 0.041]	[0.017, 0.062]	[0.026, 0.090]	[0.035, 0.12]	[0.040, 0.15]	[0.048, 0.21]
		PBA	[0.00049, 0.87]	[0.0014, 1.2]	[0.0029, 1.6]	[0.0045, 1.8]	[0.0054, 1.9]	[0.0065, 2.0]
	Older Child	MCA	0.0055	0.0094	0.015	0.024	0.031	0.056
		DBA	[0.0022, 0.013]	[0.0045, 0.021]	[0.0086, 0.031]	[0.014, 0.046]	[0.019, 0.06]	[0.033, 0.10]
		PBA	[0.000074, 0.24]	[0.00021, 0.35]	[0.00045, 0.45]	[0.00070, 0.71]	[0.00083, 0.86]	[0.0010, 0.98]
	Adult	MCA	0.0035	0.0060	0.0097	0.015	0.020	0.036
		DBA	[0.0014, 0.0074]	[0.0030, 0.011]	[0.0057, 0.017]	[0.0097, 0.025]	[0.013, 0.033]	[0.022, 0.060]
		PBA	[0.000057, 0.15]	[0.00016, 0.23]	[0.00033, 0.30]	[0.00052, 0.56]	[0.00061, 0.68]	[0.00074, 0.77]
ATV/Dirt and Mountain Biker	Older Child	MCA	0.011	0.017	0.024	0.033	0.040	0.057
		DBA	[0.0059, 0.019]	[0.0092, 0.029]	[0.013, 0.042]	[0.017, 0.059]	[0.020 0.072]	[0.023, 0.10]
		PBA	[0.00042, 0.017]	[0.00081, 0.25]	[0.0014, 0.32]	[0.0020, 0.40]	[0.0023, 0.45]	[0.0027, 0.52]
Angler	Older Child	MCA	0.0023	0.0058	0.014	0.033	0.054	0.18
		DBA	[0.0016, 0.0043]	[0.0046, 0.0095]	[0.012, 0.021]	[0.027, 0.047]	[0.042, 0.085]	[0.093, 0.32]
		PBA	[0.000060, 0.062]	[0.00013, 0.12]	[0.00028, 0.24]	[0.00055, 0.44]	[0.00081, 0.73]	[0.0023, 3.1]
	Adult	MCA	0.0015	0.0037	0.0091	0.021	0.036	0.12
		DBA	[0.0011, 0.0024]	[0.0030, 0.0054]	[0.0076, 0.012]	[0.018, 0.029]	[0.028, 0.051]	[0.064, 0.19]
		PBA	[0.000034, 0.042]	[0.000079, 0.081]	[0.00018, 0.17]	[0.00036, 0.31]	[0.00052, 0.62]	[0.0014, 2.0]
Waterfowl Hunter	Older Child	MCA	0.0013	0.0029	0.0060	0.013	0.019	0.026
		DBA	[0.00059, 0.0026]	[0.0015, 0.0053]	[0.0039, 0.010]	[0.0097, 0.019]	[0.016, 0.026]	[0.022, 0.034]
		PBA	[0.000061, 0.062]	[0.00013, 0.074]	[0.00023, 0.087]	[0.00033, 0.095]	[0.00039, 0.10]	[0.00046, 0.11]
	Adult	MCA	0.00100	0.0021	0.0044	0.0091	0.014	0.019
		DBA	[0.00044, 0.0020]	[0.0011, 0.0041]	[0.0027, 0.0075]	[0.0069, 0.014]	[0.011, 0.019]	[0.015, 0.026]
		PBA	[0.000043, 0.042]	[0.000095, 0.050]	[0.00018 0.058]	[0.00026, 0.068]	[0.00030, 0.076]	[0.00036, 0.083]
Recreational Canoeist/Boater	Older Child	MCA	0.013	0.026	0.053	0.086	0.11	0.17
		DBA	[0.0092, 0.026]	[0.021, 0.041]	[0.046, 0.071]	[0.077, 0.11]	[0.095, 0.14]	[0.13, 0.22]
		PBA	[0.00016, 0.77]	[0.00032, 1.0]	[0.00059, 1.3]	[0.00087, 1.4]	[0.0010, 1.7]	[0.0012, 1.9]
	Adult	MCA	0.0082	0.016	0.034	0.056	0.072	0.12
		DBA	[0.0059, 0.014]	[0.013, 0.023]	[0.030, 0.043]	[0.050, 0.068]	[0.063, 0.086]	[0.091, 0.15]
		PBA	[0.000087, 0.52]	[0.00020, 0.69]	[0.00038 0.87]	[0.00057, 1.2]	[0.00068, 1.4]	[0.00081, 1.6]
Sediment	Older Child	MCA	0.0082	0.017	0.034	0.056	0.071	0.11
		DBA	[0.0061, 0.015]	[0.014, 0.025]	[0.030, 0.044]	[0.050, 0.071]	[0.063, 0.089]	[0.087, 0.14]
		PBA	[0.00010, 0.36]	[0.00018, 0.51]	[0.00030, 0.66]	[0.00042, 0.76]	[0.00048, 0.87]	[0.00056, 0.99]
	Adult	MCA	0.0052	0.011	0.022	0.036	0.047	0.075
		DBA	[0.0040, 0.0084]	[0.0091, 0.015]	[0.020, 0.027]	[0.033, 0.044]	[0.041, 0.056]	[0.058, 0.091]
		PBA	[0.000051, 0.24]	[0.000099, 0.35]	[0.00018, 0.45]	[0.00025, 0.62]	[0.00030, 0.75]	[0.00035, 0.85]

Table 6-18
Sensitivity Analyses for the Probabilistic Cancer Model
(at assumed tPCB EPC of 1 mg/kg)

Adult General Recreation Scenario

Variable	Units	Probability bounds	
		Remove uncertainty	Remove uncertainty and variability
Exposure Duration (used only in cancer model)	year	1	70
Exposure Frequency	days/year	45	61
Dermal absorption factor	unitless	54	54
"X"	mg/kg-d	66	81
Body weight	kg	0	7
Proportion of Ingestion at the site	unitless	2	10
Soil Ingestion Rate	mg/day	13	16

Older Child General Recreation Scenario

Variable	Units	Probability bounds	
		Remove uncertainty	Remove uncertainty and variability
Exposure Duration (used only in cancer model)	year	14	0.07
Exposure Frequency	days/year	46	61
Dermal absorption factor	unitless	50	50
"X"	mg/kg-d	58	74
Body weight	kg	0	11
Proportion of Ingestion at the site	unitless	3	12
Soil Ingestion Rate	mg/day	17	17

Young Child General Recreation Scenario

Variable	Units	Probability bounds	
		Remove uncertainty	Remove uncertainty and variability
Exposure Duration (used only in cancer model)	year	33	0.1
Exposure Frequency	days/year	46	61
Dermal absorption factor	unitless	55	55
"X"	mg/kg-d	76	73
Body weight	kg	0	5
Proportion of Ingestion at the site	unitless	3	8
Soil Ingestion Rate	mg/day	7	11

Note:
Values are percentages.

Table 6-19
Sensitivity Analyses for the Probabilistic Noncancer Model for Adults
(at assumed tPCB EPC of 1 mg/kg)

Adult General Recreation Scenario

Variable	Units	Probability bounds: Remove uncertainty	Probability bounds: Remove uncertainty and variability
Exposure Duration (used only in cancer model)	year	0	0
Exposure Frequency	days/year	46	61
Dermal absorption factor	unitless	54	54
"X"	mg/kg-d	66	78
Body weight	kg	0	6
Proportion of Ingestion at the site	unitless	3	9
Soil Ingestion Rate	mg/day	13	15

Older Child General Recreation Scenario

Variable	Units	Probability bounds: Remove uncertainty	Probability bounds: Remove uncertainty and variability
Exposure Duration (used only in cancer model)	year	0	0
Exposure Frequency	days/year	46	61
Dermal absorption factor	unitless	50	50
"X"	mg/kg-d	58	75
Body weight	kg	0	11
Proportion of Ingestion at the site	unitless	3	12
Soil Ingestion Rate	mg/day	17	17

Young Child General Recreation Scenario

Variable	Units	Probability bounds: Remove uncertainty	Probability bounds: Remove uncertainty and variability
Exposure Duration (used only in cancer model)	year	0	0
Exposure Frequency	days/year	46	61
Dermal absorption factor	unitless	55	55
"X"	mg/kg-d	76	73
Body weight	kg	0	5
Proportion of Ingestion at the site	unitless	3.089914442	8.20778067
Soil Ingestion Rate	mg/day	7	11

Note:
Values are percentages.

Table 6-20

Monte Carlo Analog Assumptions and Sources of Uncertainty for Recreational Scenarios

Input	Recreational Scenario					
	General Recreation	ATV / Dirt Biker	Angler	Wildlife Hunter	Canoeist / Boater	Sediment Exposure
ED (Exposure Duration)	C	C	C	C	C	C
EF (Exposure Frequency)	?	?	?	?	?	?
ABS (Dermal Absorption Factor)	?	?	?	?	?	?
AF (Adherence Factors)	?	?	O	O	O	O
BW (Body Weight)	?	?	?	?	?	?
FI (Proportion ingested from the floodplain*)*	?	?	?	?	?	?
S (Proportion of year dressed for warm weather)	C	C	C	C	C	C

Notes:
C = input value likely to be conservative (i.e. might result in overestimating risk)
O= input value is optimistic (i.e. might result in underestimating risk)
? = input value has a mixed or uncertain affect on risk any bias in risk estimates

Table 6-21

Probability Bounds Analysis Assumptions and Sources of Uncertainty for Recreational Scenarios

Input	Recreational Scenario					
	General Recreation	ATV / Dirt Biker	Angler	Wildlife Hunter	Canoeist / Boater	Sediment Exposure
ED (Exposure Duration)	C	C	C	C	C	C
EF (Exposure Frequency)	?	?	?	?	?	?
ABS (Dermal Absorption Factor)	?	?	?	?	?	?
AF (Adherence Factors)	C	C	C	C	C	C
BW (Body Weight)	?	?	?	?	?	?
FI (Proportion ingested from the floodplain*)*	?	?	?	?	?	?
S (Proportion of year dressed for warm weather)	?	?	?	?	?	?

Notes:
C = input value likely to be conservative (i.e. might result in overestimating risk)
O= input value is optimistic (i.e. might result in underestimating risk)
? = input value has a mixed or uncertain affect on risk any bias in risk estimates

EXHIBIT 6-1

EXAMPLE OF RISK CALC CODE FOR MONTE CARLO ANALOG ANALYSIS ADULT ANGLER SCRIPT, TOTAL PCBs

EXHIBIT 6-1
EXAMPLE OF RISK CALC CODE FOR MONTE CARLO ANALOG ANALYSIS
ADULT ANGLER SCRIPT, TOTAL PCBs

//In the following code, annotations explaining various program elements are shown after two forward slashes (//)

```
_clear

// Total PCB concentration in soil or sediment (mg/kg)
   CS=1 mg kg{-1}

// Factor representing correlated exposure variables (mg/kg-d)
   X=@(0.77,0) (4.36,0.05) (6.52,0.1) (8.72, 0.15) (10.88,0.2) (13.05, 0.25) (15.23,0.3)
(17.53,0.35) (19.89,0.4) (22.41,0.45) (25.66,0.5)(29.92,0.55) (36.25,0.6) (45.24,0.65)
(54.43,0.7) (61.05,0.75) (66.36,0.8) (72.02,0.85) (79.94,0.9) (95.46,0.95) (215.92,1)@
mg kg{-1} day{-1}

// Dermal Absorption Factor (unitless)
   ABS=0.14

// Soil/Sediment Ingestion Rate (mg/day)
   IR=triangular(0 mg day{-1},50 mg day{-1},100 mg day{-1})

// Proportion of ingestion at the Site (unitless)
   FI=uniform(0.5,1)

// Body weight (kg)
   BW=@(34.8,0) (45.0,0.01) (50.9,0.05) (54.8,0.1) (57.7, 0.15) (60.0,0.2) (62.6, 0.25)
(64.8,0.3) (67.2,0.35) (69.3,0.4) (71.7,0.45) (74.1,0.5)(76.1,0.55) (78.1,0.6) (80.4,0.65)
(83.0,0.7) (86.1,0.75) (89.6,0.8) (94.0,0.85) (99.5,0.9) (107.2,0.95) (132.6,0.99)
(241.8,1)@ kg

// Exposure frequency (days/year)
   EF=@(1.0,0) (1.0,0.05) (2.0,0.1) (2.0,0.15) (3.0,0.2) (3.0,0.25) (4.0,0.3) (4.0,0.35)
(5.0,0.4) (5.0,0.45) (6.0,0.5) (7.0,0.55) (8.0,0.6) (10.0,0.65) (10.0,0.7) (12.0,0.75)
(15.0,0.8) (20.0,0.85) (20.0,0.9) (30.0,0.95) (180.0,1)@ day year{-1}

// Exposure duration (years)
   ED=min(lognormal(28.63 year, 20.34 year), 52 year)

// Units conversion factor (kg/mg)
   CF.cancer=0.000001 kg mg{-1}
```

```
   CF.noncancer=0.000001 kg mg{-1} * (1 year/365 day)

// Averaging time (days), cancer
   AT=25550 day

// Cancer slope factor (mg/kg-d)^-1
   CSF=2.0 mg{-1} kg day

// Reference dose (mg/kg-d)
   RfD=0.00002 mg kg{-1} day{-1}

// RISK CALCULATION

   LADD=CS |*| ((X |*| ABS) |+| ((IR |*| FI) |/| BW)) |*| ((EF |*| ED |*| CF.cancer) |/| AT)

   CancerRisk=LADD |*| CSF

   ADD= CS |*| ((X |*| ABS) |+| ((IR |*| FI) |/| BW)) |*| (EF |*| CF.noncancer)

   HI=ADD/RfD

_print "Cancer Risk," CancerRisk
_print "HI, " HI
```

EXHIBIT 6-2

EXAMPLE OF RISK CALC CODE FOR PROBABILITY BOUNDS ADULT ANGLER SCRIPT, TOTAL PCBs

EXHIBIT 6-2
EXAMPLE OF RISK CALC CODE FOR PROBABILITY BOUNDS
ADULT ANGLER SCRIPT, TOTAL PCBs

```
// In the following code, annotations explaining various program elements are shown
after two forward slashes (//)

_clear

// Total PCB concentration in soil or sediment (mg/kg)
  CS=1 mg kg{-1}

// Factor representing correlated exposure variables (mg/kg-d)
  X= fivenumbers([0.34, 172] mg kg{-1} day{-1}, [0.89, 172] mg kg{-1} day{-1}, [0.89,
172] mg kg{-1} day{-1}, [0.89, 172] mg kg{-1} day{-1}, [0.89, 311]mg kg{-1} day{-1})

// Dermal Absorption Factor (unitless)
  ABS=[0.06, 0.41]

// Soil/Sediment Ingestion Rate (mg/day)
  IR=minmaxmode(0 mg day{-1}, 300 mg day{-1}, 50 mg day{-1})

// Proportion of ingestion at the Site (unitless)
  FI=[0.5,1]

// Body weight (kg)
  BW=@(34.8,0) (45.0,0.01) (50.9,0.05) (54.8,0.1) (57.7, 0.15) (60.0,0.2) (62.6, 0.25)
(64.8,0.3) (67.2,0.35) (69.3,0.4) (71.7,0.45) (74.1,0.5)(76.1,0.55) (78.1,0.6) (80.4,0.65)
(83.0,0.7) (86.1,0.75) (89.6,0.8) (94.0,0.85) (99.5,0.9) (107.2,0.95) (132.6,0.99)
(241.8,1)@ kg

// Exposure frequency (days/year)
  EF=@(0.9,0) (0.9,0.05) (1.8,0.1) (1.8,0.15) (2.7,0.2) (2.7,0.25) (3.6,0.3) (3.6,0.35)
(4.5,0.4) (4.5,0.45) (5.4,0.5) (6.3,0.55) (7.2,0.6) (9,0.65) (9,0.7) (10.8,0.75) (13.5,0.8)
(18,0.85) (18,0.9) (27,0.95) (162,1) (1.1,0) (1.1,0.05) (2.2,0.1) (2.2,0.15) (3.3,0.2)
(3.3,0.25) (4.4,0.3) (4.4,0.35) (5.5,0.4) (5.5,0.45) (6.6,0.5) (7.7,0.55) (8.8,0.6) (11,0.65)
(11,0.7) (13.2,0.75) (16.5,0.8) (22,0.85) (22,0.9) (33,0.95) (198,1)@ day year{-1}

// Exposure duration (years)
//calculate confidence intervals around mean and std dev for p-box
// xbar is average from MADPH, 2001
  xbar=28.63
//z95 is 95% percentile of standard normal distribution (it is constant equal to 1.96)
  z95=1.96
```

```
// ss is standard deviation from MADPH, 2001
  ss=20.34
//s2 = ss^2 i.e. the variance
  s2= (20.34) * (20.34)
  n=84
// Interval for average exposure duration (xlcl, xucl) is given by 95% CI on mean: mean+-stdev/sqrt(n) where n is sample size
  xlcl = xbar - (z95 * ss/sqrt(n))
  xucl= xbar + (z95 * ss/sqrt(n))
// 95% confidence interval for variance (following Sokal and Rohlf, Section 7.7)
  slcl=18
  sucl=24

  ED=mmms(1 year, 52 year, [xlcl,xucl] year, [slcl,sucl] year)

// Units conversion factor (kg/mg)
  CF.cancer=0.000001 kg mg{-1}
  CF.noncancer=0.000001 kg mg{-1} * (1 year/365 day)

// Averaging time (days), cancer
  AT=25550 day

// Cancer slope factor (mg/kg-d)-1
  CSF=2.0 mg{-1} kg day

// Reference dose (mg/kg-d)
  RfD=0.00002 mg kg{-1} day{-1}

// RISK CALCULATION

  LADD=CS |*| (((X * ABS) + ((IR |*| FI) / BW)) * ED) |*| ((EF |*| CF.cancer) |/| AT)

  CancerRisk=LADD |*| CSF

  ADD= CS |*| ((X * ABS) + ((IR |*| FI) / BW)) |*| (EF |*| CF.noncancer)

  HI=ADD/RfD

_print "Cancer Risk," CancerRisk
_print "HI, " HI
```

ADDENDUM 6.1

QUANTIFYING UNCERTAINTY IN REGRESSION MODELS AND DEVELOPING BODY WEIGHT DISTRIBUTIONS

ADDENDUM 6.1

QUANTIFYING UNCERTAINTY IN REGRESSION MODELS AND DEVELOPING BODY WEIGHT DISTRIBUTIONS

INTRODUCTION AND NOTATION

The equation for a linear regression model has the form (for example, Robert et al., 1997):

$$(1)\quad Y_i = \beta_0 + \sum_{j=1}^{m} \beta_j \cdot X_{ij} + \varepsilon_i , \; i = 1,...,n$$

where *m* is the number of predictor variables, *n* is the number of measured values included in the regression, Y_i are the measured values, X_{ij} are the values of the predictor variables corresponding to the measured values Y_i, and ε_i are the normally distributed regression residuals.

Matrix notation is as follows:

$$\mathbf{Y} = \begin{bmatrix} Y1 \\ Y2 \\ ... \\ Yn \end{bmatrix}, \; \mathbf{X} = \begin{bmatrix} 1 \; X_{11} \;\; X_{12}...X_{1m} \\ 1 \; X_{21} \;\; X_{22}...X_{2m} \\ ... \\ 1 \; X_{n1} \;\; X_{n2}...X_{nm} \end{bmatrix}, \; \boldsymbol{\beta} = \begin{bmatrix} \beta_0 \\ \beta_1 \\ ... \\ \beta_m \end{bmatrix}, \; \boldsymbol{\varepsilon} = \begin{bmatrix} \varepsilon_0 \\ \varepsilon_1 \\ ... \\ \varepsilon_n \end{bmatrix}.$$

In matrix notation, (1) has the following form:

$$(2)\quad \mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon}$$

The variance-covariance matrix used to estimate confidence limits (CL) for the regression model coefficients and model predictions is:

$$(3)\quad \mathbf{V}(\boldsymbol{\beta}) = (\mathbf{X}^T\mathbf{X})^{-1}\sigma^2 ,$$

where $\sigma^2 = Var(\boldsymbol{\varepsilon}) = E(\boldsymbol{\varepsilon}\boldsymbol{\varepsilon}^T)$ is the variance of model residuals, the superscript "*T*" denotes matrix transposition, and the exponent "-1" denotes matrix inversion. Diagonal elements of the symmetric variance-covariance matrix represent variances of the estimated regression model coefficients: $V_{jj} = \sigma^2(\beta_j)$, and the other elements represent covariance of the regression coefficients $V_{jk} = \sigma^2(\beta_j, \beta_k)$, j,k=1,2,…m. Values $\sigma(\beta_j)$ are called standard errors of regression coefficients. These values are commonly available in summaries of statistical packages. The next section describes a procedure for using the standard errors to reconstruct the entire variance-covariance matrix using literature data where the original variance-covariance matrix was not presented.

If $\mu_Y(\mathbf{X_0}) = \mathbf{X}_0{}^T\boldsymbol{\beta}$, $\mathbf{X_0} = \begin{bmatrix} 1 \\ X_{01} \\ \ldots \\ X_{0m} \end{bmatrix}$, $\mathbf{X_0}{}^T = [1\ \ X_{01}\ \ X_{02}\ \ \ldots\ \ X_{0m}]$ is the regression model estimation (mean prediction) given predictor-variable values X_{0j}, then CL for $\mu_Y(\mathbf{X_0})$ with confidence $1-\alpha$ is

(4) $$CL_{1-\alpha}(\mu_Y(\mathbf{X_0})) = \mu_Y(\mathbf{X_0}) \pm t(1-\alpha, n-2)\cdot\sqrt{\mathbf{X}_0{}^T\mathbf{V}(\boldsymbol{\beta})\mathbf{X}_0},$$ and

the CL for individual data prediction (i.e., when we predict a single future observation of ***Y*** rather than the average of many future predictions) is

(5) $$CL_{1-\alpha}(\mu_Y(\mathbf{X_0})) = \mu_Y(\mathbf{X_0}) \pm t(1-\alpha, n-2)\cdot\sqrt{\sigma^2 + \mathbf{X}_0{}^T\mathbf{V}(\boldsymbol{\beta})\mathbf{X}_0},$$

where t(1-α,n-2) is the α-*th* percentile of Student's t-distribution with n-2 degrees of freedom.

The examples for m=1 and 2 (one and two predictor-variables) of variance-covariance matrix are summarized below. Short notation is used for the sums:

(6) $$\Sigma x_j = \sum_{i=1}^{n} X_{ij}, \quad \Sigma x_j^2 = \sum_{i=1}^{n} X_{ij}^2, \quad \Sigma x_j x_k = \sum_{i=1}^{n} X_{ij} X_{ik}.$$

a) One predictor-variable: m=1

$$\mathbf{V}(\boldsymbol{\beta}) = \frac{\sigma^2}{n\Sigma x_1^2 - (\Sigma x_1)^2}\begin{bmatrix} \Sigma x_1^2 & -\Sigma x_1 \\ -\Sigma x_1 & n \end{bmatrix}$$

(7)

$$\mathbf{X}_0{}^T\mathbf{V}(\boldsymbol{\beta})\mathbf{X}_0 = \sigma^2 \frac{\Sigma x_1^2 - 2X_0\Sigma x_1 + nX_0{}^2}{n\Sigma x_1^2 - (\Sigma x_1)^2} = (\frac{\sigma^2}{n} + \sigma^2(\beta_1)(X_0 - \frac{1}{n}\Sigma x_1)^2)$$

b) Two predictor-variables: m=2

$$\mathbf{V}(\boldsymbol{\beta}) = \frac{\sigma^2}{\Delta}\begin{bmatrix} \Sigma x_1^2\Sigma x_1^2 - (\Sigma x_1 x_2)^2 & \Sigma x_2\Sigma x_1 x_2 - \Sigma x_1\Sigma x_2^2 & \Sigma x_1\Sigma x_1 x_2 - \Sigma x_2\Sigma x_1^2 \\ \Sigma x_2\Sigma x_1 x_2 - \Sigma x_1\Sigma x_2^2 & n\Sigma x_2^2 - (\Sigma x_2)^2 & n\Sigma x_1 x_2 - \Sigma x_1\,\Sigma x_2 \\ \Sigma x_1\Sigma x_1 x_2 - \Sigma x_2\Sigma x_1^2 & n\Sigma x_1 x_2 - \Sigma x_1\,\Sigma x_2 & n\Sigma x_1^2 - (\Sigma x_1)^2 \end{bmatrix};$$

$$\Delta = n\Sigma x_1^2\Sigma x_2^2 - n(\Sigma x_1 x_2)^2 - (\Sigma x_1)^2\Sigma x_2^2 + 2\Sigma x_1\Sigma x_2\Sigma x_1 x_2 - (\Sigma x_2)^2\Sigma x_1^2$$

(8)

$$\begin{aligned}\mathbf{X}_0{}^T\mathbf{V}(\boldsymbol{\beta})\mathbf{X}_0 = \frac{\sigma^2}{\Delta}[&\Sigma x_1^2\Sigma x_2^2 - (\Sigma x_1 \mathrm{x}_2)^2 - 2\mathrm{X}_{01}\Sigma x_1\Sigma x_2^2 + 2\mathrm{X}_{01}\Sigma x_2\Sigma x_1 \mathrm{x}_2 + 2\mathrm{X}_{02}\Sigma x_1\Sigma x_1 \mathrm{x}_2 - \\ &2\mathrm{X}_{02}\Sigma x_2\Sigma x_1^2 + \mathrm{nX}_{01}{}^2\Sigma x_2^2 - \mathrm{X}_{01}{}^2(\Sigma x_2)^2 - 2\mathrm{nX}_{01}\mathrm{X}_{02}\Sigma x_1 x_2 + 2\mathrm{X}_{01}\mathrm{X}_{02}\Sigma x_1\Sigma x_2 + \\ &\mathrm{nX}_{02}{}^2\Sigma x_1^2 - \mathrm{X}_{02}{}^2(\Sigma x_1)^2]\end{aligned}$$

RECONSTRUCTING VARIANCE-COVARIANCE MATRIX GIVEN STANDARD ERRORS FOR REGRESSION COEFFICIENTS

Data are available from the literature for adult human body part surface areas (A) predicted from body weight (BW) and height (H) (EPA, 1985). The regression model used is

(9) $\ln(A) = \beta_0 + \beta_1\ln(BW) + \beta_2\ln(H)$

Only the coefficients $\beta_0, \beta_1, \beta_2$ and their standard errors $\sigma(\beta_0), \sigma(\beta_1), \sigma(\beta_2)$, and the regression standard error σ are available from EPA (1985). The challenge is to reconstruct the entire variance-covariance matrix using only this information and other available constraints.

The standard errors are the diagonal elements of the matrix (8), where $x_1 = BW, x_2 = H$

The total number of unknown variables defining the variance-covariance matrix is 5 (i.e., 6-1 since $\Sigma x_j x_k$ is symmetric on j, k) in the case of two predictors (BW and H):

$$\Sigma x_j = \sum_{i=1}^{n} X_{ij}, \quad \Sigma x_j^2 = \sum_{i=1}^{n} X_{ij}^2, \quad \Sigma x_j x_k = \sum_{i=1}^{n} X_{ij} X_{ik}, \quad \Sigma x_j x_k = \Sigma x_k x_j, \; j = 1,2.$$

Three values, $\sigma(\beta_0), \sigma(\beta_1), \sigma(\beta_2)$, define three constraints on the unknown variance-covariance matrix elements:

$$(10) \quad \begin{aligned} &\frac{\sigma^2}{\Delta}(\Sigma x_1^2 \Sigma x_1^2 - (\Sigma x_1 x_2)^2) = \sigma^2(\beta_0) \\ &\frac{\sigma^2}{\Delta}(n\Sigma x_2^2 - (\Sigma x_2)^2) = \sigma^2(\beta_1) \\ &\frac{\sigma^2}{\Delta}(n\Sigma x_1^2 - (\Sigma x_1)^2) = \sigma^2(\beta_2) \end{aligned}$$

Two additional constraints which allow reconstruction of the entire matrix are:

$$(11) \quad \begin{aligned} &\Sigma x_1 = n\overline{BW} \\ &\Sigma x_2 = n\overline{H} \end{aligned}$$

where $\overline{BW}, \overline{H}$ are the average body weight and height derived from the original data used in [1], and n is the sample size available from [1].

The unique solution of the system of algebraic equations (10-11) is

(12)

$$
\begin{aligned}
\Sigma x_1 &= n\overline{BW} \\
\Sigma x_2 &= n\overline{H} \\
\Sigma x_1^2 &= \frac{\overline{BW}^2 n}{D}(1 - 2nv_0 + 2nv_1\overline{BW}^2 - 2nv_2\overline{H}^2 + n^2 v_0{}^2 + n^2 v_1{}^2\overline{BW}^4 + \\
&\quad n^2 v_2{}^2\overline{H}^4 - 2n^2 v_0 v_1\overline{BW}^2 - 2n^2 v_1 v_2\overline{H}^2\overline{BW}^2 - 2n^2 v_0 v_2\overline{H}^2) \\
\Sigma x_2^2 &= \frac{n\overline{H}^2}{D}\ (1 - 2nv_0 + 2nv_2\overline{H}^2 + n^2 v_2{}^2\overline{H}^4 + n^2 v_0{}^2 - 2nv_1\overline{BW}^2 + n^2 v_1{}^2\overline{BW}^4 - \\
&\quad 2n^2 v_0 v_2\overline{H}^2 - 2n^2 v_1 v_2\overline{H}^2\overline{BW}^2 - 2n^2 v_0 v_1\overline{BW}^2) \\
\Sigma x_1 x_2 &= \frac{\overline{BW}\,\overline{H} n}{D}(-1 - 2n^2 v_1 v_2\overline{H}^2\overline{BW}^2 + n^2 v_2{}^2\overline{H}^4 + n^2 v_1{}^2\overline{BW}^4 - 2n^2 v_0 v_2\overline{H}^2 - \\
&\quad 2n^2 v_0 v_1\overline{BW}^2 + n^2 v_0{}^2)
\end{aligned}
$$

$$
\begin{aligned}
D &= 1 + 2nv_1\overline{BW}^2 + 2nv_2\overline{H}^2 + n^2 v_2{}^2\overline{H}^4 + n^2 v_1{}^2\overline{BW}^4 - 2nv_0 + n^2 v_0{}^2 - \\
&\quad 2n^2 v_0 v_1\overline{BW}^2 - 2n^2 v_1 v_2\overline{H}^2\overline{BW}^2 - 2n^2 v_0 v_2\overline{H}^2 \\
v_i &= \frac{\sigma^2(\beta_i)}{\sigma^2}, i = 0,1,2.
\end{aligned}
$$

BODY PART SURFACE AREA REGRESSION ON BODY WEIGHT FOR CHILDREN

Table 1 summarizes regression models developed for predicting body part surface area from the body weight of children.

Table 1
Surface Area Regression Models for Children

$SA_x = a_x * BW + b_x$

	a	*b*	*SE a*	*SE b*	*total SE*	*mean BW*	*n*	R^2
SA_{head}	0.003047	0.047501	0.000712	0.01086	0.0082	25.82	23	62.5%
SA_{hands}	0.001611	0.014558	8.95E-05	0.002086	0.00429	20.685	20	94.7%
$SA_{forearms}$	0.002489	0.004356	0.00011	0.002478	0.005014	19.91	6	96.8%
$SA_{lowerlegs}$	0.004602	0.008679	0.000242	0.00563	0.011581	20.685	11	95.3%
SA_{feet}	0.002404	0.013192	0.000132	0.003082	0.00634	20.685	20	94.8%

The regression is of the form:

(13) $A = \beta_0 + \beta_1 \cdot BW$,

where A is the surface area, and BW is the body weight. Coefficients of the regression, along with their standard error, average body weight and sample sizes, and model standard errors for each body part, were evaluated for all available data (EPA, 1985) using Microsoft Excel (see also Section 6.5.1.9.2). Random body surface area is simulated with the equation:

(14) $$A = \beta_0 + \beta_1 BW + t_{n-2} \cdot \sqrt{\frac{\sigma^2}{n} + \sigma^2(\beta_1)[BW - Average(BW)]^2}\},$$

where the random value t has Student's t-distribution with n-2 degrees of freedom. The distribution of BW is discussed below.

BODY PART SURFACE AREA REGRESSION ON BODY WEIGHT AND HEIGHT FOR ADULTS

The regression is of the form:

(15) $$\ln(A) = \beta_0 + \beta_1 \ln(BW) + \beta_2 \ln(H)$$

The variance-covariance matrix $\mathbf{V}(\boldsymbol{\beta})$ was reconstructed using equation (9) given standard errors, sample sizes, and average height and body weight in studied groups available from EPA (1985). The following expression is used to define random surface area:

(16) $$A = \exp\{\beta_0 + \beta_1 \ln(BW) + \beta_2 \ln(H) + t_{n-2}\sqrt{\mathbf{X}_0^T \mathbf{V}(\boldsymbol{\beta}) \mathbf{X}_0}\}$$

where $\mathbf{X}_0^T \mathbf{V}(\boldsymbol{\beta}) \mathbf{X}_0$ expressed by equation (8) with x_1=BW, x_2=H, and t has Student's t-distribution with n-2 degrees of freedom.

Body weight and height are correlated for adults. The method to construct the distribution of BW and H is described in the next section.

BODY WEIGHT AND HEIGHT DISTRIBUTIONS

Raw data from NHANES-III (USDHHS, 1996) were used to construct probabilistic distributions of body weight and height. Each record for an individual subject includes the sex, age, body weight BW_i height H_i and statistical weight W_i. Statistical weights indicate the number of people in the U.S. population represented by each sample.

According to the definition of a cumulative distribution function:

$$\mathrm{CDF(BW) = Pr\,obability(individual\ BW < BW) =} \frac{\mathrm{Number(i\ such\ as\ BW_i < BW)}}{\mathrm{N}} = \frac{\sum\limits_{\mathrm{BW_i < BW}} \mathrm{W_i}}{\sum \mathrm{W_i}}$$

(17)

$$\mathrm{CDF(H) = Pr\,obability(individual\ H < H) =} \frac{\mathrm{Number(i\ such\ as\ H_i < H)}}{\mathrm{N}} = \frac{\sum\limits_{\mathrm{H_i < H}} \mathrm{W_i}}{\sum \mathrm{W_i}}$$

Crystal Ball® accepts correlation coefficients to simulate statistical dependence between variables. Correlations between BW and H were calculated using STATISTICA®, which allows the use of statistical weights of samples. The minimum and maximum values for each age group in the NHANES III data set were used to define the minimum and maximum values of each cumulative distribution function.

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7. UNCERTAINTY ANALYSIS

7.1 INTRODUCTION

EPA guidance and policy (EPA, 1995) recommend that a thorough discussion be provided of the variability and uncertainty surrounding the calculation of risk to inform decisionmakers when considering risk management alternatives. Multiple approaches were used to characterize the variability and uncertainty in this risk assessment:

- Point estimate calculations of both reasonable maximum exposure (RME) and central tendency exposure (CTE) (Section 5).
- Monte Carlo analysis to characterize variability in risks, providing estimates of both a CTE and an RME range (i.e., 90th to 99.9th percentiles) (Section 6 and summarized in Section 7.3).
- Probability bounds analysis to quantify uncertainty in the risk assessment modeling assumptions, including the derivation of point estimates and probability distributions.
- Sensitivity analyses to identify the contribution of individual exposure parameters to variability and uncertainty.
- Qualitative evaluation of sources of uncertainty in the underlying data, the selection of parameter values, and modeling assumptions (Section 7.2).
- Evaluation of cancer risk from dioxin TEQ (Section 7.2.4.1).

RME risk generally should be the principal basis for evaluating potential risks at Superfund sites (EPA, 1990, NCP Preamble, 55 FR 8711). The RME is defined as the highest exposure that is reasonably expected to occur at a site. As described in RAGS, "The intent of the RME is to estimate a conservative exposure case (i.e., well above the average case) that is still within the range of possible exposures." In addition to the RME, EPA guidance suggests that the CTE be estimated as a semiquantitative predictor of uncertainty and variability. The CTE is designed to represent exposure to an average member of the exposed population. For the point estimate risk assessment, these two risk descriptors describe an upper- and mid-level estimate of risk (as presented in Section 5).

Probabilistic risk assessment (PRA) uses probability distributions for one or more variables in a risk equation to quantitatively characterize variability and/or uncertainty. The results of a PRA can provide important information to supplement the point estimates of risk. EPA's *Risk Assessment Guidance for Superfund – Process for Conducting Probabilistic Risk Assessment* (EPA, 2001a) describes a tiered approach for conducting risk assessments, with three levels of complexity of analysis of variability and uncertainty. The decision to proceed beyond each tier is based on whether there is sufficient information for risk management decisions. The point estimate approach described in Section 5 represents Tier 1 and is supplemented with a qualitative discussion of uncertainty in Section 7.2. The probabilistic risk assessment described in Section 6 represents a Tier 2 assessment. For this risk assessment, Tier 2 consists of a semianalytic method (i.e., analytic solution with discretization error) analogous to Monte Carlo simulation, with uncertainty further characterized using probability bounds analysis. The PRA also includes a formal sensitivity analysis to determine which parameters are most significant for the risk estimates.

The following sections provide additional information on the uncertainties associated with both the point estimate and probabilistic risk estimates. Section 7.2 provides a qualitative overview of sources of uncertainties in the risk assessment and identifies whether the uncertainty is likely to overestimate or underestimate risk. This section also includes a brief discussion on the uncertainties associated with the health effects of exposure to the COPCs and a quantitative evaluation of the contribution of TEQ to the risk estimates. Section 7.3 describes the treatment of uncertainties in the probabilistic analyses.

7.2 UNCERTAINTIES ASSOCIATED WITH SUPPORTING DATA

The risk assessment process is composed of four steps: Hazard Identification, Exposure Assessment, Toxicity Assessment, and Risk Characterization. An understanding of the uncertainties associated with the first three steps leads to a better understanding of the final step, Risk Characterization. It is important for the public as well as risk managers to be able to evaluate the results of the direct contact risk assessment within the context of these uncertainties. The following sections provide a qualitative discussion of uncertainties associated with each step of the risk assessment process.

7.2.1 Uncertainties Associated with the Hazard Identification

7.2.1.1 Selection of Soil-Related COPCs

A small number of polycyclic aromatic hydrocarbons (PAHs) were detected in soil above screening levels at very low frequency in localized areas. Although it is evident that these contaminants do not occur in concentrations above screening levels site-wide, additional unquantified risks may be present in a few small areas. EPA considers any additional risks from these contaminants at this site to be small and characterizes the uncertainty associated with the contribution of risks from PAHs in soil to be minimal.

7.2.1.2 Selection of Sediment-Related COPCs

A small number of PAHs were detected in sediment at concentrations above conservative screening levels at very low frequency in localized areas. Although it is evident that these contaminants do not occur in concentrations above screening levels site-wide, additional unquantified risks may be present in a few small areas. EPA considers any additional risks from these contaminants at this site to be small and characterizes the uncertainty associated with the contribution of risks from PAHs in sediment to be minimal.

7.2.2 Uncertainty in the Exposure Assessment

7.2.2.1 Exposure Point Concentration for tPCBs

Based on the assumption that exposure to contaminated soil or sediment occurs randomly across an exposure area, as modified by a use-weighting factor for soil, an estimate of the arithmetic mean concentration was selected as the appropriate exposure concentration to use in the risk assessment. The 95% upper confidence limit (UCL) of the mean of spatially and use-weighted data was used as a conservative estimate of an average soil concentration in an exposure area. The use of spatially weighted and use-weighted data also may either overestimate or underestimate the exposure point concentration. Overall, because of the use of the 95% UCL as a conservative estimate of the mean, it is unlikely that the mean concentration is underestimated.

7.2.2.2 Exposure Point Concentration for Dioxin-like PCBs, Dioxins, and Furans

As described in Attachment 2 of the HHRA, the 2,3,7,8-TCDD TEQ (TEQ) was estimated based on a regression of total PCB (tPCB) concentration to each individual congener in paired samples (i.e., samples subject to both PCB and congener analyses). The paired samples are a subset of the tPCB data set. The results of the regression were then applied to all EAs. Because the subset of paired data is relatively small, and a regression model was used instead of measured concentrations, the TEQ concentration may be either overestimated or underestimated. However, the uncertainty associated with prediction of congener concentrations is illustrated in Section 6 of Volume V, where uncertainty in the regression model for PCB-126 is quantified in a case study of the commercial dairy scenario.

7.2.2.3 Selection of Exposure Scenarios

Exposure scenarios were selected to represent the variety of potential uses of the river and its floodplain. The scenarios evaluated in the quantitative risk assessment are generally conservative descriptors of reasonable exposures. These scenarios are more likely to overestimate than underestimate the risks, even for individuals whose behavior may differ somewhat from that described in the specific scenario other than a nonrandom use pattern over the entire parcel.

7.2.2.4 Current versus Future Residential, Industrial/Commercial, and Agricultural Scenarios

Residential use occurs at many properties along the river, and it is possible that properties at several other locations that are not currently residential could be developed for housing in the future. Not all possible properties were assessed for future residential uses. If any properties not evaluated for future residential exposure become residential properties at some point in the future, risks would likely be underestimated at these EAs.

Industrial/commercial and agricultural exposures were assessed only for those areas currently designated for these uses. Thus, the use of these scenarios is not expected to contribute to either the overestimation or underestimation of risk, except in cases noted above, where the current land use changes at some point in the future. Depending on the potential changes in land use, the risks for any particular EA could be overestimated or underestimated.

7.2.2.5 Recreational Scenarios

Many recreational scenarios were evaluated in the risk assessment. General recreation was the most commonly evaluated scenario throughout the floodplain. The recreational scenarios evaluated in the direct contact risk assessment are considered protective of other observed or possible recreational uses of the floodplain that were not specifically evaluated. It was assumed that recreational use would continue (because many of the EAs designated as recreational are owned and managed for such use) and that recreational use may occur in areas where specific activities were not observed during the period in which the Supplemental Investigation (SI) was conducted. Because only those scenarios that would result in the greatest risks were quantified, it is more likely that risks are overestimated rather than underestimated for other uses not specifically evaluated.

7.2.2.6 Soil and Sediment Ingestion Rates

There are several uncertainties associated with soil ingestion rates. The number of studies on soil ingestion in children and in adults is limited, and the receptor activities are generally limited to residential exposures. No studies evaluating adult soil ingestion during recreational activities were identified. The studies that were identified have experimental limitations including the small number of individuals sampled, sample collection and measurement errors, and relatively short study durations. Because of these uncertainties, the soil ingestion rates selected may overestimate or underestimate risk.

EPA, CDPHE, and DOE (2002) developed a soil ingestion rate distribution for a young child that became publicly available after this assessment was completed. They recommend use of a truncated lognormal distribution, with an arithmetic mean of 47.5, standard deviation of 112, and a maximum of 1,000 mg/day. This distribution is applicable only to the young child recreational scenario. When it is substituted for the young child's soil ingestion rate used in this assessment (i.e., a triangular distribution with minimum of 50, mode of 100, and maximum of 200 for the MCA analog, and a p-box defined by a minimum of 0, mode of 100, and maximum of 300 for the PBA), cancer risk and hazard index estimates change slightly. Cancer risks and hazard indices for the MCA analog decreased by about a factor of 2.4 to 3 at the 25th, 50th, and 75th percentiles, 1.4 to 1.9 at the 90th and 95th percentiles, and stayed about the same at the 99th percentile. Similar results were obtained by re-calculating the PBA results, substituting the lognormal distribution for soil ingestion rate.

7.2.2.7 Exposure Frequency

The number of days per year that exposure was estimated to occur was based on field observations, standard default values, and site-specific information. These assumptions may either overestimate or underestimate risks.

7.2.2.8 Exposure Duration

The number of years during which exposure may occur was based on site-specific information from a survey of 1,882 persons who reside in the Housatonic River Area. A high-end estimate derived from the years reported in the survey was used in the assessment of the RME risk and a central tendency estimate was used for the CTE risks. Therefore, the exposure duration assumptions used in the risk assessment are likely to be reasonable estimates of the actual exposure duration in the population in the Pittsfield area, and the overall level of uncertainty associated with these assumptions would be low.

7.2.2.9 Use of Soil Exposure Parameters for Sediment Exposure

Dermal adherence factors and ingestion rates have not been developed for exposure to sediment. The use of soil exposure parameters for the evaluation of sediment is a potentially significant uncertainty, since it is likely that exposure to sediment would result in different ingestion rates and dermal adherence. The use of soil exposure parameters for sediment may either overestimate or underestimate risks.

7.2.3 Uncertainty Associated with the Toxicity Assessment

PCBs and 2,3,7,8-TCDD TEQ from dioxins, furans, and dioxin-like PCB congeners were the two COPCs evaluated in this risk assessment. PCBs were evaluated in Section 5 (Risk Characterization), and TEQ is evaluated in Section 7.2.4.1 in combination with tPCBs.

The toxicity values used in this risk assessment for the COPCs were the most current values available in EPA databases and reports (EPA, 2004 and 1997). A more-detailed discussion of the toxicology of PCBs, dioxins, and furans is included in Section 4 of the HHRA. The following sections provide a brief discussion of some of the principal issues related to the toxicity of these contaminants.

7.2.3.1 Cancer Slope Factors (CSFs)

CSFs are plausible upper-bound estimates of carcinogenic potency used to calculate cancer risk from exposure to carcinogens by relating estimates of lifetime average chemical intake to the incremental probability of an individual developing cancer over a lifetime. Because the CSFs developed by EPA are plausible upper-bound estimates, EPA is reasonably confident that the actual cancer risks are likely to be less than the risks estimated with the upper-bound slope factor. It is not possible to estimate how much less, but risks to some individuals could be zero.

7.2.3.1.1 PCB CSF

The PCB CSF is based on animal studies using commercial mixtures (Aroclors). For PCBs, EPA has developed both high-end and central tendency estimates of the PCB CSF. The upper-bound and central estimate slope factors for highly chlorinated PCB mixtures, such as those detected in floodplain soil and sediment sampled in the HRA, differ only by a factor of two.

There are a number of uncertainties associated with the use of animal studies to predict cancer risk in humans, both qualitatively and quantitatively through the CSF. Qualitatively, PCBs have been classified as probable human carcinogens (former EPA category B2) based on clear evidence of carcinogenicity in animal experiments and suggestive studies in human populations. Quantitatively, major sources of uncertainty in the application of experimental information to human exposure are the extrapolation of animal studies to human populations, the extrapolation of the high experimental doses to the lower doses from environmental exposures, extrapolation to less than lifetime doses (including the impact of early life exposures), and extrapolation of results from commercial mixtures to environmental mixtures. The first three uncertainties are common to the derivation of many CSFs derived by EPA, and are discussed more fully in Section 4.2 of the HHRA. The extrapolation from commercial to environmental mixtures is specific to mixtures such as PCBs. This issue is summarized in Section 3.2.4.2 and discussed in HHRA Volume I, Section 4 in greater detail.

7.2.3.1.2 Dioxins, Furans, and Dioxin-like PCBs

Cancer risks from dioxins, furans, and dioxin-like PCBs were characterized using the TEQ methodology (described in Section 3). Toxic equivalency factors (TEFs) developed by the World Health Organization (WHO) (Van den Berg et al., 1998) were used to calculate the TEQ for these contaminants. TEFs are order of magnitude estimates that do not include expressions of uncertainty in predicted dioxin-like toxicity. Some TEFs are based on cancer-related effects, and others are based on noncancer-related effects. The TEQ approach assumes that the effects of the individual congeners are additive and does not address possible antagonism or synergism. The result of the TEQ methodology is a concentration or dose that has a potency that is expressed in terms of its equivalency to 2,3,7,8-TCDD. Cancer risks are characterized by multiplying the TEQ, expressed as average daily dose, with the CSF for 2,3,7,8-TCDD.

The weight of the evidence that dioxins are human carcinogens has been evaluated by several national and international organizations. EPA has withdrawn its evaluation of TCDD carcinogenicity from IRIS. The EPA evaluation in HEAST (EPA, 1997), which in turn was based on an evaluation conducted in 1985, gave a weight of evidence classification of B2, probable human carcinogen. More recently, the International Agency for Research on Cancer (IARC, 1997) evaluated the weight of evidence of that 2,3,7,8-TCDD is a human carcinogen and concluded it was a Group 1, human carcinogen, indicating that there was adequate evidence based on human studies to consider it carcinogenic to humans.

EPA recently reviewed available epidemiology and toxicity studies on 2,3,7,8-TCDD and other dioxin-like compounds. A preliminary draft document (EPA, 2000) presents EPA's scientific reassessment of the health risks resulting from exposure to these compounds. This document has undergone review by the public as well as EPA's Science Advisory Board (SAB) (EPA, 2001b). Based on its review of epidemiology, animal toxicology and mechanistic studies, EPA concluded that 2,3,7,8-TCDD met the criteria of human carcinogen, as set forth in the cancer assessment guidelines (EPA, 1999). EPA, along with other members of an Interagency Workgroup, has asked the National Academy of Sciences to provide an additional review to ensure that the risk estimates contained in the draft are scientifically robust and that there is a clear delineation of all associated uncertainties (EPA, 2003).

There is considerable uncertainty regarding the appropriate CSF for TCDD. The CSF derived by EPA (1985) and published in HEAST (EPA, 1997), 1.5E+05 $(mg/kg\text{-}d)^{-1}$, was used in this assessment. The CSF was derived from liver tumor incidence data in female Sprague-Dawley rats in a 2-year feeding study and extrapolated from the experimental doses given to the animals to lower doses typical of environmental exposed using a linearized multistage model. Species extrapolation from animals to humans was calculated based on a body weight ratio to the ¾ power.

In the reassessment, EPA recommended a revised CSF of 1E+06 $(mg/kg\text{-}d)^{-1}$ to estimate upper-bound cancer risk for background intakes and incremental intakes above background, of 2,3,7,8-TCDD and other dioxin-like compounds. Use of this recommended CSF would result in an approximately six-times increase in the cancer risk estimates associated with 2,3,7,8-TCDD and other dioxin-like compounds. Thus, the current CSF for 2,3,7,8-TCDD used in this assessment may underestimate potential risks. However, as with all upper-bound slope factors used to calculate cancer risks, EPA believes that the true risks are likely to be less than the risks estimated with the upper-bound slope factor. It is not possible to estimate how much less, but risks to some individuals could be zero.

7.2.3.2 Chronic Reference Doses (RfDs)

The chronic RfD represents an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime.

7.2.3.2.1 PCBs

The Reference Dose (RfD) for PCBs used in this assessment is based on immunological effects observed in rhesus monkeys exposed to Aroclor 1254. An uncertainty factor of 300, which accounts for sensitive members of the population and for extrapolating from animal data to human data, is incorporated into the RfD. EPA is currently reviewing new studies on noncancer effects of PCBs as part of the ongoing IRIS review process. These studies report possible associations between developmental and neurotoxic effects in children from pre-natal or post-natal exposures to PCBs.

Major sources of uncertainty associated with the PCB RfDs include:

- The selection of uncertainty factors in the derivation of the RfDs, including the length of the study, the critical effect, the quality of the dataset, and the variability of human population, including sensitive subpopulations.
- The assumption that the critical effects in animal studies are the critical effects in humans.
- The dose metric of average daily dose is applicable to bioaccumulative compounds.
- Toxicity changes resulting from alterations in PCB mixtures ("weathering") following release to the environment.

Each of these sources is described in HHRA Section 4.

In addition to uncertainties in the chronic RfD, there is additional uncertainty associated with toxic effects that may result from shorter exposure durations. The critical period of exposure for developmental effects associated with in utero exposure may be days or weeks instead of the long-term exposure assessed in this report. The potential impact of these acute (short-term) exposures was not evaluated in this assessment, which could lead to an underestimate of the risk associated with PCBs. A perspective on the contribution of direct contact exposure to the concentration of dioxins and furans in breast milk is provided in Volume 1, Section 10.3.

7.2.3.2.2 Dioxins, Furans, and Dioxin-like PCBs

Exposure to dioxins, furans, and dioxin-like PCBs (dioxin-like compounds) has been shown to result in adverse effects on multiple organ systems in many animal species. The spectrum of effects observed depends upon dose, exposure duration, developmental stage of the organism, and the animal species (and strain). These studies suggest that, following oral exposure to dioxin-like compounds, the most sensitive effects (effects that occur at the lowest doses) are those to the immune, endocrine, and developmental systems (EPA, 2000; IARC, 1997). The science associated with noncancer effects of dioxin is under review by the NAS.

An RfD for dioxin-like compounds has not been developed. Further, EPA (2000) concluded that a reference dose for dioxin calculated in the manner typical of the way EPA determines RfDs would result in a dose that is significantly lower than current average background doses. RfDs are used primarily to evaluate increments of exposure from specific sources when background exposures are low and insignificant, and background exposures for dioxin-like compounds are not insignificant.

Because an RfD has not been developed for PCDD/PCDFs, the potential for noncancer effects from exposure to dioxin-like compounds is not evaluated quantitatively in this assessment. This represents a potential underestimate of the risk associated with exposure to these contaminants at the site.

7.2.4 Uncertainty Associated with Risk Characterization

7.2.4.1 TEQ Cancer Risk

In Section 5, cancer risks and noncancer hazard indices were evaluated for tPCBs. In this section, the additional cancer risks associated with the presence of dioxins, furans, and dioxin-like PCB congeners are evaluated. Dioxins, furans, and dioxin-like PCB congeners are evaluated as 2,3,7,8-TCDD TEQ. The analytical program implemented in the SIWP (WESTON, 2000) required that approximately 10% of all samples be analyzed for PCB congeners, dioxins, and furans in addition to tPCBs; however, sufficient congener data were not available to directly calculate EPCs for all exposure areas that were evaluated.

Therefore, linear regression models were developed to predict individual congener concentrations from tPCB concentrations using the data collected under the SIWP. The derivation of these regressions is presented in Attachment 2 of the HHRA. The predicted congener concentrations were summed to derive the TEQ concentrations associated with the tPCB concentration. These estimated TEQ concentrations were used in the evaluation of TEQ risk discussed below. The data used to predict the individual congener concentrations from tPCB concentrations were collected from soil, and does not apply to sediment.

The regression analysis indicates that the relationship between tPCB and TEQ changes based upon the tPCB concentration. As the tPCB concentration increases, the relative TEQ concentration decreases. Table 7-1 shows the predicted TEQ concentration at five PCB concentrations ranging from 1 to 100 mg/kg, based on the regression equations presented in Attachment 2 of the HHRA.

To further examine the relationship between the tPCB and congener TEQ concentrations, cancer risk calculations were performed for the general recreation exposure scenario using both the tPCB and congener-specific TEQ concentrations. The general recreation scenario was selected for this analysis because it was the most common scenario evaluated across the entire site; includes the young child, older child, and adult receptors; and general recreation exposure could apply to all EAs. Cancer risks for the young child, older child, and adult receptors were calculated using the exposure equations and parameters presented in Table 4-12 and the CSFs for tPCBs and 2,3,7,8-TCDD. Exposure doses were calculated for each of the congener-specific TEQ concentrations and then summed to yield a total TEQ dose, which was then multiplied by the 2,3,7,8-TCDD CSF to yield a total TEQ cancer risk. In the case of dermal exposure, the appropriate dermal absorption factors (0.14 for dioxin-like PCB congeners and 0.03 for dioxin and furan congeners) were used.

Table 7-2 presents the RME and CTE risks for tPCBs and TEQ along with the ratio of the TEQ risk to the tPCB risk. As shown in the table, the ratios exhibit a similar pattern across all three receptors.

To provide an example describing the relationship between TEQ and tPCB risk, the risk ratios for the general recreation scenario for the RME adult were used (the older child and young child receptor values were essentially the same as the adult). Any differences in the TEQ:tPCB risk ratios for the other scenarios would be small given the similar nature of the exposure parameters, and are not expected to significantly impact this relationship.

Figure 7-1 presents the relationship between the tPCB concentrations and the ratios of the TEQ cancer risks to the tPCB cancer risks. At a tPCB concentration of 1 mg/kg, the TEQ risk is approximately 2.2 times greater than the tPCB risk. At a tPCB concentration of 100 mg/kg, the TEQ risk is less than half (0.4 times) the tPCB risk. No correlation for the noncancer HIs is presented because, as noted in Section 3, there is no RfD for 2,3,7,8-TCDD (used as the benchmark for TEQ) with which to quantify noncancer effects.

The relationships between the tPCB concentrations and the TEQ risks presented in Figure 7-1 were used to estimate a range of TEQ risks based on the range of tPCB EPCs. Table 7-3 presents the range of tPCB EPCs by exposure scenario. Table 7-4 summarizes the cancer risks from tPCBs and TEQ risks separately.

7.3 QUANTITATIVE TREATMENT OF UNCERTAINTY

The probability bounds analysis described in Section 6 propagates both variability and uncertainty in the risk assessment. This bounding approach extends and complements the Monte Carlo analog analyses by depicting how both variability and uncertainty associated with the point estimate or probability distribution input variables may collectively contribute to the uncertainty in the distribution of estimated risks, as well as the nature of the dependencies of the variables in the risk model (see Attachment 5 of the HHRA). The sensitivity analysis presented in Section 6 provides a quantitative measure of the relative contributions of various sources of uncertainty to the overall uncertainty in the risk estimates.

Uncertainty regarding the importance of variability in frequency, duration, and magnitude of exposure across exposure events in a single individual's lifetime was addressed by calculating risk distributions with Monte Carlo analog analysis. Uncertainty due to dependencies between input variables was analyzed using dependency bounds analysis. Uncertainty in the risk distribution due to uncertainty regarding the precise nature and parameterization of exposure model input variables was analyzed using probability bounds analysis. A detailed breakdown of the effect of the quantitative modeling of uncertainty on the risk distributions is provided in Section 6. Attachment 5 to the HHRA provides detailed examples of the sensitivity analysis process.

7.4 SUMMARY

Development of the cancer risks and noncancer hazard indices calculated in this risk assessment required the use of a number of assumptions and associated uncertainties, as is common practice in risk assessment. In general, and consistent with EPA policy, guidance and prior practice, when lack of data or knowledge necessitated the use of assumptions, parameter values or ranges were selected as a conservative representation of the uncertainty to ensure protection of public health. In such cases, if data or knowledge becomes available to either eliminate the need for assumptions or to reduce the uncertainty associated with the assumptions, it is likely that a recalculation of risks following adjustment of the exposure parameters would in many cases indicate that risks were overestimated to some degree. However, in some cases, it is likely that additional data or knowledge about exposure parameters would indicate that risks were underestimated to some degree. In the absence of more definitive site-specific information on both exposure and toxicity, the high end (RME) and central tendency (CTE) risk estimates presented in this report were developed to be protective of public health and are also consistent with EPA policies and guidance.

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SECTION 7

TABLES

Table 7-1

Total PCB and Predicted 2,3,7,8-TCDD TEQ Concentrations*

Concentration (mg/kg)	
tPCBs	2,3,7,8-TCDD TEQ
1	0.00004
5	0.0001
10	0.0001
50	0.0005
100	0.0007

* Based on the regression analysis presented in Attachment 2 of the HHRA Volume I.

Table 7-2

Comparison of the tPCB Cancer Risks and the 2,3,7,8-TCDD TEQ Cancer Risks for Different tPCB Concentrations

Receptor	Concentration (mg/kg)		Total Cancer Risks for the General Recreation Scenario*					
			RME			CTE		
	tPCBs	2,3,7,8-TCDD TEQ	Based on tPCBs	Based on 2,3,7,8-TCDD TEQ	Ratio of TEQ Risk to tPCB Risk	Based on tPCBs	Based on 2,3,7,8-TCDD TEQ	Ratio of TEQ Risk to tPCB Risk
Young Child								
	1	4E-05	7E-07	2E-06	2.5	5E-08	3E-07	4.6
	5	1E-04	4E-06	5E-06	1.4	3E-07	7E-07	2.4
	10	1E-04	7E-06	8E-06	1.0	5E-07	1E-06	1.9
	50	5E-04	4E-05	3E-05	0.7	3E-06	3E-06	1.3
	100	7E-04	7E-05	4E-05	0.5	5E-06	5E-06	0.88
Older Child								
	1	4E-05	3E-07	6E-07	2.5	2E-08	9E-08	4.6
	5	1E-04	1E-06	2E-06	1.4	1E-07	2E-07	2.4
	10	1E-04	3E-06	3E-06	1.0	2E-07	4E-07	1.8
	50	5E-04	1E-05	9E-06	0.7	1E-06	1E-06	1.3
	100	7E-04	3E-05	1E-05	0.5	2E-06	2E-06	0.88
Adult								
	1	4E-05	7E-07	2E-06	2.5	2E-08	7E-08	4.5
	5	1E-04	3E-06	5E-06	1.3	8E-08	2E-07	2.4
	10	1E-04	7E-06	7E-06	1.0	2E-07	3E-07	1.8
	50	5E-04	3E-05	2E-05	0.7	8E-07	1E-06	1.3
	100	7E-04	7E-05	3E-05	0.5	2E-06	1E-06	0.86

* General recreation high use risks are based on an EF of 90 days/year for the RME and 30 days/year for the CTE.

Table 7-3

Total PCB EPC Ranges for Each Exposure Scenario

Exposure Scenario	Range of tPCB EPCs (mg/kg)
Residential (low contact)[a]	2.2 - 43
Residential (high contact)[b]	3 - 34
Recreational	
General recreation (high use)[c]	2.2 - 76
General recreation (medium use)[d]	12 - 43
General recreation (low use)[e]	4.5 - 44
ATV/Dirt and Mountain Biker	8 - 61
Marathon Canoeist	19
Recreational Canoeist/Boater	3 - 27
Angler	3.5 - 83.3
Waterfowl hunter	17 - 117
Farmer	2 - 29
Commercial/Industrial	
Groundskeeper (low contact)[f]	20
Groundskeeper (high contact)[g]	3 - 4
Utility worker	12 - 121

[a] Residential (low contact) risks are based on an EF of 90 days/year for the RME and 30 days/year for the CTE.

[b] Residential (high contact) risks are based on an EF of 150 days/year for both the RME and the CTE.

[c] General recreation high use risks are based on an EF of 90 days/year for the RME and 30 days/year for the CTE.

[d] General recreation medium use risks are based on an EF of 60 days/year for the RME and 30 days/year for the CTE.

[e] General recreation low use risks are based on an EF of 30 days/year for the RME and 15 days/year for the CTE.

[f] Groundskeeper (low contact) risks are based on an EF of 30 days/year for the RME and 15 days/year for the CTE.

[g] Groundskeeper (high contact) risks are based on an EF of 150 days/year for both the RME and the CTE.

Table 7-4

Summary of the Cancer Risks for tPCBs and TEQ

Exposure Scenario	Minimum tPCB EPC (mg/kg)	tPCB Risk	TEQ Risk	Maximum tPCB EPC (mg/kg)	tPCB Risk	TEQ Risk
Residential	2.2	3E-06	5E-06	43	6E-05	4E-05
Recreational						
General recreation	2.2	2E-06	3E-06	76	5E-05	2E-05
ATV/Dirt and Mountain Biker	8	4E-06	5E-06	61	3E-05	2E-05
Marathon Canoeist *	-	-	-	19	2E-05	2E-05
Recreational Canoeist/Boater	3	3E-06	5E-06	27	2E-05	2E-05
Angler	3.5	1E-06	2E-06	83.3	3E-05	1E-05
Waterfowl hunter	17	2E-06	2E-06	117	1E-05	4E-06
Farmer	2	2E-06	4E-06	29	2E-05	2E-05
Commercial/Industrial						
Groundskeeper	3	2E-06	3E-06	20	2E-06	2E-06
Utility worker	12	7E-07	9E-07	121	7E-06	2E-06

* The marathon canoeist scenario was evaluated at a single area (EA 39).

tPCB = Total PCBs.

8. RISK SUMMARY

8.1 INTRODUCTION

Both point estimate and probabilistic approaches were used in this risk assessment to characterize high-end and central tendency tPCB risk to individuals (i.e., children and adults) who contact soil and sediment in the Housatonic River and floodplain. Consistent with EPA guidance, point estimate risks were calculated for both upper (RME) and central tendency (CTE) exposures, and probabilistic analyses were used to calculate a range of high-end risk percentiles corresponding to the RME and to calculate the CTE percentile (median).

Point estimate PCB-related cancer risks and the noncancer hazard indices for 140 soil and sediment EAs and subareas along the river are described in Section 5 and are summarized in this section by medium, exposure scenario, and receptor for current and future uses. The probabilistic risk assessment (PRA) for these receptors is not specific to any EA; therefore, it does not include an assessment of variability and uncertainty in parcel-specific exposure point concentrations (EPCs), including use-weighting factors (see Section 4.4). Instead, variability and uncertainty in model inputs were examined at an assumed tPCB floodplain soil or sediment EPC of 1 mg/kg.

Probabilistic analyses consisted of probability bounds analysis (PBA) and a semianalytic analog of one-dimensional Monte Carlo analysis (MCA analog) performed using PBA. These latter analyses are referred to as an MCA analog because MCA and PBA are not computationally identical. However, PBA yields the same answers as Monte Carlo simulation if it is provided with the same inputs and assumptions (see HHRA Volume I, Attachment 5).

The Monte Carlo analog analyses provide information on the likelihood of exceeding a risk level of concern. They also provide information on variability and more fully illustrate where the point estimates (both RME and CTE) fall in the risk range. The Monte Carlo analog analyses provide distributions of risk (rather than single values) that represent the frequencies of different risk levels experienced by a population, which is a result of the variability among individuals in the population in terms of their individual characteristics and specific exposure.

The PBA was conducted to provide bounding estimates of the risk distributions. The probability bounds delineate how variability and uncertainty regarding each point estimate or probability distribution selected to represent inputs may contribute to the uncertainty in the distribution of estimated risks. The probability bounds also show the effect of uncertainty regarding the dependencies between inputs (i.e., whether an exposure variable was dependent on or independent of the others). PBA provides the risk manager with plausible extremes of both the shape and the extent of the risk distribution.

The purpose of this section is to:

1. Compare the results of the point estimate and probabilistic risk analyses.
2. Summarize the point estimate RME and CTE tPCB risks by medium, exposure scenario, and receptor for both the current and future uses to provide an overall understanding of the risks associated with the variety of activities that are likely to occur in the floodplain.
3. Compare the point estimates and probabilistic risks calculated in this assessment to EPA guidance for cancer risk and noncancer health effects.

8.2 COMPARISON OF POINT ESTIMATE AND MONTE CARLO SIMULATION RESULTS

A combination of high-end and average values for exposure parameters was used in the point estimate approach to calculate the RME risk, and average values were used to calculate the CTE risk. In the probabilistic assessments, the RME risk and CTE risk were obtained from the risk distribution. EPA defines the high-end risk, or RME range, as generally between the 90th and 99.9th percentiles, and the CTE risk is generally defined as the 50th percentile (EPA, 2001).

Tables 8-1 and 8-2 provide the RME and CTE results from the point estimate risk assessment and the 95th percentile and 50th percentile (median) of the MCA analog, assuming a tPCB floodplain soil or sediment EPC of 1 mg/kg for the recreational exposure scenarios. The 95th percentile is the approximate midpoint of the RME range and is the recommended starting point for risk management decisions (EPA, 2001). Alternative percentiles within the RME range may be selected to account for the level of confidence in the estimated risk distribution.

As indicated in Table 8-1, the point estimate RME cancer risks for the general recreation and ATV/dirt and mountain biker exposure scenarios, are approximately two (1.9) to four (3.8) times higher than the 95th percentile of the risk calculated using the MCA analog. In general, the point estimate RME risks are above the 99th percentile cancer risks for these scenarios. The point estimate RME cancer risks for the angler, waterfowl hunter, recreational canoeist/boater, and sediment exposure scenarios are up to three times lower than the 95th percentile of risk calculated using the MCA analog. The RME cancer risks for these scenarios are generally between the 90th and 95th percentile risk of the MCA analog approach. The point estimate CTE cancer risks for most exposure scenarios are 1.6 (older child) to 4 (adult) times lower than the 50th percentile risk of the MCA analog, with the exception of the young and older child general recreation scenarios and the older child angler scenario. For the general recreation scenarios (young child and older child), the CTE point estimate risks are slightly greater than the 50th percentile risk. For the older child angler, the point estimate CTE is about the same as the 50th percentile. Point estimates that are lower than the 50th percentile are generally between the 25th and 50th percentile cancer risk of the MCA analog.

Table 8-2 provides a comparison of the point estimate and Monte Carlo analog analysis for noncancer hazards to both adults and children. The point estimate RME noncancer hazards for the ATV/dirt and mountain biker and young child general recreation exposure scenarios are approximately two (1.8) to three (2.6) times higher than the 95th percentile of the risk calculated using the MCA analog. These RME point estimates are above the 99th percentile noncancer hazards of the MCA analog. The point estimate noncancer hazards for the older child and adult general recreation scenarios are slightly greater than the MCA analog 95th percentile risk. The point estimate RME noncancer hazards for the angler, waterfowl hunter, recreational canoeist/boater and sediment exposure scenarios are two (1.9) to five (4.6 for the older child recreational canoeist/boater) times lower than the 95th percentile of risk calculated using the MCA analog. The RME point estimates for these scenarios are generally between the 75th and 90th percentile MCA analog HIs, with the exception of the older child recreational canoeist/boater. The point estimate CTE noncancer hazards for the adult and older child general recreation, ATV/dirt and mountain biker, older child recreational canoeist/boater, and adult and older child sediment exposure scenarios are 1.4 to 3 times lower than the 50th percentile risk of the MCA analog. Point estimates that are lower than the 50th percentile are generally between the 25th and 50th percentile cancer risk of the MCA analog, with the exception of the older child recreational canoeist/boater. The point estimate CTE noncancer hazards for the other exposure scenarios are about the same as the 50th percentile MCA analog HIs.

8.3 RELATIONSHIP BETWEEN RISK ESTIMATES AND THE EPA RISK RANGE

The results of the point estimate and probabilistic risk assessments were compared to the EPA risk range, identified in the National Contingency Plan (NCP) (EPA, 1990) as 1E-06 to 1E-04, or an increased probability of developing cancer of 1 in 1,000,000 to 1 in 10,000 over the course of a 70-year lifetime.

Where the cumulative site risk to an individual based on the RME exceeds the 1E-04 lifetime excess cancer risk, action is generally warranted at a site. For sites where the cumulative site risk to an individual based on the RME is less than 1E-04, action generally is not warranted, but may be warranted if a chemical-specific standard that defines acceptable risk is violated or if there are noncancer effects or an adverse environmental impact that warrants action. EPA may also decide that a lower level of risk is unacceptable and that action is warranted where, for example, there are uncertainties in the risk assessment results. Once EPA has decided to take an action, EPA has expressed a preference for cleanups achieving the more-protective end of the range (i.e., 1E-06), although strategies achieving reductions in site risks anywhere in the risk range may be deemed acceptable by EPA (EPA, 1991). HIs of less than 1 indicate that adverse health effects associated with the exposure scenario are unlikely to occur. EPA considers action when the HI exceeds 1.

8.3.1 Point Estimate Risks from Floodplain Soil Exposure

Exposure to PCB-contaminated soil can occur through a number of potential exposure scenarios as described in Section 4, Exposure Assessment. Figures 8-1 and 8-2 present a summary of the range of tPCB cancer risks by soil exposure scenario, how these risks compare to the EPA risk range, and how the risks from the scenarios compare to each other for the RME and CTE, respectively. Similarly, Figures 8-3 and 8-4 present a summary of the range of tPCB HIs by soil exposure scenario, how they compare to the EPA benchmark, and how the HIs associated with the scenarios compare to one another for the RME and CTE, respectively.

As shown in Figures 8-1 and 8-2, all of the soil exposure scenarios had tPCB cancer risks within or less than the EPA risk range. None of the cancer risks exceeded 1E-04.

As shown in Figure 8-3, 5 of the 10 soil exposure scenarios had a number of tPCB RME hazard indices greater than 1. The scenarios with all RME hazard indices less than 1 for all EAs were the recreational canoeist/boater, waterfowl hunter, farmer, groundskeeper, and utility worker scenarios. As shown in Figure 8-4, only the residential and general recreation exposure scenarios had at least one CTE hazard index greater than 1.

The following sections describe the tPCB risk results for each exposure scenario in greater detail. For each exposure scenario, summary tables present the tPCB cancer risks and HIs for each EA where that scenario was evaluated. Each table includes the EA or subarea, the receptor(s), the land use(s) (i.e., current or future), the EPC, and the RME and CTE cancer risks or HIs.

8.3.1.1 Residential

The residential scenario considers future residential exposure. Table 8-3 provides a summary of the RME and CTE cancer risks for all EAs where the residential scenario was evaluated, including the receptors, the land use, and the EPC. The RME cancer risks ranged from 3E-06 to 1E-04. The highest RME cancer risk was for future residential use at EA 18. The CTE cancer risks ranged from 2E-07 to 2E-05.

Table 8-4, which also includes the receptors, land use, and EPC, provides a summary of the RME and CTE HIs for the residential scenario. The RME HIs at 8 of the 10 residential EAs were equal to or greater than 1. The RME HIs ranged from 0.057 to 16. The maximum RME HI was based on future young child exposure at EA 18. The CTE HIs at 6 of the 10 residential EAs were greater than 1. The CTE HIs ranged from 0.013 to 10. The maximum CTE HI was based on future young child exposure at EA 18. In general, the adult HIs, for both the RME and CTE evaluations, were approximately 10 times lower than the young child HIs.

8.3.1.2 General Recreation

Eighty-one EAs and subareas were evaluated using the general recreation scenario. Table 8-5 provides a summary of the RME and CTE cancer risks for all of the general recreational EAs and subareas. None of the receptors (young child, older child, or adult) had risks greater than 1E-04. The RME cancer risks for both the current and future uses of the floodplain ranged from 6E-07 to 5E-05. The CTE cancer risks for both the current and future uses of the floodplain ranged from 3E-08 to 3E-06.

Table 8-6 provides a summary of the RME and CTE hazard indices for all of the general recreational EAs and subareas for tPCBs. Sixteen of the 81 areas had RME HIs greater than 1. The RME HIs for both the current and future uses ranged from 0.032 to 12. The maximum RME hazard index was based on young child exposure at subarea 10A, which is the trail portion of the Canoe Meadows Wildlife Sanctuary, a popular recreational area owned by the Massachusetts Audubon Society. Only one of the 81 areas had a CTE hazard index greater than 1. The CTE HIs for both the current and future uses ranged from 0.0079 to 1.7. The maximum CTE HI was also based on young child exposure at subarea 10A.

8.3.1.3 ATV/Dirt and Mountain Biking

Three subareas (subareas 22A, 27A, 28A) were evaluated using the ATV/dirt and mountain biking scenario. Table 8-7 provides a summary of the RME and CTE cancer risks for these subareas. All of the RME and CTE risk levels were within or less than the risk range. The RME cancer risks ranged from 4E-06 to 3E-05.

Table 8-8 provides a summary of the RME and CTE hazard indices for the ATV/dirt and mountain biking scenario. Two of the three subareas (EAs 22A and 28A) had RME HIs greater than 1. The RME HIs ranged from 0.57 to 4.3. The maximum RME hazard index was based on exposure at subarea 22A. None of the CTE HIs exceeded 1.

8.3.1.4 Marathon Canoeist

The marathon canoeist scenario was evaluated at a single area, EA 39, known as the John Decker Canoe Launch. The RME and CTE cancer risks for both the current and future uses of EA 39 (2E-05 and 3E-06, respectively) were within the EPA risk range.

The HIs for both the current and future uses of EA 39 were 1.4 and 0.77 for the RME and CTE evaluations, respectively.

8.3.1.5 Recreational Canoeist/Boater

The recreational canoeist/boater scenario was evaluated at seven EAs and subareas. Table 8-9 provides a summary of the RME and CTE cancer risks for the recreational canoeist/boater scenario. None of the EAs or subareas had a cancer risk greater than 1E-04. The RME cancer risks for both the current and future uses ranged from 6E-07 to 2E-05. The CTE cancer risks for both the current and future uses ranged from 1E-07 to 2E-06.

Table 8-10 provides a summary of the RME and CTE hazard indices for the recreational canoeist/boater scenario. All of the RME and CTE hazard indices were less than 1. The RME hazard indices for both the current and future uses ranged from 0.081 to 0.97. The CTE hazard indices for both the current and future uses ranged from 0.029 to 0.37.

8.3.1.6 Angler

The angler scenario was evaluated at 13 EAs and subareas. Table 8-11 provides a summary of the RME and CTE cancer risks for the angler scenario. None of the EAs or subareas had a cancer risk greater than 1E-04. The RME cancer risks for both the current and future uses ranged from 6E-07 to 3E-05. The CTE cancer risks for both the current and future uses ranged from 5E-08 to 2E-06.

Table 8-12 provides a summary of the RME and CTE hazard indices for the angler scenario. Six of the 13 areas had RME HIs greater than 1. The RME hazard indices for both the current and future uses ranged from 0.064 to 2.0. The maximum RME HI was for the older child angler at subarea 38A. All of the CTE HIs were less than 1. The CTE hazard indices for both the current and future uses ranged from 0.016 to 0.46.

8.3.1.7 Waterfowl Hunter

The waterfowl hunter scenario was evaluated at 10 EAs and subareas. Table 8-13 provides a summary of the RME and CTE cancer risks for the waterfowl hunter scenario. All of the RME and CTE cancer risks were within or less than the risk range. The RME cancer risks for both the current and future uses ranged from 4E-07 to 1E-05. The CTE cancer risks for both the current and future uses ranged from 7E-08 to 2E-06.

Table 8-14 provides a summary of the RME and CTE hazard indices for the waterfowl hunter scenario. All of the RME and CTE HIs were less than 1. The RME HIs for both the current and future uses ranged from 0.085 to 0.84. The CTE HIs for both the current and future uses ranged from 0.031 to 0.29.

8.3.1.8 Farmer

The farmer scenario was evaluated at five EAs and subareas; the summary of the RME and CTE cancer risks is presented in Table 8-15. The cancer risks for both the RME and CTE evaluations were within or less than the risk range. The RME cancer risks for both the current and future uses ranged from 2E-06 to 2E-05. The CTE cancer risks for both the current and future uses ranged from 5E-08 to 7E-07.

Table 8-16 provides a summary of the RME and CTE hazard indices for the farmer scenario. All of the RME or CTE HIs were less than 1. The RME hazard indices for both the current and future uses ranged from 0.047 to 0.67. The CTE hazard indices for both the current and future uses ranged from 0.0058 to 0.083.

8.3.1.9 Groundskeeper

Table 8-17 provides a summary of the RME and CTE cancer risks for the groundskeeper scenario, which was evaluated at three EAs and subareas. The cancer risks for both the RME and CTE evaluations were within or less than the EPA risk range. The RME cancer risks for both the current and future uses at all three areas were about 2E-06. The CTE cancer risks for both the current and future uses ranged from 1E-07 to 2E-07.

Table 8-18 provides a summary of the RME and CTE hazard indices for the groundskeeper scenario. All of the RME or CTE HIs were less than 1. The RME hazard indices for both the current and future uses ranged from 0.11 to 0.16. The CTE hazard indices for both the current and future uses ranged from 0.035 to 0.065.

8.3.1.10 Utility Worker

The utility worker scenario was evaluated at six EAs and subareas; a summary of the RME and CTE cancer risks is presented in Table 8-19. The cancer risks for both the RME and CTE evaluations were within or less than the EPA risk range. The RME cancer risks for both the current and future uses ranged from 7E-07 to 7E-06. The CTE cancer risks for both the current and future uses ranged from 6E-08 to 6E-07.

Table 8-20 provides a summary of the RME and CTE hazard indices for the utility worker scenario. All of the RME or CTE HIs were less than 1. The RME hazard indices for both the current and future uses ranged from 0.050 to 0.50. The CTE hazard indices for both the current and future uses ranged from 0.017 to 0.17.

8.3.2 Point Estimate Risks from Sediment Exposure

As described in Section 4, Exposure Assessment, sediment exposure can occur through a variety of potential exposure scenarios. Sediment exposure was evaluated at eight exposure areas: three in Reaches 5 and 6 and five in Reaches 7 and 8. Table 8-21 presents the RME and CTE cancer risks for each sediment area and receptor. Figure 8-5 summarizes the ranges of cancer risks by sediment area, and provides a comparison to the EPA risk range, and to the risks at the other sediment exposure areas. All of the sediment areas had RME and CTE cancer risks within or less than the EPA risk range. The RME cancer risks ranged from 1E-06 to 8E-05. The CTE cancer risks ranged from 2E-07 to 4E-06. The highest risk is associated with Sediment Area 3 (Woods Pond).

Table 8-22 provides a summary of the RME and CTE hazard indices for the sediment exposure scenario. Figure 8-6 presents a summary and comparison of these hazard indices. As shown in Table 8-22, two of the eight sediment areas (Areas 3 and 7) had RME HIs greater than 1. The RME hazard indices ranged from 0.16 to 3.5. The maximum RME HI was 3.5 and was for the older child at Sediment Area 3 (Woods Pond). All of the CTE HIs were less than 1. The CTE hazard indices ranged from 0.042 to 0.88.

8.3.3 Comparison of Point Estimate, MCA Analog and Probability Bounds Risks from Floodplain Soil and Sediment Exposure

The point estimate, MCA and PBA risks (both RME and CTE cancer risks, and noncancer His) for specific exposure scenarios at an assumed floodplain soil or sediment concentration of 1 mg/kg tPCBs are presented in Figures 8-7a, 8-7b, 8-8a, and 8-8b. Soil exposures via ingestion and dermal contact were considered for all of the scenarios, with the exception of the sediment exposure scenario, which considered exposure via ingestion and dermal contact from a composite of recreational activities (e.g., wading, swimming, fishing, waterfowl hunting, canoeing, and other related activities).

Figures 8-7a, 8-7b, 8-8a, and 8-8b also provide a comparison of the cancer risks and hazard indices to the EPA risk range. The red bars summarize the results for the central tendency exposures and the blue bars summarize the results for the high-end exposures associated with each exposure scenario. EPA guidelines for cancer risks and noncancer health effects are noted by a gray shaded area and a gray line, respectively.

Using Figure 8-7a as an example, the red diamonds represent the median (50^{th} percentile) cancer risk calculated using the MCA analog. The black horizontal lines (on the red bars) represent the point estimate results for the CTE. For example, the central tendency cancer risk from tPCB for the older child angler is 2E-08 for both the point estimate CTE and the median of the MCA analog. The light red bands correspond to the uncertainty around the median of the MCA analog analysis that was calculated with probability bounds analysis.

EPA guidance (EPA, 2001) suggests risk managers select the RME from the high-end (i.e., 90^{th} to 99.9^{th}) percentiles of risk when using a probabilistic assessment. The blue diamonds represent the 90^{th} and 99^{th} percentile risks calculated using the MCA analog. The point estimate RME cancer risks are shown as black horizontal lines on the blue bars. The light blue bands correspond to the uncertainty surrounding the high-end percentiles of the MCA analog calculated with probability bounds analysis.

These figures can be used to estimate risk for a particular soil or sediment concentration because the relationship between soil or sediment concentration and risk is linear. For example, if the risk associated with adult recreational exposure where the soil EPC equals 1 mg/kg is approximately 2E-06, then the risk associated with a soil EPC of 5 mg/kg is 5 times greater, or 1E-05.

8.3.3.1 Cancer Risks

Figures 8-7a and 8-7b present the tPCB cancer risks for the subset of exposure scenarios that were evaluated using probabilistic analyses. These figures combine results presented in Tables 6-16 and 8-1 to illustrate that the RME and CTE tPCB cancer risks, assuming a soil or sediment EPC of 1 mg/kg, are within or less than the EPA risk range.

8.3.3.2 Hazard Indices

Figures 8-8a and 8-8b present the tPCB hazard index results for the subset of exposure scenarios that were evaluated using probabilistic analyses. These figures combine results presented in Tables 6-17 and 8-2. At the assumed EPC of 1 mg/kg tPCB, the HIs based on both the point estimate and MCA analysis for high-end and central tendency exposures are below the EPA benchmark of 1. However, when uncertainty is taken into account, the upper-bound RME HIs are above 1 for the young child general recreation, adult angler, older child angler, adult canoeist, and older child canoeist scenarios. The upper-bound CTE HI for the young child general recreation exposure scenario is also above the EPA benchmark of 1.

8.4 REFERENCES

EPA (U.S. Environmental Protection Agency). 1990. 40 CFR Part 300, National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule. March 1990.

EPA (U.S. Environmental Protection Agency). 1991. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. Memorandum from Don R. Clay to Division Directors. 22 April 1991.

EPA (U.S. Environmental Protection Agency). 2001. *Risk Assessment Guidance for Superfund: Volume III – Part A, Process for Conducting Probabilistic Risk Assessment.* Office of Emergency and Remedial Response, Washington DC. EPA 540-R-02-002. December 2001.

SECTION 8

TABLES

Table 8-1
Cancer Risk from Direct Contact:
Point Estimate and Monte Carlo Analog Analyses[a]

Exposure Scenario	Receptor	High End Range: RME Point Estimate	High End Range: 95th Percentile Monte Carlo	Central Tendency Range: CTE Point Estimate	Central Tendency Range: 50th Percentile Monte Carlo
General Recreation[b]	Young Child	7E-07	2E-07	1E-07	6E-08
	Older Child	3E-07	1E-07	4E-08	3E-08
	Adult	7E-07	4E-07	3E-08	6E-08
ATV/Dirt and Mountain Biker[b]	Older Child	5E-07	2E-07	3E-08	5E-08
Recreational Canoeist/Boater[c]	Older Child	2E-07	5E-07	3E-08	8E-08
	Adult	8E-07	1E-06	8E-08	2E-07
Angler[d]	Older Child	2E-07	2E-07	2E-08	2E-08
	Adult	4E-07	6E-07	1E-08	5E-08
Waterfowl Hunter[e]	Older Child	2E-08	4E-08	4E-09	5E-09
	Adult	2E-07	2E-07	1E-08	3E-08
Sediment Exposure[f]	Older Child	2E-07	3E-07	3E-08	5E-08
	Adult	7E-07	9E-07	4E-08	1E-07

[a] Cancer risk estimates assuming a total PCB concentration of 1 mg/kg in soil or sediment.

[b] Point estimate risks are based on an EF of 90 days/year for the RME and 30 days/year for the CTE.

[c] Point estimate risks are based on an EF of 30 and 60 days/year for the RME older child and adult, respectively, and 15 and 30 days/year for the CTE older child and adult, respectively.

[d] Point estimate risks are based on an EF of 30 days/year for the RME and 10 days/year for the CTE.

[e] Point estimate risks are based on an EF of 14 days/year for the RME and 7 days/year for the CTE.

[f] Point estimate risks are based on an EF of 36 days/year for the RME and 12 days/year for the CTE.

Table 8-2
Noncancer Hazards from Direct Contact:
Point Estimate and Monte Carlo Analog Analyses[a]

Exposure Scenario	Receptor	High End Range: RME Point Estimate	High End Range: 95th Percentile Monte Carlo	Central Tendency Range: CTE Point Estimate	Central Tendency Range: 50th Percentile Monte Carlo
General Recreation[b]	Young Child	0.2	0.08	0.03	0.03
	Older Child	0.04	0.03	0.006	0.009
	Adult	0.03	0.02	0.004	0.006
ATV/Dirt and Mountain Biker[b]	Older Child	0.07	0.04	0.01	0.02
Recreational Canoeist/Boater[c]	Older Child	0.02	0.1	0.008	0.03
	Adult	0.04	0.07	0.01	0.02
Angler[d]	Older Child	0.02	0.05	0.006	0.006
	Adult	0.02	0.04	0.005	0.004
Waterfowl Hunter[e]	Older Child	0.005	0.02	0.003	0.003
	Adult	0.009	0.01	0.002	0.002
Sediment Exposure[f]	Older Child	0.03	0.07	0.008	0.02
	Adult	0.03	0.05	0.007	0.01

[a] Cancer risk estimates assuming a total PCB concentration of 1 mg/kg in soil or sediment.

[b] Point estimate risks are based on an EF of 90 days/year for the RME and 30 days/year for the CTE.

[c] Point estimate risks are based on an EF of 30 and 60 days/year for the RME older child and adult, respectively, and 15 and 30 days/year for the CTE older child and adult, respectively.

[d] Point estimate risks are based on an EF of 30 days/year for the RME and 10 days/year for the CTE.

[e] Point estimate risks are based on an EF of 14 days/year for the RME and 7 days/year for the CTE.

[f] Point estimate risks are based on an EF of 36 days/year for the RME and 12 days/year for the CTE.

Table 8-3

Summary of the Cancer Risks from tPCBs for the Residential Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Total Cancer Risk	CTE tPCB Total Cancer Risk
6	Young child/Adult	Future	32	4E-05	3E-06
18	Young child/Adult	Future	43	1E-04	2E-05
21-22	Young child/Adult	Future	25	6E-05	1E-05
34	Young child/Adult	Future	29	6E-05	1E-05
72-73	Young child/Adult	Future	34	8E-05	2E-05
76	Young child/Adult	Future	2.2	3E-06	2E-07
78	Young child/Adult	Future	11.9	3E-05	5E-06
80	Young child/Adult	Future	3	6E-06	1E-06
83	Young child/Adult	Future	3	6E-06	1E-06
86	Young child/Adult	Future	4	8E-06	2E-06

Table 8-4

Summary of the Hazard Indices from tPCBs for the Residential Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Hazard Index	CTE tPCB Hazard Index
6	Young child	Future	32	7.0	1.5
	Adult			0.83	0.18
18	Young child	Future	43	16	10
	Adult			1.8	1.3
21-22	Young child	Future	25	9.1	5.7
	Adult			1.1	0.72
34	Young child	Future	29	11	6.6
	Adult			1.3	0.83
72-73	Young child	Future	34	12	7.7
	Adult			1.5	0.98
76	Young child	Future	2.2	0.48	0.10
	Adult			0.057	0.013
78	Young child	Future	11.9	4.3	2.7
	Adult			0.51	0.34
80	Young child	Future	3	1.0	0.64
	Adult			0.12	0.082
83	Young child	Future	3	0.98	0.61
	Adult			0.12	0.077
86	Young child	Future	4	1.3	0.84
	Adult			0.16	0.11

Table 8-5

Summary of the Cancer Risks from tPCBs for the General Recreation Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Total Cancer Risk	CTE tPCB Total Cancer Risk
1	Older child	current/future	15	2E-06	2E-07
	Adult			8E-06	2E-07
2	Older child	current/future	24	6E-06	5E-07
	Adult			2E-05	4E-07
2A	Older child	current/future	24	2E-06	2E-07
2B	Older child	current/future	26	7E-06	5E-07
3	Adult	current/future	8	6E-06	1E-07
4	Young child	current/future	40	5E-06	1E-06
	Older child			1E-05	8E-07
	Adult			3E-05	6E-07
5	Older child	current/future	22	6E-06	4E-07
	Adult			2E-05	3E-07
6	Adult	current	32	7E-06	3E-07
7	Older child	current/future	24	6E-06	5E-07
	Adult			2E-05	4E-07
9	Older child	current/future	15	1E-06	1E-07
10	Young child	current/future	14	1E-05	8E-07
	Adult			1E-05	2E-07
10A	Young child	current/future	53.1	4E-05	3E-06
	Adult			4E-05	8E-07
11	Adult	current/future	21	1E-05	3E-07
12	Young child	current/future	9	1E-06	2E-07
	Older child			2E-06	2E-07
	Adult			6E-06	1E-07
13	Adult	current/future	18	1E-05	3E-07
14	Adult	current/future	5	3E-06	8E-08
15	Adult	current/future	6.9	5E-06	1E-07
16	Adult	current/future	48	3E-05	8E-07
17	Adult	current/future	26	2E-05	4E-07
18	Adult	current	43	2E-05	7E-07
19	Adult	current/future	76	5E-05	1E-06
20	Adult	current/future	28	2E-05	4E-07
22	Older child	current	29	7E-06	6E-07
	Adult			2E-05	5E-07
23	Older child	current/future	12	2E-06	2E-07
24	Adult	current/future	29	2E-05	5E-07
25	Older child	current/future	44	1E-05	9E-07
26	Older child	future	5	1E-06	1E-07
	Adult			4E-06	8E-08
26A	Older child	current	6	2E-06	1E-07
	Adult			4E-06	9E-08
27	Older child	current/future	6	2E-06	1E-07
	Adult			4E-06	1E-07

Table 8-5

Summary of the Cancer Risks from tPCBs for the General Recreation Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Total Cancer Risk	CTE tPCB Total Cancer Risk
28	Young child	current/future	40.4	5E-06	1E-06
	Older child			1E-05	8E-07
	Adult			3E-05	6E-07
29	Older child	current/future	28	2E-06	3E-07
	Adult			7E-06	2E-07
30	Older child	current/future	34.8	9E-06	7E-07
	Adult			2E-05	6E-07
31	Older child	current/future	23	6E-06	4E-07
	Adult			2E-05	4E-07
31A	Older child	current/future	37.6	1E-05	7E-07
	Adult			3E-05	6E-07
32	Adult	current/future	23	2E-05	4E-07
33	Adult	current/future	33	2E-05	5E-07
35	Older child	current/future	23	6E-06	4E-07
	Adult			2E-05	4E-07
35A	Older child	current/future	12	3E-06	2E-07
	Adult			8E-06	2E-07
37	Older child	current/future	16	4E-06	3E-07
	Adult			1E-05	3E-07
37B	Older child	current/future	7	2E-06	1E-07
	Adult			5E-06	1E-07
38	Adult	current/future	29	2E-05	5E-07
40	Young child	current/future	9	1E-06	2E-07
	Adult			6E-06	1E-07
40B	Young child	current/future	61.6	8E-06	2E-06
	Adult			4E-05	1E-06
41	Adult	current/future	18	8E-06	2E-07
42	Adult	current/future	15	7E-06	2E-07
43	Adult	current/future	17	8E-06	3E-07
44	Adult	current/future	43	3E-05	7E-07
45	Adult	current/future	20	1E-05	3E-07
46	Adult	current/future	11	8E-06	2E-07
48	Adult	current/future	4	3E-06	7E-08
49	Adult	current/future	26	6E-06	2E-07
50	Adult	current/future	6	1E-06	5E-08
51	Adult	current/future	11	3E-06	9E-08
54	Adult	current/future	8	6E-06	1E-07
55	Young child	current/future	21	3E-06	6E-07
	Adult			2E-05	3E-07
56	Older child	current/future	44	8E-06	8E-07
	Adult			2E-05	6E-07
57	Young child	current/future	9	1E-06	2E-07
	Adult			6E-06	1E-07
58	Adult	current/future	27	2E-05	4E-07

Table 8-5

Summary of the Cancer Risks from tPCBs for the General Recreation Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Total Cancer Risk	CTE tPCB Total Cancer Risk
59	Young child	current/future	32	4E-06	9E-07
	Adult			2E-05	5E-07
60	Young child	current/future	10	1E-06	3E-07
	Adult			7E-06	2E-07
67	Adult	current/future	16	1E-05	3E-07
68	Adult	current/future	5.5	4E-06	9E-08
69	Adult	current/future	12	8E-06	2E-07
70	Young child	current/future	12.5	9E-06	7E-07
	Adult			9E-06	2E-07
71	Adult	current/future	12	3E-06	1E-07
73	Adult	current	2.5	2E-06	4E-08
74	Adult	current/future	17.9	1E-05	3E-07
75	Adult	current/future	15	1E-05	2E-07
76	Adult	current	2.2	2E-06	3E-08
77	Adult	current/future	2	2E-06	4E-08
78	Older child	current	11.9	3E-06	2E-07
79	Adult	current/future	5	3E-06	8E-08
80A	Adult	current	4.5	1E-06	4E-08
81	Adult	current	3.7	9E-07	3E-08
		future		3E-06	6E-08
82	Adult	current	7	2E-06	5E-08
		future		5E-06	1E-07
84	Adult	current	7.4	2E-06	6E-08
		future		5E-06	1E-07
85B	Older child	current/future	2.3	6E-07	4E-08
87	Young child	current/future	24	2E-05	1E-06
	Adult			2E-05	4E-07
88	Older child	current/future	12	2E-06	2E-07
89	Adult	current/future	2	2E-06	4E-08
90	Older child	current/future	19.1	5E-06	4E-07
	Adult			1E-05	3E-07

Table 8-6

Summary of the Hazard Indices from tPCBs for the General Recreation Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Hazard Index	CTE tPCB Hazard Index
1	Older child	current/future	15	0.38	0.086
	Adult			0.26	0.064
2	Older child	current/future	24	0.92	0.14
	Adult			0.64	0.10
2A	Older child	current/future	24	0.30	0.069
2B	Older child	current/future	26	0.97	0.15
3	Adult	current/future	8	0.21	0.034
4	Young child	current/future	40	1.5	0.63
	Older child			1.5	0.23
	Adult			1.0	0.17
5	Older child	current/future	22	0.83	0.12
	Adult			0.57	0.094
6	Adult	current	32	0.28	0.068
7	Older child	current/future	24	0.89	0.13
	Adult			0.62	0.10
9	Older child	current/future	15	0.19	0.043
10	Young child	current/future	14	3.1	0.45
	Adult			0.37	0.061
10A	Young child	current/future	53.1	12	1.7
	Adult			1.4	0.23
11	Adult	current/future	21	0.55	0.090
12	Young child	current/future	9	0.31	0.14
	Older child			0.32	0.049
	Adult			0.22	0.037
13	Adult	current/future	18	0.47	0.077
14	Adult	current/future	5	0.13	0.021
15	Adult	current/future	6.9	0.18	0.030
16	Adult	current/future	48	1.2	0.21
17	Adult	current/future	26	0.68	0.11
18	Adult	current	43	0.75	0.18
19	Adult	current/future	76	2.0	0.32
20	Adult	current/future	28	0.73	0.12
22	Older child	current	29	1.1	0.16
	Adult			0.75	0.12
23	Older child	current/future	12	0.30	0.063
24	Adult	current/future	29	0.75	0.12
25	Older child	current/future	44	1.7	0.25
26	Older child	future	5	0.20	0.030
	Adult			0.14	0.022
26A	Older child	current	6	0.23	0.034
	Adult			0.16	0.026
27	Older child	current/future	6	0.23	0.034
	Adult			0.16	0.026

Table 8-6

Summary of the Hazard Indices from tPCBs for the General Recreation Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Hazard Index	CTE tPCB Hazard Index
28	Young child	current/future	40.4	1.5	0.64
	Older child			1.5	0.23
	Adult			1.0	0.17
29	Older child	current/future	28	0.35	0.079
	Adult			0.24	0.060
30	Older child	current/future	34.8	1.3	0.20
	Adult			0.91	0.15
31	Older child	current/future	23	0.86	0.13
	Adult			0.60	0.098
31A	Older child	current/future	37.6	1.4	0.21
	Adult			0.98	0.16
32	Adult	current/future	23	0.60	0.098
33	Adult	current/future	33	0.86	0.14
35	Older child	current/future	23	0.85	0.13
	Adult			0.59	0.097
35A	Older child	current/future	12	0.45	0.068
	Adult			0.31	0.051
37	Older child	current/future	16	0.61	0.092
	Adult			0.42	0.069
37B	Older child	current/future	7	0.26	0.040
	Adult			0.18	0.030
38	Adult	current/future	29	0.75	0.12
40	Young child	current/future	9	0.32	0.14
	Adult			0.23	0.038
40B	Young child	current/future	61.6	2.2	0.98
	Adult			1.6	0.26
41	Adult	current/future	18	0.32	0.076
42	Adult	current/future	15	0.26	0.064
43	Adult	current/future	17	0.30	0.073
44	Adult	current/future	43	1.1	0.18
45	Adult	current/future	20	0.52	0.085
46	Adult	current/future	11	0.29	0.047
48	Adult	current/future	4	0.11	0.018
49	Adult	current/future	26	0.23	0.056
50	Adult	current/future	6	0.054	0.013
51	Adult	current/future	11	0.095	0.023
54	Adult	current/future	8	0.22	0.036
55	Young child	current/future	21	0.76	0.33
	Adult			0.54	0.090
56	Older child	current/future	44	1.1	0.24
	Adult			0.76	0.19
57	Young child	current/future	9	0.33	0.14
	Adult			0.23	0.038
58	Adult	current/future	27	0.70	0.12

Table 8-6

Summary of the Hazard Indices from tPCBs for the General Recreation Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Hazard Index	CTE tPCB Hazard Index
59	Young child	current/future	32	1.2	0.51
	Adult			0.83	0.14
60	Young child	current/future	10	0.36	0.16
	Adult			0.26	0.043
67	Adult	current/future	16	0.42	0.068
68	Adult	current/future	5.5	0.14	0.024
69	Adult	current/future	12	0.31	0.051
70	Young child	current/future	12.5	2.7	0.40
	Adult			0.33	0.053
71	Adult	current/future	12	0.10	0.026
73	Adult	current	2.5	0.065	0.011
74	Adult	current/future	17.9	0.47	0.076
75	Adult	current/future	15	0.39	0.064
76	Adult	current	2.2	0.057	0.0094
77	Adult	current/future	2	0.058	0.0096
78	Older child	current	11.9	0.45	0.067
79	Adult	current/future	5	0.12	0.021
80A	Adult	current	4.5	0.039	0.0096
81	Adult	current	3.7	0.032	0.0079
		future		0.097	0.016
82	Adult	current	7	0.060	0.015
		future		0.18	0.029
84	Adult	current	7.4	0.064	0.016
		future		0.19	0.031
85B	Older child	current/future	2.3	0.086	0.013
87	Young child	current/future	24	5.2	0.76
	Adult			0.62	0.10
88	Older child	current/future	12	0.30	0.068
89	Adult	current/future	2	0.063	0.010
90	Older child	current/future	19.1	0.72	0.11
	Adult			0.50	0.082

Table 8-7

Summary of the Cancer Risks from tPCBs for the ATV/Dirt and Mountain Bike Riding Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Total Cancer Risk	CTE tPCB Total Cancer Risk
22A	Older child	Current	61	3E-05	2E-06
27A	Older child	Current/Future	8	4E-06	3E-07
28A	Older child	Current/Future	23	1E-05	8E-07

Table 8-8

Summary of the Hazard Indices from tPCBs for the ATV/Dirt and Mountain Bike Riding Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Hazard Index	CTE tPCB Hazard Index
22A	Older child	Current	61	4.3	0.61
27A	Older child	Current/Future	8	0.57	0.081
28A	Older child	Current/Future	23	1.6	0.23

Table 8-9

Summary of the Cancer Risks from tPCBs for the Recreational Canoeist/Boater Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Total Cancer Risk	CTE tPCB Total Cancer Risk
8	Older child	current/future	23	4E-06	7E-07
	Adult			2E-05	2E-06
39	Older child	current/future	19	3E-06	5E-07
	Adult			2E-05	1E-06
47	Older child	current	27	4E-06	8E-07
	Adult			2E-05	2E-06
	Older child	future	14	2E-06	4E-07
	Adult			1E-05	1E-06
52	Older child	current/future	3	6E-07	1E-07
	Adult			3E-06	3E-07
53	Older child	current/future	14	2E-06	4E-07
	Adult			1E-05	1E-06
60A	Older child	current/future	17	3E-06	5E-07
	Adult			1E-05	1E-06
85A	Older child	current/future	4.8	8E-07	1E-07
	Adult			4E-06	4E-07

Table 8-10

Summary of the Hazard Indices from tPCBs for the Recreational Canoeist/Boater Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Hazard Index	CTE tPCB Hazard Index
8	Older child	current/future	23	0.54	0.19
	Adult			0.83	0.31
39	Older child	current/future	19	0.45	0.16
	Adult			0.69	0.26
47	Older child	current	27	0.64	0.23
	Adult			0.97	0.37
	Older child	future	14	0.33	0.12
	Adult			0.50	0.19
52	Older child	current/future	3	0.081	0.029
	Adult			0.12	0.047
53	Older child	current/future	14	0.33	0.12
	Adult			0.50	0.19
60A	Older child	current/future	17	0.40	0.14
	Adult			0.61	0.23
85A	Older child	current/future	4.8	0.11	0.040
	Adult			0.17	0.066

Table 8-11

Summary of the Cancer Risks from tPCBs for the Angler Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Total Cancer Risk	CTE tPCB Total Cancer Risk
37A	Older child	current/future	55.1	9E-06	1E-06
	Adult			2E-05	8E-07
38A	Older child	current/future	83.3	1E-05	2E-06
	Adult			3E-05	1E-06
40A	Older child	current/future	37	6E-06	7E-07
	Adult			1E-05	5E-07
41A	Older child	current/future	55.3	9E-06	1E-06
	Adult			2E-05	8E-07
42A	Older child	current/future	51.1	8E-06	1E-06
	Adult			2E-05	7E-07
43A	Older child	current/future	52.7	9E-06	1E-06
	Adult			2E-05	8E-07
58	Older child	current/future	27	4E-06	5E-07
	Adult			1E-05	4E-07
59A	Older child	current/future	48	8E-06	9E-07
	Adult			2E-05	7E-07
69	Older child	current/future	12	2E-06	2E-07
	Adult			5E-06	2E-07
70A	Older child	current/future	5.9	1E-06	1E-07
	Adult			2E-06	8E-08
71	Older child	current/future	12	2E-06	2E-07
	Adult			5E-06	2E-07
72	Older child	current	34	5E-06	6E-07
	Adult			1E-05	5E-07
87A	Older child	current/future	3.5	6E-07	7E-08
	Adult			1E-06	5E-08

Table 8-12

Summary of the Hazard Indices from tPCBs for the Angler Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Hazard Index	CTE tPCB Hazard Index
37A	Older child	current/future	55.1	1.3	0.31
	Adult			0.99	0.25
38A	Older child	current/future	83.3	2.0	0.46
	Adult			1.5	0.38
40A	Older child	current/future	37	0.87	0.21
	Adult			0.67	0.17
41A	Older child	current/future	55.3	1.3	0.31
	Adult			0.99	0.25
42A	Older child	current/future	51.1	1.2	0.28
	Adult			0.92	0.23
43A	Older child	current/future	52.7	1.2	0.29
	Adult			0.95	0.24
58	Older child	current/future	27	0.64	0.15
	Adult			0.49	0.12
59A	Older child	current/future	48	1.1	0.27
	Adult			0.87	0.22
69	Older child	current/future	12	0.28	0.067
	Adult			0.22	0.054
70A	Older child	current/future	5.9	0.14	0.033
	Adult			0.11	0.027
71	Older child	current/future	12	0.28	0.065
	Adult			0.21	0.053
72	Older child	current	34	0.80	0.19
	Adult			0.61	0.15
87A	Older child	current/future	3.5	0.083	0.020
	Adult			0.064	0.016

Table 8-13

Summary of the Cancer Risks from tPCBs for the Waterfowl Hunter Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Total Cancer Risk	CTE tPCB Total Cancer Risk
45	Older child	current/future	23	6E-07	1E-07
	Adult			3E-06	3E-07
46	Older child	current/future	17	4E-07	7E-08
	Adult			2E-06	2E-07
48	Older child	current/future	20	5E-07	9E-08
	Adult			2E-06	3E-07
49	Older child	current/future	47.4	1E-06	2E-07
	Adult			5E-06	6E-07
50A	Older child	current/future	24	6E-07	1E-07
	Adult			3E-06	3E-07
51A	Older child	current/future	17	4E-07	8E-08
	Adult			2E-06	2E-07
54	Older child	current/future	37	9E-07	2E-07
	Adult			4E-06	5E-07
55A	Older child	current/future	59	1E-06	3E-07
	Adult			7E-06	8E-07
56A	Older child	current/future	117	3E-06	5E-07
	Adult			1E-05	2E-06
57	Older child	current/future	22	5E-07	9E-08
	Adult			2E-06	3E-07

Table 8-14

Summary of the Hazard Indices from tPCBs for the Waterfowl Hunter Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Hazard Index	CTE tPCB Hazard Index
45	Older child	current/future	23	0.16	0.058
	Adult			0.12	0.043
46	Older child	current/future	17	0.12	0.042
	Adult			0.085	0.031
48	Older child	current/future	20	0.14	0.050
	Adult			0.10	0.037
49	Older child	current/future	47.4	0.34	0.12
	Adult			0.24	0.088
50A	Older child	current/future	24	0.17	0.060
	Adult			0.12	0.045
51A	Older child	current/future	17	0.13	0.044
	Adult			0.089	0.033
54	Older child	current/future	37	0.26	0.093
	Adult			0.19	0.069
55A	Older child	current/future	59	0.42	0.15
	Adult			0.30	0.11
56A	Older child	current/future	117	0.84	0.29
	Adult			0.60	0.22
57	Older child	current/future	22	0.16	0.055
	Adult			0.11	0.041

Table 8-15

Summary of the Cancer Risks from tPCBs for the Farmer Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Total Cancer Risk	CTE tPCB Total Cancer Risk
21	Adult	current	4	3E-06	1E-07
26B	Adult	current	2	2E-06	5E-08
34	Adult	current	29	2E-05	7E-07
36B	Adult	current/future	8	6E-06	2E-07
80B	Adult	current	3	3E-06	7E-08

Table 8-16

Summary of the Hazard Indices from tPCBs for the Farmer Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Hazard Index	CTE tPCB Hazard Index
21	Adult	current	4	0.094	0.012
26B	Adult	current	2	0.047	0.0058
34	Adult	current	29	0.67	0.083
36B	Adult	current/future	8	0.18	0.022
80B	Adult	current	3	0.070	0.0087

Table 8-17

Summary of the Cancer Risks from tPCBs for the Groundskeeper Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Total Cancer Risk	CTE tPCB Total Cancer Risk
36A	Adult	current/future	20	2E-06	1E-07
83	Adult	current	3	2E-06	2E-07
86	Adult	current	4	2E-06	2E-07

Table 8-18

Summary of the Hazard Indices from tPCBs for the Groundskeeper Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Hazard Index	CTE tPCB Hazard Index
36A	Adult	current/future	20	0.16	0.035
83	Adult	current	3	0.11	0.047
86	Adult	current	4	0.15	0.065

Table 8-19

Summary of the Cancer Risks from tPCBs for the Utility Worker Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Total Cancer Risk	CTE tPCB Total Cancer Risk
61	Adult	current/future	59	3E-06	3E-07
62	Adult	current/future	121	7E-06	6E-07
63	Adult	current/future	39	2E-06	2E-07
64	Adult	current/future	37.6	2E-06	2E-07
65	Adult	current/future	19	1E-06	9E-08
66	Adult	current/future	12	7E-07	6E-08

Table 8-20

Summary of the Hazard Indices from tPCBs for the Utility Worker Exposure Scenario

Exposure Area	Receptor	Land Use	EPC (mg/kg)	RME tPCB Hazard Index	CTE tPCB Hazard Index
61	Adult	current/future	59	0.24	0.082
62	Adult	current/future	121	0.50	0.17
63	Adult	current/future	39	0.16	0.054
64	Adult	current/future	37.6	0.16	0.052
65	Adult	current/future	19	0.079	0.027
66	Adult	current/future	12	0.050	0.017

Table 8-21

Summary of the Cancer Risks from tPCBs for the Sediment Exposure Scenario

Sediment Exposure Area	Receptor	EPC (mg/kg)	RME tPCB Total Cancer Risk	CTE tPCB Total Cancer Risk
1	Older child	23	5E-06	6E-07
	Adult		2E-05	8E-07
2	Older child	24	5E-06	7E-07
	Adult		2E-05	9E-07
3	Older child	110	2E-05	3E-06
	Adult		8E-05	4E-06
4	Older child	19	4E-06	5E-07
	Adult		1E-05	7E-07
5	Older child	25	5E-06	7E-07
	Adult		2E-05	9E-07
6	Older child	7	2E-06	2E-07
	Adult		6E-06	3E-07
7	Older child	38	8E-06	1E-06
	Adult		3E-05	1E-06
8	Older child	6	1E-06	2E-07
	Adult		5E-06	2E-07

Table 8-22

Summary of the Hazard Indices from tPCBs for the Sediment Exposure Scenario

Sediment Exposure Area	Receptor	EPC (mg/kg)	RME tPCB Hazard Index	CTE tPCB Hazard Index
1	Older child	23	0.74	0.18
	Adult		0.58	0.15
2	Older child	24	0.77	0.19
	Adult		0.60	0.16
3	Older child	110	3.5	0.88
	Adult		2.8	0.72
4	Older child	19	0.62	0.15
	Adult		0.48	0.13
5	Older child	25	0.79	0.20
	Adult		0.62	0.16
6	Older child	7	0.24	0.060
	Adult		0.19	0.049
7	Older child	38	1.2	0.30
	Adult		0.94	0.25
8	Older child	6	0.20	0.051
	Adult		0.16	0.042

LIST OF ATTACHMENTS

ATTACHMENT B.1

PCB RAW DATA

The Attachment B.1 files are Excel spreadsheets located in the Attachment B.1 folder on this CD. Open Excel and select File Open from the menu to access these files.

ATTACHMENT B.2

DIRECT CONTACT VARIATIONS FROM THE SIWP

ATTACHMENT B.2

DIRECT CONTACT VARIATIONS FROM THE SIWP

INTRODUCTION

This attachment discusses differences in the approaches proposed for use in the direct contact risk assessment as presented in the *Supplemental Investigation Work Plan for the Lower Housatonic River* (WESTON, 2000) and those actually used in the completion of the assessment. The general topics are called out as headings below, followed by text from the Supplemental Investigation Work Plan (SIWP) and a discussion of the deviations and rationale for such.

PRESENTATION OF SUMMARY STATISTICS

SIWP

Summary tables will be prepared for each site, by medium and exposure scenario, that present the following information for site-related data:

- List of contaminants detected at the site.
- Frequency of detection.
- Range of detected concentrations.
- Range of sample quantitation limits.
- Arithmetic mean concentration of nontransformed data.
- Standard deviation of the mean.
- Distribution of data (normal, lognormal, neither).
- 95% upper confidence limit (UCL) of the arithmetic mean.
- Exposure point concentration (EPC).

Deviation/Rationale

Instead of a separate table for each exposure area (EA), the data summary for PCBs for each EA was presented on the accompanying EA-specific figure. Included in this figure was the exposure scenario that was evaluated, the range of PCB concentrations, the arithmetic mean, standard deviation, sample count, data distribution, the 95% UCL, and the EPC. This was done to provide the reader with a summary of the data along with the spatially weighted PCB surface presented in the figure.

DISTRIBUTION DETERMINATION

SIWP

Site data will be evaluated initially by the Shapiro-Wilk *W*-test to determine whether data are normally or lognormally distributed, after which the appropriate summary statistics will be calculated.

Deviation/Rationale

Distributions were determined using either the Shapiro-Wilk or the Lilliefors test statistic based on sample size. Shapiro-Wilk is best applied to data sets of fewer than 50 samples. For data sets with more than 50 samples, the Lilliefors test statistic was used.

95% UCL CALCULATION FOR DATA SETS NEITHER NORMAL NOR LOGNORMALLY DISTRIBUTED

SIWP

The 95% UCL of the mean for COPCs will be calculated in accordance with EPA guidelines presented in *Supplemental Guidance to RAGS: Calculating the Concentration Term* (EPA, 1992). The appropriate formula (dependent on the type of distribution) will be used to estimate the 95% UCL of the mean.

Deviation/Rationale

For each exposure area or subarea, the 95% upper confidence limit (UCL) of the mean was calculated for use in the exposure dose calculations. The computational method used depends upon the shape of the distribution and the number of samples collected in the exposure area or subarea. In all cases, if the 95% UCL concentration exceeded the maximum detected concentration, the maximum detected concentration was used as the EPC. The use of the conservative estimate of the mean is consistent with EPA guidance.

If the data appeared to be normally distributed, then the UCL was computed using the *t*-statistic. If the data appeared to be lognormally distributed, the UCL was based on Land's method using the *H*-statistic. If the data were neither normal nor lognormal in distribution, a modified bootstrap procedure devised by Hall that takes some account of bias and skewness was used.

REGRESSION ANALYSIS TO ESTIMATE 2,3,7,8-TCDD TEQ CONCENTRATIONS

SIWP

At the time of the writing of the SIWP, no mention was made about an approach to estimate the 2,3,7,8-TCDD TEQ concentrations. Therefore, the approach followed was not presented in the SIWP.

Deviation/Rationale

Along with tPCBs, dioxins, furans, and dioxin-like PCB congeners were selected as COPCs. These compounds were evaluated as 2,3,7,8-TCDD toxic equivalents (TEQs); however, given the limited data for these compounds in comparison to the amount of total PCB data, and the size of the area under evaluation, a different approach was taken to estimate EPCs for TEQs. Instead of calculating EPCs for each EA, when in many cases there were little or no data within an EA, a regression analysis was performed to estimate the TEQ concentration for the entire Reach 5 and 6 area. This was accomplished by investigating the correlation between the congener concentrations and the total PCB concentrations at sampling locations where both total PCBs and dioxins, furans, and dioxin-like PCB congeners were analyzed. This regression analysis is presented in Attachment 2 of the HHRA.

USE OF RECREATIONAL EXPOSURE SCENARIO

SIWP

Three separate recreational scenarios will be evaluated in this risk assessment:

- Direct-contact recreational user
- Hunter
- Angler

Deviation/Rationale

A total of seven exposure scenarios were developed to evaluate recreational exposure to soil and sediment. These scenarios included general recreation, all-terrain vehicle (ATV)/dirt and mountain bike riding, marathon canoeing, recreational canoeing/boating, angling, waterfowl hunting, and sediment exposure. This was done to provide a more detailed evaluation of the various activities that occur in the area.

USE OF SPATIAL WEIGHTING

SIWP

At the time of the writing of the SIWP, no mention was made about a spatial weighting approach. Therefore, the approach followed was not presented in the SIWP.

Deviation/Rationale

A spatial weighting approach (i.e., inverse distance weighting [IDW]) was used in Reaches 5 and 6 to generate a surface of interpolated PCB data from which EPCs were calculated. Spatial weighting was considered an appropriate and useful tool in the floodplain because of its vast size and because the assumption that concentrations are spatially correlated is supported both by the original sample data and by scientific plausibility. Floodplain soil contamination is a result of transport of sediment during flooding with the highest concentrations expected near the river and in low-lying areas.

USE OF EPA RAGS PART D TABLES

SIWP

- The medium-specific EPCs will be presented in the risk assessment in accordance with EPA RAGS Part D guidance as Table 3.
- Results of the cancer risk evaluation will be presented in RAGS Part D Table 8-1 format in the risk assessment report.
- The presentation of the summary information for the noncancer health effects in the risk assessment will follow the format presented in Table 8-1 in RAGS Part D guidance documentation.

- Both cancer risk and noncancer health effects will be summarized in the risk assessment as presented in Tables 9 and 10 of RAGS Part D Guidance.

Deviation/Rationale

None of the tables presented in this report used EPA RAGS Part D format. Because of the number of risk assessments conducted and the need to present risk results by individual EA or subarea, a table that presents the EPC, the exposure dose, the toxicity value, and the cancer or noncancer risk results for both the RME and CTE scenarios for each area was developed. This was done to limit the number of tables in the report.

GUIDELINES FOR DATA REDUCTION

SIWP

If a sample duplicate is collected and analyzed, the average of the two reported concentrations will be used for subsequent calculations unless there is a greater than 50% difference in soil and sediment concentrations, in which case the higher of the two concentrations will be used.

Deviation/Rationale

When summarizing soil data for use in spatial weighting applications, the results of duplicates and co-located samples were averaged. If one of the duplicate samples was below the detection limit, then one-half of the detection limit was used to compute the average. This guideline was followed regardless of whether the samples were co-located (collected at the same location at different times) or duplicates (collected at the same location and time).

REFERENCES

EPA (U.S. Environmental Protection Agency). 1992. Supplemental Guidance to RAGS: Calculating the Concentration Term. May 1992.

WESTON (Roy F. Weston, Inc.). 2000. *Supplemental Investigation Work Plan for the Lower Housatonic River*, Volumes 1 and II. Prepared for U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. 22 February 2000.