Back to Table of Contents

U.S. Army Corps of Engineers

New England District
Concord, Massachusetts

U.S. Environmental Protection Agency

New England Region
Boston, Massachusetts

HUMAN HEALTH RISK ASSESSMENT GE/HOUSATONIC RIVER SITE REST OF RIVER

VOLUME V
APPENDIX D
AGRICULTURAL PRODUCT CONSUMPTION RISK ASSESSMENT

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-1690-5

WESTON SOLUTIONS

HUMAN HEALTH RISK ASSESSMENT
GE/HOUSATONIC RIVER SITE
REST OF RIVER

VOLUME V
APPENDIX D
AGRICULTURAL PRODUCT CONSUMPTION RISK ASSESSMENT

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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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February 2005

W.O. No. 20123.001.096.0728

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS
(Continued)

Section **Page**

TABLE OF CONTENTS
(Continued)

Section **Page**

TABLE OF CONTENTS
(Continued)

Section **Page**

TABLE OF CONTENTS
(Continued)

Section **Page**

TABLE OF CONTENTS
(Continued)

Section **Page**

LIST OF ATTACHMENTS

LIST OF TABLES

Title

LIST OF TABLES
(Continued)

Title

LIST OF TABLES
(Continued)

Title

LIST OF TABLES
(Continued)

Title

LIST OF TABLES
(Continued)

Title

LIST OF FIGURES

Title

LIST OF FIGURES
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Title

LIST OF FIGURES
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Title

LIST OF FIGURES
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(Continued)

Title

LIST OF ACRONYMS

2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
ADD	average daily dose
AF	adjustment factor
AhR	aryl hydrocarbon receptor
AIPL	Animal Improvement Programs Laboratory
ARS	Agricultural Research Service
AT	averaging time
BCF	bioconcentration factor
BEHA	Bureau of Environmental Health Assessment
BTF	biotransfer factor
CDFA	California Department of Food and Agriculture
CL	cooking loss
COPC	contaminant of potential concern
COR	carry-over rate
CR	consumption rate
CSF	Cancer Slope Factor
CSFII	Continuing Survey of Food Intake by Individuals
CSM	conceptual site model
CTDEP	Connecticut Department of Environmental Protection
CTE	central tendency exposure
DBA	dependency bound analysis
DOC	dissolved organic carbon
DOJ	Department of Justice
DQO	data quality objective
ED	exposure duration
EF	exposure frequency
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
GE	General Electric Company
HEAST	Health Effects Assessment Summary Tables
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
HRA	Housatonic River Area
IARC	International Agency for Research on Cancer

LIST OF ACRONYMS (Continued)

IRIS	Integrated Risk Information System
K_{OA}	octanol-air partition coefficient
K_{OW}	octanol-water partition coefficient
LADD	lifetime average daily dose
LOAEL	lowest observed adverse effect level
LOD	limit of detection
LOQ	limit of quantitation
MADFA	Massachusetts Department of Food and Agriculture
MassWildlife	Massachusetts Division of Fisheries and Wildlife
MCA	Monte Carlo Analysis
MDEP	Massachusetts Department of Environmental Protection
MDPH	Massachusetts Department of Public Health
mg/kg	milligrams per kilogram
NAPL	non-aqueous phase liquid
NAS	National Academy of Sciences
NCP	National Contingency Plan
NFCS	Nationwide Food Consumption Survey
OCDD	octachlorodibenzo-p-dioxin
PAH	polycyclic aromatic hydrocarbon
PBA	probability bounds analysis
PBT	persistent, bioaccumulative, and toxic
PCB	polychlorinated biphenyl
PCDD/PCDF	polychlorinated dibenzo-p-dioxin and furan
PCL	post-cooking loss
ppm	parts per million
PQL	practical quantitation limit
PRA	probabilistic risk assessment
PRG	preliminary remediation goal
PSA	Primary Study Area
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RFI	RCRA Facility Investigation
RME	reasonable maximum exposure
RPD	relative percent difference

LIST OF ACRONYMS
(Continued)

SAB	Science Advisory Board
SIWP	Supplemental Investigation Work Plan
SVOC	semivolatile organic compound
TCDD	tetrachlorodibenzo-p-dioxin
TEF	toxic equivalency factor
TEQ	toxic equivalence
TF	transfer factor
TOC	total organic carbon
tPCB	total PCB
UE	uncertainty factor
USACE	U.S. Army Corps of Engineers
USDA ARS	U.S. Department of Agriculture Agricultural Research Service
USDA	U.S. Department of Agriculture
USFDA	U.S. Food and Drug Administration
WEAC	Winchester Engineering and Analytical Center
WHO	World Health Organization
ww	wet weight
µg/kg	microgram per kilogram
µg/L	microgram per liter

AGRICULTURAL PRODUCT CONSUMPTION 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 is the subject of this risk assessment, is the portion of the river that extends 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 PCB isopleth. Between the confluence and the Woods Pond

Dam, the 1-ppm tPCB isopleth is approximately equivalent to the 10-year floodplain (BBL, 1996).

Risk Assessment Overview

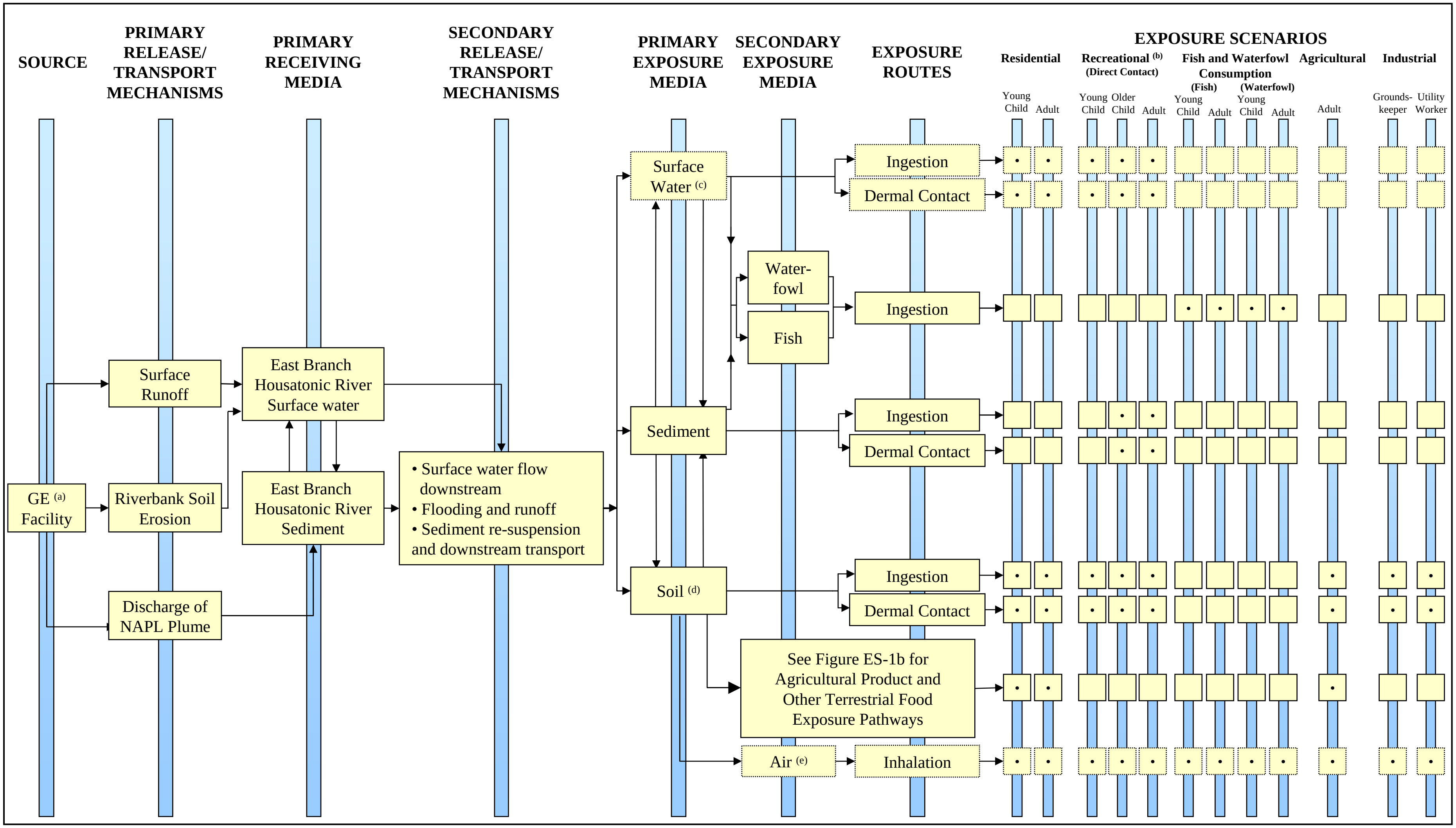
The Human Health Risk Assessment (HHRA), along with the Ecological Risk Assessment and Modeling Study, represents an important component of EPA's investigation of the Rest of River. The HHRA provides a comprehensive evaluation of health risks associated with uses of the river, its banks, and floodplain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

- Determining the need for remedial actions, and
- Setting media protection goals for contaminants of concern.

This volume, Agricultural Product Consumption Risk Assessment (Appendix D), is a technical appendix of the HHRA for the Rest of River portion of the GE/Housatonic River Site. The report and technical appendices provides an evaluation of health risks associated with current recreational, residential, agricultural, and commercial/industrial uses of the site which have been identified; and uses that might reasonably be expected in the future. Figures ES-1a and ES-1b present the conceptual site model (CSM) for the HHRA, with the agricultural product and other terrestrial food exposure pathways highlighted in Figure ES-1b. 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 Agricultural Product Consumption Risk Assessment

This appendix provides quantitative risk estimates for the consumption of agricultural products from the Rest of River using both point estimate and probabilistic methodologies. Both approaches evaluate potential cancer risks and noncancer health hazards to children and adults from consumption of agricultural products from the floodplain. The focus of this assessment is on current and potential future food production and gathering activities within the 1-ppm tPCB



• = Complete exposure pathway

= Incomplete exposure pathway

= Not evaluated quantitatively.

NAPL = nonaqueous phase liquid.

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

(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.

Human Health Risk Assessment
GE/Housatonic River Site
Rest of River

Figure ES-1a

Conceptual Site Model

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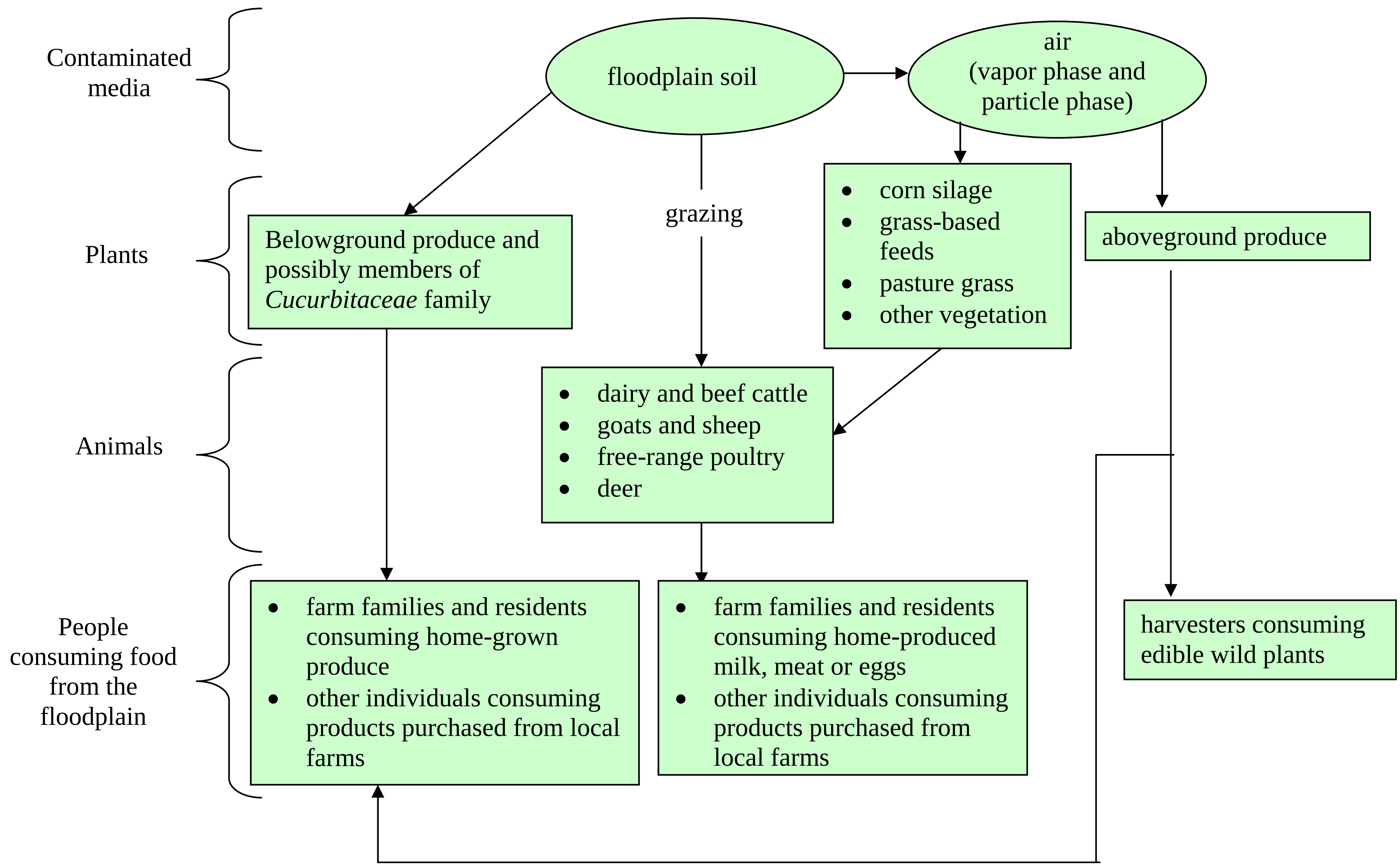


Figure ES-1b
Conceptual Model of Agricultural Product and Other Terrestrial Food Exposure Pathways in the Housatonic River Floodplain

isopleth of the Housatonic River floodplain. The contaminants of potential concern (COPCs) are PCBs and toxic equivalence (TEQ) associated with dioxins, furans, and dioxin-like PCBs.

The risk assessment was performed in accordance with EPA policies and procedures. This technical appendix was organized according to the standard EPA risk assessment format and includes hazard identification, dose-response assessment, exposure assessment, risk characterization, and uncertainty analysis sections.

HAZARD IDENTIFICATION

The purpose of the hazard identification is to:

- Define the conceptual site model, including current and potential future agricultural product and other terrestrial food exposure pathways.
- Describe agricultural product and wild edible plant data collected during the site investigation.
- Identify the COPCs.

Current and Future Activities

Current agricultural activities consist primarily of several dairy farms that grow corn silage and, to a lesser extent, grass-based feed in the floodplain. There are currently no commercial beef cattle or pig farms in the floodplain, although a small herd of beef cattle graze on one residential parcel. There is a commercial farm that grows a wide variety of vegetables and raises free-range chickens for meat, with some activities occurring in the floodplain. Deer hunting, home gardening, and edible wild plant harvesting occur in the floodplain.

Based on consultations with local farmers, commercial agriculture appears to be on the decline in this area. In the future, any change in animal production in the Housatonic River area that involves beef, poultry, sheep, or goats would likely fall into one of two categories. The first, production of special niche products such as free-range poultry and organic beef, might be economically viable in the Housatonic River area because of the ability to command higher prices based on local demographics. The other possibility is the noncommercial backyard farm where a few animals, or a small flock of hens, are used to produce products for home consumption. Such a backyard farm currently exists, with a small herd of beef cattle.

Conceptual Site Model

The focus of this assessment is on current and potential future terrestrial food production and gathering activities within the 1-ppm tPCB isopleth of the Housatonic River floodplain. The conceptual site model shown in Figure ES-1b illustrates potential exposure pathways evaluated in this assessment that link people to COPCs in animal products and plants from the floodplain. This appendix provides estimates of potential cancer risks and noncancer hazards associated with consumption of vegetable, fruit, dairy, beef, and poultry products from commercial farms and from backyard operations involving homeowners who keep a small number of animals for food production or maintain a home garden. Products from sheep, goats, and deer were assessed using methodologies adapted from those developed for cattle. Individuals might also be exposed directly to soil during food production and gathering. These direct contact exposures are evaluated in Appendix B of the HHRA. Cumulative risks from soil and food exposure pathways are discussed in Section 10 of HHRA Volume I.

Persistent organic pollutants such as PCBs, dioxins, and furans accumulate in fat and fat-containing products of animals. Individuals can be exposed to contamination by consuming dairy, meat, or egg products from animals that eat contaminated feed (e.g., corn silage and grass-based feeds) grown in the floodplain, or that inadvertently ingest soil while grazing in the floodplain. Lactating dairy cows were not observed grazing in the Housatonic River floodplain, but may be fed corn or hay that was grown in the floodplain. Poultry are fed grain that is not likely to be grown in the floodplain, but portable confinement pens may at times be located in the floodplain, or the birds may not be confined. Thus, soil ingestion, not feed, is the major pathway of poultry exposure.

Individuals eating commercial produce, home garden produce, or edible wild plants growing in the floodplain also might be exposed to contamination. However, PCBs, dioxins, and furans do not accumulate in plants to the extent that they accumulate in animal products. Soil-based contamination can deposit on aboveground vegetation (e.g., leaves and fruits) as a result of soil splashing onto plants during rain events. Dust generated by erosion or harvesting activities can adhere to plants. Sorption of vapor-phase contamination to aboveground vegetation also might occur, and soil-bound contaminants can partition to belowground vegetation (e.g., roots and tubers).

Site-Specific Data for Agricultural Product and Other Terrestrial Foods

Site-specific data and information, where available, were used in this assessment to minimize uncertainty in the risk estimates. Total PCB data are available for three agricultural products (acorn squash, corn grown for silage, and milk); one edible wild plant (fiddlehead ferns); and grass. Milk samples were collected in 1993, and all other samples were collected between 1998 and 2001. With the exception of four milk samples, all agricultural samples were collected along Reach 5 upstream from Woods Pond. Some site-specific data available from the literature also were used in this assessment. This assessment also incorporates PCB congener concentration data for animal feed (grass).

COPC Selection

The methods and results of the COPC selection process are presented in detail in the analysis of Direct Contact Exposure Pathways (Appendix B). Because screening was performed with residential risk-based screening criteria, an additional screening analysis was performed for contaminants that might bioaccumulate in agricultural food chains. As a result of this screening process, PCBs, PCDDs, and PCDFs were retained as COPCs. Other contaminants (e.g., pesticides and metals) were screened out of this assessment because they were not detected in floodplain soil at concentrations that are likely to result in agricultural product concentrations associated with significant risk.

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 consumption of agricultural products are combined with dose-response values to calculate potential cancer risk and noncancer hazard.

Toxicity values for tPCBs were obtained from the Integrated Risk Information System (IRIS) (EPA, 2004b). For mixtures such as the highly chlorinated tPCB mixture at the site, EPA recommends using an upper-bound CSF of 2.0 $(mg/kg\text{-}d)^{-1}$ and a central estimate CSF of 1.0 $(mg/kg\text{-}d)^{-1}$. The IRIS database provides oral RfDs for Aroclor 1016 and Aroclor 1254. The PCB mixture at the site most closely resembles Aroclor 1260 with minor contributions from Aroclor 1254 (WESTON, 2002; BBL & QEA, 2003), 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.

The risks associated with 2,3,7,8-TCDD and other dioxin-like congeners were evaluated using a toxic equivalence (TEQ) approach (Van den Berg at al., 1998). Each dioxin-like congener was assigned a toxic equivalency factor (TEF) that is used to transform concentrations of individual dioxin-like dioxin, furan, and PCB congeners into equivalent concentrations of 2,3,7,8-TCDD. Toxicity values for 2,3,7,8-TCDD TEQ are not published in IRIS. The provisional CSF value of 1.5E+05 $(mg/kg\text{-}d)^{-1}$ was obtained from the *Health Effects Assessment Summary Tables* (HEAST) (EPA, 1997). No noncancer toxicity values are available for PCDD/PCDFs, and noncancer health effects from these compounds were not quantitatively evaluated.

Cancer risks from 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).

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 by consumption of agricultural products. To provide a range of exposure estimates, both the reasonable maximum exposure (RME) and central tendency exposure (CTE) scenarios are presented. The RME, an estimate of the upper range of exposure in a population, is based on a combination of the upper and central estimates of exposure parameters representing the 90^{th} 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.

The agricultural product risk assessment is composed of two tiers. The point estimate risk models represent the first tier of the risk assessment. The second tier consisted of one-dimensional probability bounds analyses (PBAs) 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 the HHRA Volume 1, Attachment 5). The second-tier risk analysis consists of a probability distribution of risk, and plausible extreme uncertainty bounds on that risk distribution for a subset of agricultural product consumption scenario.

Non-Parcel-Specific Exposure Scenarios

The exposure scenarios evaluated in this assessment are listed in Table ES-1. The table indicates whether each scenario was qualitatively or quantitatively evaluated and, if quantitative, whether point estimate and/or probabilistic analyses were performed.

Table ES-1

Agricultural Product and Other Terrestrial Food Exposure Pathways Evaluated in this Assessment[1]

Agricultural Product or Other Terrestrial Food	Current or Future Scenario	Quantitative or Qualitative Assessment Deterministic and/or Probabilistic Analysis
Commercial Activities		
Dairy cattle: milk	current/future	quantitative (point estimate and probabilistic)
Beef cattle or surplus dairy: meat	future	quantitative (point estimate)
Free-range poultry: meat and eggs	current/future	quantitative (point estimate and probabilistic)
Goats: milk	future	qualitative
Sheep: lamb's meat	future	qualitative
Produce	current/future	quantitative (point estimate and probabilistic)
Non-Commercial "Backyard" Animals		
Dairy cattle: milk	future	quantitative (point estimate)
Beef cattle: meat	current/future	quantitative (point estimate and probabilistic)
Free-range poultry: meat and eggs	future	quantitative (point estimate)
Goats: milk	future	qualitative
Sheep: lamb's meat	future	qualitative
Other Non-Commercial Activities		
Deer hunting	current/future	qualitative
Wild edible plant harvesting	current/future	fiddlehead ferns: quantitative (point estimate); other plants: qualitative
Home garden	current/future	quantitative (point estimate)

[1] All scenarios are assessed on a non-parcel-specific basis. Exposures are calculated based on assumed tPCB soil EPCs that reflect the range measured in current and potential future agricultural areas and the fraction of these areas within the floodplain (i.e., the 1-ppm tPCB isopleth along Reaches 5 and 6, and the 100-year floodplain along Reaches 7, 8, and 9).

Because management practices and animal types on any given farm may change over time, a farm-specific assessment would become obsolete when these changes occur. To address this concern, hypothetical scenarios were assessed that reflect the range of current and potential future farm types, management practices (e.g., animal housing and feed) in the floodplain, and PCB concentrations. Thus this assessment can be used to assess risk for the practices and/or uses for any parcel at any time.

Exposure estimates were based on assumed tPCB soil exposure point concentrations (EPCs) that reflect the range of concentrations measured in current and potential future agricultural areas, and on a range of assumed fractions of agricultural area within the floodplain (i.e., the 1-ppm tPCB isopleth along Reaches 5 and 6, and the 100-year floodplain along Reaches 7, 8, and 9), with the exception of some residential properties. Also, although tPCB concentrations outside this range have been measured on some recreational properties, no plans to convert these areas to agricultural uses in the future were identified.

PCB, dioxin, and furan congener concentrations associated with the range of tPCB EPCs were predicted using linear regression models described in the HHRA Volume I, Attachment 2.

All scenarios listed in Table ES-1 were evaluated in this assessment; however, scenarios that reflect current activities, represent bioaccumulative pathways, and/or involve relatively high potential exposure to floodplain soil were subject to a full quantitative assessment. These scenarios are:

- Commercial dairy, beef, poultry, and produce.
- Backyard dairy, beef, poultry, and produce (i.e., home gardens).

The levels of possible animal exposure and human health risk associated with other exposure scenarios (i.e., sheep, goats, deer, and wild edible plants other than fiddleheads) were evaluated relative to the scenarios assessed quantitatively.

Estimation of PCB and PCDD/PCDF Concentrations in Foods

Contaminant concentrations in animal products from exposure to contaminants in an environmental medium such as soil are a function of many factors. These factors include the various feeding and management practices that determine the direct and indirect access of animals to the source, and the physiological factors that determine the absorption and disposition of the ingested contaminants in the animal.

Farm management practices typical for the area were identified through interviews with local farmers. Site-specific corn, grass, and soil data were used to define soil-to-plant transfer factors for PCBs. Animals can be exposed to site-related contamination present in feed or in soil that is ingested while grazing. The degree to which animals are in direct contact with the soil is the most significant management variable affecting animal exposure to environmental contaminants. Under current commercial farming practices along the river, contact with soil occurs primarily through grazing, because no animal housing and holding facilities are located on the floodplain (with the possible exception of free-range poultry in Reach 9). The facilities that were observed had concrete floors rather than earthen floors.

The degree of contaminant transfer from soil or feed to food products depends on the nature of the contaminant and physiological status of the animal. Data from the literature were used to derive bioconcentration factors (BCFs) appropriate for calculating concentrations of PCBs, dioxins, and furans in animal tissue, milk, and eggs. More data are available regarding bioconcentration of dioxins and furans than PCB congeners, leading to greater uncertainty about dioxin-like PCB congener BCFs than dioxin and furan congener BCFs.

The basic assumptions in the measurement and application of these BCFs are that the animals are at a steady state, and that levels of contamination in the environment are stable. A number of complex processes and variables control contaminant absorption and partitioning in animals. For this reason, there are uncertainties in the prediction of contaminant concentrations in a single animal or a small group of animals over a short time period. However, studies of dairy cattle demonstrate that it is reasonable to use average transfer coefficients for large animal populations (Sweetman et al., 1999). Because the long-term average concentration of contaminants in milk fat and beef fat is important in the evaluation of cancer risk and chronic hazards, relatively simple transfer coefficients that reflect the steady-state conditions rather than short-term variability are appropriate for use in relating contaminant intake of animals to tissue accumulation or elimination through milk.

A wide range of soil-to-plant transfer factors has been published in the literature, reflecting the variable experimental conditions and PCB mixtures used in the underlying studies. The soil-to-plant transfer factors for animal feeds (i.e., corn silage and grass-based feeds) and home garden produce were selected for use in this assessment from available site-specific data.

Exposure Models and Parameters

Exposure was calculated as average daily dose (ADD), expressed as administered dose in milligrams of contaminant per kilogram of body weight per day (mg/kg-d). ADDs were calculated for each receptor based on two different averaging times. For each scenario a 1 to 7-year-old child receptor and an adult receptor were evaluated. ADDs averaged over the exposure duration were used to evaluate noncancer health effects. Lifetime average daily doses (LADDs), in which the doses are averaged over a 70-year lifetime, were used to evaluate potential cancer risk. To the extent possible, site-specific data were used to derive exposure parameters, including exposure duration and soil-to-plant transfer factors.

Infant consumption patterns differ from those of older children and adults, and home-produced food consumption rate information is not available for infants (EPA, 1997). The measured and predicted PCB, dioxin, and furan concentrations in food were combined with site-specific exposure parameters and those derived from EPA guidance to estimate doses of PCBs, dioxins, and furans.

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 associated with consumption of foods from the floodplain. Cancer risks and noncancer health hazards associated with tPCB exposures were evaluated for both the RME and CTE point estimate and the probabilistic assessments. Cancer risks associated with 2,3,7,8-TCDD TEQ exposures are presented in the uncertainty analysis (Section 7) rather than the risk characterization due to uncertainties associated with predicting congener concentrations in floodplain soil, and the limited BCF data for dioxin-like PCB congeners. Some dioxin-like congener risk estimates are sufficiently certain to remain in this section (e.g., risk from dioxin congeners in soil for the dairy and poultry exposure scenarios). However, to avoid the confusion of having some aspects of the TEQ pathway for a given exposure scenario divided between the risk characterization and uncertainty analysis sections, all congener-specific TEQ cancer risk estimates are presented in Section 7.

Cancer risk is calculated by multiplying the lifetime average daily exposure to a COPC by the cancer slope factor for the COPC. The calculated cancer risk, which has no units, represents the excess cancer risk (above the background cancer risk) over a lifetime of exposure.

EPA's cancer risk range represents the increased risk of developing cancer, based on plausible upper-bound exposure, of approximately 1 in 1,000,000 (1E-06, equivalent to 1×10^{-6}) to 1 in 10,000 (1E-04, equivalent to 1×10^{-4}) over the course of a 70-year (assumed) lifetime (EPA, 1990). Where the cumulative site risk to an individual based on the RME exceeds the 1E-04 lifetime excess cancer risk end of the risk range, 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 hazards are described using the hazard index (HI), which is calculated by summing the hazard quotients (HQs) for all COPCs. In the assessment of agricultural and other terrestrial food exposure pathways, there is only one COPC (tPCBs) that is evaluated for noncancer effects, because RfDs are not available for PCB congeners or PCDD/PCDF congeners. An HQ is the ratio of the exposure duration-averaged daily dose (ADD) to the contaminant-specific RfD. Because only one HQ is being calculated for tPCBs, the HQs are equal to HIs for each receptor.

HIs of less than 1 indicate that adverse noncancer hazards associated with the exposure scenario are unlikely to occur. EPA considers action when the HI exceeds 1.

Point Estimate, MCA Analog, and PBA Results

A combination of upper 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 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).

In Section 5, cancer risk and noncancer hazard estimates are presented in matrix format for different combinations of tPCB EPCs in floodplain soil and fractions of cultivated land or pasture that is in the floodplain. A separate matrix is provided for each agricultural scenario, with cancer risk and noncancer hazard estimates reported for four tPCB soil EPCs (0.5, 2, 10, and 25 mg/kg) and four fractions of cultivated fields and pastures in the floodplain (0.25, 0.5, 0.75, and 1.0), resulting in a total of 16 combinations of the two factors. The 2 mg/kg concentration is the cleanup level established in the Consent Decree for residential properties. Using these matrices, risk can be estimated for each agricultural scenario for any combination of tPCB soil EPC and fraction of farmland in the floodplain for a parcel of interest. An underlying assumption of this approach is that the tPCB concentration in farm soil outside the floodplain is zero. This assumption is likely to underestimate risk slightly, depending upon site-specific background concentrations of tPCBs.

The results of the point estimate risk characterization are summarized in Tables ES-2 and ES-3 for those scenarios subjected to probabilistic analyses assuming a tPCB concentration of 2 mg/kg in floodplain soil and a fraction of agricultural land in the floodplain of 1. These tables also include results of the 95^{th} percentile (representative of an RME) and 50^{th} percentile (median, representative of a CTE) of the MCA analog. The 95^{th} percentile of the MCA analog is presented in these tables because it approximates the midpoint of the RME range and is the recommended starting point for risk management decisions (EPA, 2001).

Table ES-2

Cancer Risk from Agricultural Product Consumption: Point Estimate and Monte Carlo Analog Analyses [1]

	RME Range		Central Tendency Range	
	RME Point Estimate	95th Percentile MCA	CTE Point Estimate	50th Percentile MCA
Commercial Dairy	8.E-06	5.E-06	2.E-06	7.E-07
Backyard Beef	1.E-04	1.E-04	1.E-05	1.E-05
Commercial Poultry Meat	1.E-04	8.E-05	1.E-05	1.E-05
Commercial Poultry Egg	3.E-04	2.E-04	7.E-05	3.E-05
Commercial Produce	5.E-06	3.E-06	8.E-07	4.E-07

[1] This table provides cancer risk estimates assuming a tPCB floodplain soil EPC of 2 mg/kg with all agricultural activities within the floodplain (i.e., fraction =1), the risks will vary for other combinations of EPC and fraction of use in floodplain.

Table ES-3

Noncancer Hazards from Agricultural Product Consumption: Point Estimate and Monte Carlo Analog Analyses [1]

	RME Range		Central Tendency Range	
	RME Point Estimate	95th Percentile Monte Carlo	CTE Point Estimate	50th Percentile Monte Carlo
Hazard Index - Adult				
Commercial Dairy	0.2	0.2	0.1	0.08
Backyard Beef	4	11	3	2
Commercial Poultry Meat	3	5	1	1
Commercial Poultry Egg	7	13	6	4
Commercial Produce	0.1	0.2	0.07	0.05
Hazard Index - Child				
Commercial Dairy	0.7	0.8	0.5	0.5
Backyard Beef	8	21	4	4
Commercial Poultry Meat	4	8	2	2
Commercial Poultry Egg	16	37	14	10
Commercial Produce	0.2	0.4	0.1	0.09

[1] Example hazard indices assuming a tPCB floodplain soil EPC of 2 mg/kg with all agricultural activities within the floodplain (i.e., fraction =1).

Commercial Dairy

Currently, dairy cattle are confined outside the floodplain and fed concentrates and corn silage, with little to no grass-based feed. Therefore, it was assumed that cattle were exposed only through consumption of contaminated corn silage grown in the floodplain, and the risk estimates for the farm family consuming of dairy products are ultimately attributable to ingestion of contaminated corn silage by the herd. All RME and CTE cancer risks were below or within EPA's risk range. Nearly all adult RME and CTE HIs were less than 1. Child RME and CTE HIs were less than 1 at assumed tPCB EPC of 0.5 mg/kg and 2 mg/kg, but most exceeded 1 at assumed tPCB EPCs of 10 mg/kg and 25 mg/kg.

Commercial Beef

Currently, no commercial beef cattle operations have been identified in the floodplain. If current dairy farms or other land suitable for agriculture is converted to commercial beef cattle production in the future, a likely scenario would include a cattle roughage diet consisting of a 50:50 mixture of corn silage and grass-based feed, and soil ingested while grazing at a rate of 2% of the diet. RME cancer risks for the farm family consuming beef exceeded 1E-04 at assumed tPCB EPCs of 10 mg/kg and 25 mg/kg, and CTE cancer risks exceeded 1E-04 only at an assumed tPCB EPC of 25 mg/kg. RME and CTE child and adult HIs exceeded 1 at assumed tPCB EPCs of 10 mg/kg and 25 mg/kg and all fractions of land in the floodplain, and they exceeded 1 at an assumed tPCB EPC of 2 mg/kg at most assumed fractions. Cancer risk and non-cancer hazard from tPCBs in beef resulted primarily from soil consumption by the animals (55%), followed by grass consumption (44%), and corn silage consumption (1%).

Backyard Dairy and Beef

Risk and hazard estimates for families consuming animal products from backyard beef and dairy operations, where one or a few cattle are kept, were generally higher than for commercial farms. Backyard cattle were assumed to consume more grass-based feeds because of the impracticality of growing corn on residential lots and the expense associated with purchasing commercial feeds. This approach is conservative because soil-to-grass transfer factors exceed soil-to-corn transfer factors. Also, unlike commercial dairy cattle, backyard dairy cattle would be more likely to graze in the floodplain, with consequent ingestion of soil.

In this scenario, it was assumed that cattle were exposed to contamination in grass and soil while grazing. RME cancer risks for consumption of home-produced dairy products exceeded 1E-04 at all assumed tPCB EPCs except for 0.5 mg/kg, and RME cancer risks for consumption of home-produced beef exceeded 1E-04 at only the assumed tPCB EPCs of 10 mg/kg and 25 mg/kg. CTE cancer risks for backyard dairy and beef were generally lower than corresponding RME cancer risks, with dairy risks nearly always exceeding 1E-04 at assumed tPCB EPCs of 10 mg/kg and 25 mg/kg and beef risks exceeding 1E-04 only at an assumed tPCB EPC of 25 mg/kg with a fraction in the floodplain of 1.

Adult and child RME HIs for consumption of backyard dairy and beef products exceeded 1 under nearly all assumed tPCB EPC and fraction combinations, except for 0.5 mg/kg tPCBs in the backyard beef scenario.

For backyard dairy animals, about 68% of the intake of tPCBs by the animals came from grass consumption and 32% from soil consumption. For backyard beef cattle, about 64% of the intake of tPCBs came from grass consumption and 36% from soil consumption.

Commercial and Backyard Free-Range Poultry

In this scenario, soil ingestion is the major exposure pathway for poultry because they are fed grains that are unlikely to be contaminated with PCBs or PCDD/PCDFs, but they might have access to floodplain soil. Therefore, the risk estimates for consumption of poultry products are ultimately attributable to ingestion of contaminated soil by poultry. The only difference between the commercial and backyard scenarios is the higher RME and CTE exposure duration assumed for farm families than for other residents, which resulted in different age-weighted poultry meat and egg consumption rates.

RME cancer risks for commercial farm families consuming poultry meat exceeded 1E-04 at the assumed tPCB EPCs of 10 mg/kg and 25 mg/kg. Corresponding CTE cancer risks exceeded 1E-04 only at an assumed tPCB EPC of 25 mg/kg with a fraction in the floodplain of 1. RME cancer risks for consumption of backyard poultry meat are somewhat less than for commercial farm families due to the shorter exposure duration and lower RME consumption rate, with RME risks greater than 1E-04 only at assumed tPCB EPCs of 10 mg/kg and 25 mg/kg, and CTE risks all within EPA's risk range.

RME cancer risks for commercial farm families consuming poultry eggs exceeded 1E-04 at the assumed tPCB EPCs of 2 mg/kg, 10 mg/kg, and 25 mg/kg, except for the combination of 2 mg/kg with a fraction in the floodplain of 0.25. CTE cancer risks for these commercial farm families exceeded 1E-04 at fewer tPCB EPC and fraction combinations, with exceedances limited to assumed tPCB EPCs of 10 mg/kg and 25 mg/kg. Similar, but slightly lower, CTE and RME cancer risks were estimated for consumption of backyard poultry eggs.

RME and CTE HIs for commercial and backyard farm families consuming poultry meat and eggs were similar for these two scenarios, with most or all RME HIs exceeding 1 at assumed tPCB EPCs of 2 mg/kg, 10 mg/kg, and 25 mg/kg. Adult RME HIs at an assumed tPCB EPC of 0.5 mg/kg were nearly always less than 1, and child RME HIs at this concentration were sometimes less than 1.

Home Gardens

Risks from ingestion of home-grown garden produce were estimated for both a farm family and a resident with a backyard garden in the Housatonic River area. Cancer risks and noncancer HIs were estimated for exposed fruit, exposed vegetables, and root vegetables. Cancer risks and HIs were summed across these three produce categories to yield the total cancer risk and HI.

All RME and CTE cancer risks for the farm family and home gardening family were below or within EPA's risk range. Nearly all HIs for the farm family and home gardening family were below 1 except for the child RME HIs at an assumed tPCB EPC of 25 mg/kg and fractions of the floodplain of 0.71 and 1, and child CTE HIs at an assumed tPCB EPC of 25 mg/kg and a fraction of 1. The exceptions were most RME and several CTE HIs at an assumed tPCB EPC of 25 mg/kg regardless of fraction in the floodplain, and the child RME HI at an assumed tPCB EPC of 10 mg/kg and fraction of 1.

The home garden risk estimates may not account for risks associated with consumption of squash, which were estimated separately using a site-specific mean tPCB concentration of 0.049 mg/kg (wet weight basis). A cancer risk of 5E-06 would be associated with consumption of one ½-cup squash meal per week, 12 weeks per year for 45 years (6 as a 15-kg child and 39 as a 70-kg adult). A noncancer HI of 0.6 would be associated with a young child's consumption of one ½-cup squash meal per week, 12 weeks per year, assuming a body weight of 15 kg. If a very young child (1 to 2 years old with a body weight of about 11 kg) consumed this much squash, the noncancer HI would be 0.8. These risk and hazard estimates do not include a cooking loss factor.

Sheep, Goats, and Deer

Sheep, goats, and deer were all evaluated as variations of the non-parcel-specific cattle scenarios. Risk associated with home-produced lamb consumption would be less than that associated with home-produced beef consumption. Risk associated with home-produced goat milk consumption would likely be less than that associated with home-produced cow milk consumption. Given the low fat content and foraging habits of deer, risk associated with consumption of deer meat is likely to be substantially less than consumption of home-produced beef.

Relationship between Risk Estimates and the EPA Risk Range

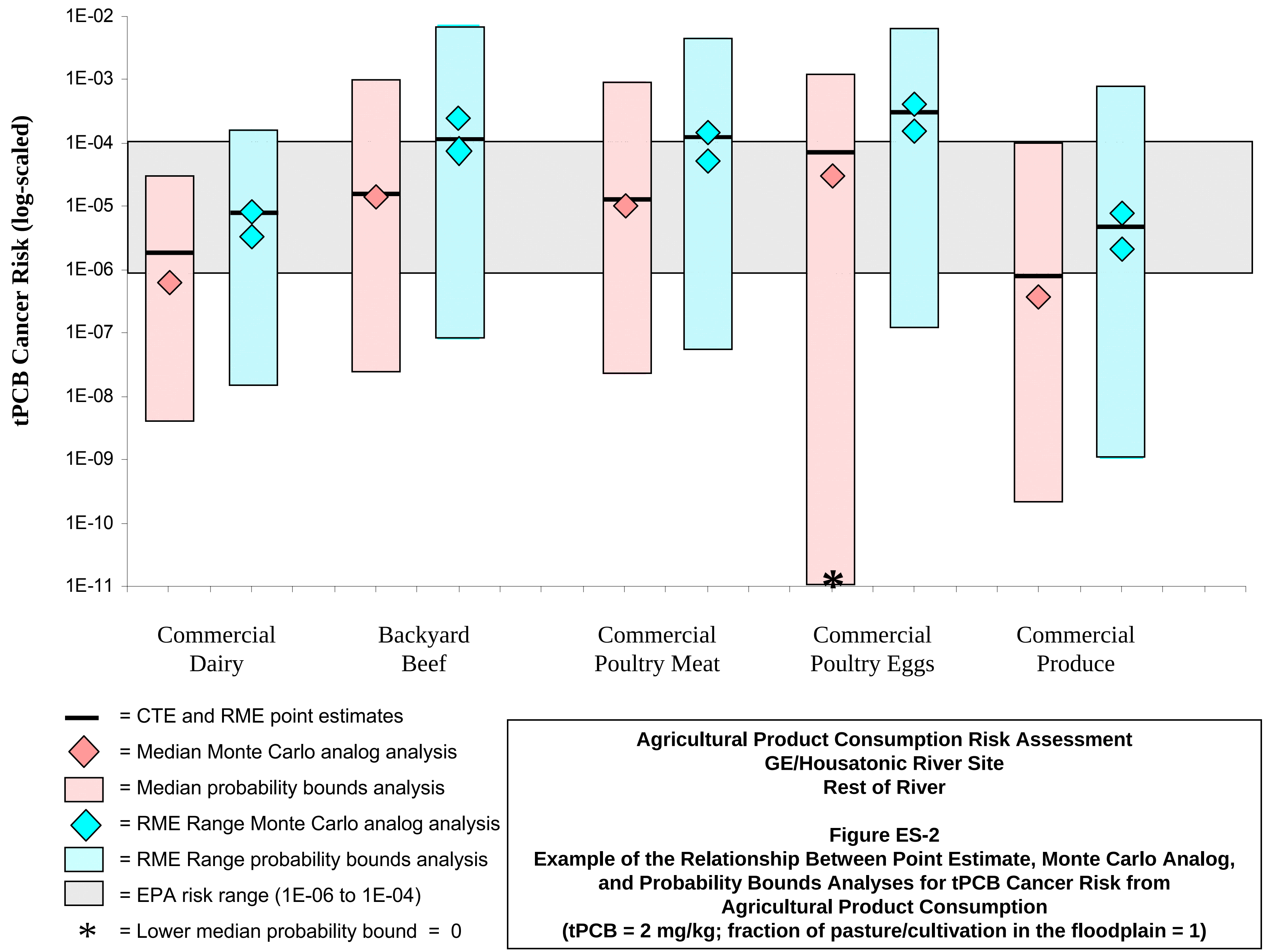
The results of the point and probabilistic risk assessments were compared to the EPA risk range. The EPA cancer risk range identified in the National Contingency Plan (NCP) (EPA, 1990) is 1E-06 to 1E-04, or an increased probability of developing cancer of 1 in 1,000,000 to 1 in 10,000 over the course of a 70-year lifetime. Exposure that results in no appreciable risk of significant adverse effect to individuals is the goal for COPC with noncancer effects. An HI of 1 or less indicates no appreciable significant risk.

As previously noted, where the cumulative site risk to an individual based on the RME exceeds the 1E-04 lifetime excess cancer risk end of the risk range, 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). For noncancer health effects, EPA considers action when the HI exceeds 1.

Figures ES-2 through ES-4 provide summaries of the tPCB cancer risks and tPCB HIs calculated using the point estimate, MCA analog, and probability bounds approaches, and a comparison of these cancer risks and HIs to the EPA risk range. Like Tables ES-2 and ES-3, the results in these figures are an example of the risk results based on an assumed tPCB floodplain soil EPC of 2 mg/kg with all agricultural activities occurring within the floodplain (i.e., fraction=1). 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 agricultural scenario. EPA guidelines for cancer risks and noncancer health effects are noted by a gray shaded area and a gray line, respectively.

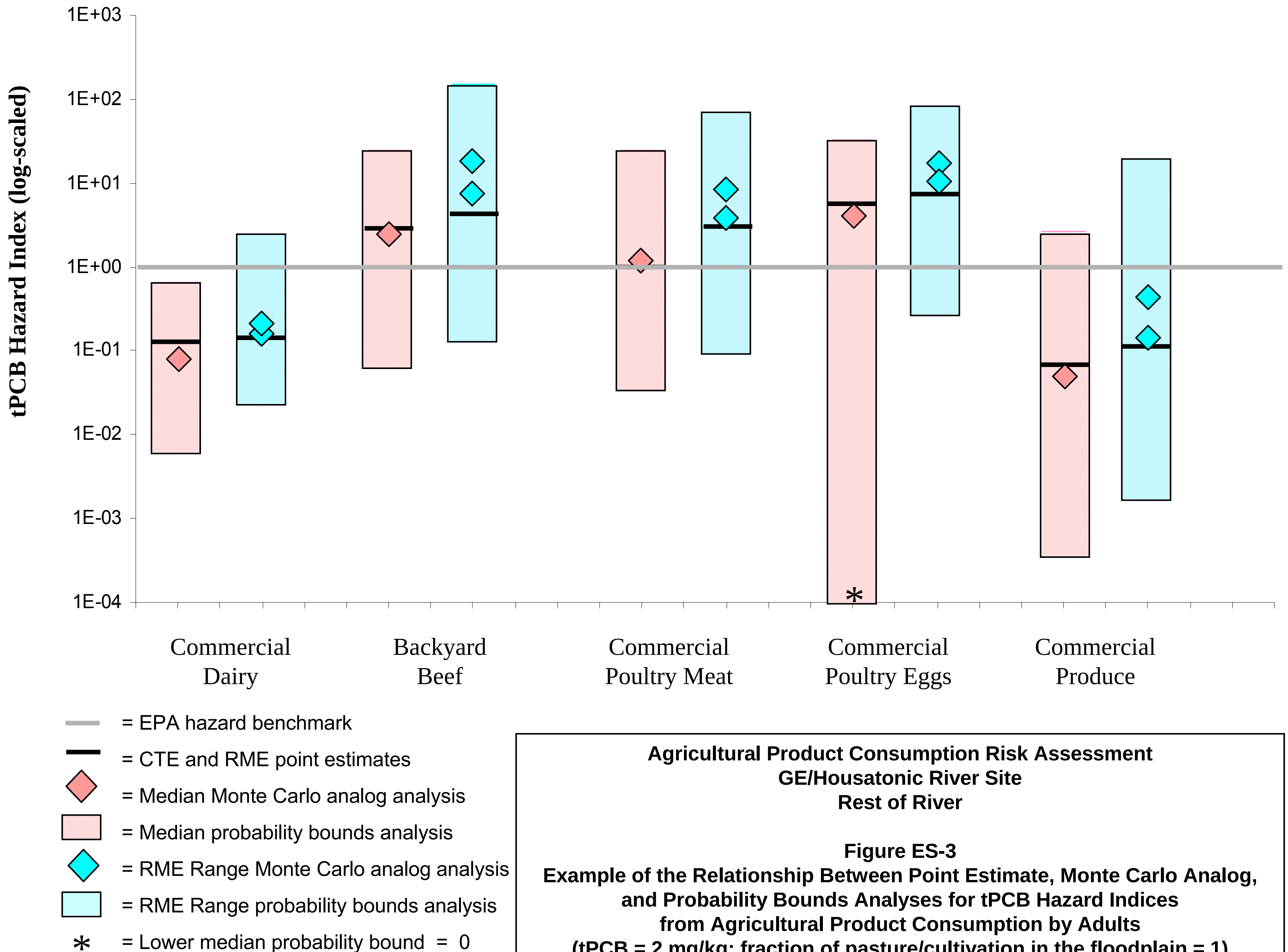
Interpreting Figure ES-2, the red diamonds represent the median (50^{th} percentile) cancer risk calculated using the MCA analog. The black horizontal lines (on the red bars) represent the point estimate results for the CTE. For example, the central tendency cancer risk from tPCB due to consumption of backyard beef is 1E-05 for both the point estimate CTE and the median of the MCA analog. The light bands of red correspond to the uncertainty around the median of the MCA analog analysis that was calculated with PBA.

EPA guidance (EPA, 2001) suggests risk managers select the RME from the upper range (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 bands of blue correspond to the uncertainty surrounding the high-end percentiles of the MCA analog calculated with PBA.



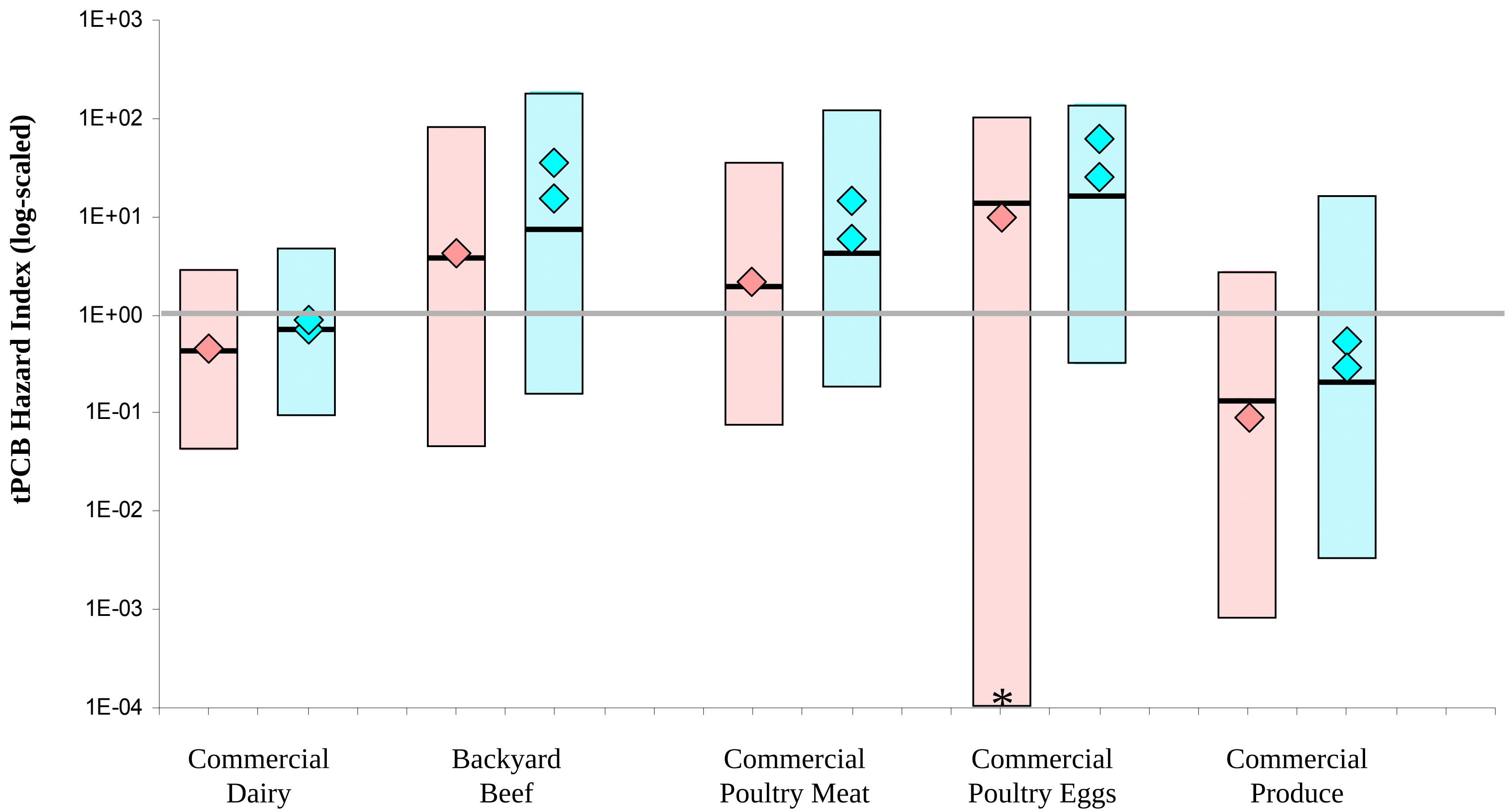
Agricultural Product Consumption Risk Assessment
GE/Housatonic River Site
Rest of River

Figure ES-2
Example of the Relationship Between Point Estimate, Monte Carlo Analog, and Probability Bounds Analyses for tPCB Cancer Risk from Agricultural Product Consumption
(tPCB = 2 mg/kg; fraction of pasture/cultivation in the floodplain = 1)



Agricultural Product Consumption Risk Assessment
GE/Housatonic River Site
Rest of River

Figure ES-3
Example of the Relationship Between Point Estimate, Monte Carlo Analog, and Probability Bounds Analyses for tPCB Hazard Indices from Agricultural Product Consumption by Adults
(tPCB = 2 mg/kg; fraction of pasture/cultivation in the floodplain = 1)



= EPA hazard benchmark
= CTE and RME point estimates
= Median Monte Carlo analog analysis
= Median probability bounds analysis
= RME Range Monte Carlo analog analysis
= RME Range probability bounds analysis
* = Lower median probability bound = 0

Agricultural Product Consumption Risk Assessment
GE/Housatonic River Site
Rest of River

Figure ES-4
Example of the Relationship Between Point Estimate, Monte Carlo Analog, and Probability Bounds Analyses for tPCB Hazard Indices from Agricultural Product Consumption by Children
(tPCB = 2 mg/kg; fraction of pasture/cultivation in the floodplain = 1)

Cancer Risks

Figure ES-2 presents the tPCB cancer risk results for the five agricultural pathways currently operating in the floodplain. This example of risk calculations assumes that the tPCB floodplain soil EPC is 2 mg/kg and all agricultural operations occur in the floodplain.

Commercial poultry egg consumption tPCB cancer risks calculated with the point estimate RME and the 95th percentile of the MCA analog are above the upper end of the EPA risk range. The RME point estimate and MCA analog results for the backyard beef and commercial poultry meat scenarios span the upper end of EPA's risk range (i.e., the 99th percentile of the MCA analog is above the upper end of the EPA risk range, but the 90th percentile of the MCA analog is within in EPA's risk range). Point estimate and MCA analog results for other agricultural exposure scenarios are within or, in the case of commercial produce, below EPA's risk range. However, the uncertainty around the median and RME range of the MCA analog generally spans the entire EPA risk range.

Hazard Indices

Figures ES-3 and ES-4 present examples of the tPCB HI results for an adult and child, respectively, for the five agricultural pathways currently operating in the floodplain, assuming that the tPCB floodplain soil EPC is 2 mg/kg and all agricultural operations occur in the floodplain.

The tPCB HIs based on the both the adult and child backyard beef, commercial poultry meat, and commercial poultry egg consumption point estimate and Monte Carlo analog analysis for high-end and central tendency are above the EPA benchmark of 1. The commercial dairy and commercial produce point estimate and Monte Carlo analog HIs are below the benchmark for both central tendency and high-end exposure. However, when uncertainty is taken into account, the upper bound HIs are above the risk range, with the exception of the median probability bounds for the adult commercial dairy scenario.

UNCERTAINTY ANALYSIS

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

- Point estimate calculations of both reasonable maximum exposure (RME) and central tendency exposure (CTE).
- Monte Carlo analog analyses to characterize variability in risks, providing estimates of both a CTE and an RME range (i.e., 90th to 99.9th percentiles).
- PBA 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 discussion describing sources of uncertainty in the underlying data, the selection of parameter values, and modeling assumptions.

In addition, point estimate cancer risks associated with TEQ exposures were described as part of the uncertainty analysis due to uncertainties associated with some congener-specific risk model inputs. Of all dioxin-like congeners, PCB-126 typically contributed the most to the TEQ cancer risk estimates because this congener is the most dioxin-like of the PCB congeners, which are generally more prevalent at the site than dioxin and furan congeners. This congener also has the highest assumed BCF and soil-to-plant transfer factor among PCB congeners.

MAJOR FINDINGS

The major findings of the Agricultural Product Consumption Risk Assessment include the following:

- Risk estimates associated with backyard farms exceeded risk estimates associated with commercial farms. This is because backyard animals were assumed to have greater access to floodplain soil and to be fed higher proportions of grass-based feed. Grass-based feed was the most important exposure medium for dairy and beef cattle, and soil was the most important exposure medium for poultry.

- Total PCB cancer risk estimates and noncancer hazard indices (HIs) associated with home garden produce consumption were less than those associated with animal product consumption, reflecting the lower rate of PCB accumulation in plants relative to animal products.

- All TEQ cancer risk estimates were dominated by PCB-126 because the CSF for TEQ is greater than the CSF for tPCBs, and PCB-126 is the most dioxin-like of the PCB congeners and is assumed to bioaccumulate in animal products to a greater degree than other dioxin-like PCB congeners.

Cancer risks and noncancer hazards were estimated for a range of tPCB EPCs and fractions of agricultural land within the floodplain with the following important findings:

- All cancer risks and nearly all noncancer HIs from consumption of garden produce and commercial dairy are below the EPA cancer risk range and noncancer hazard benchmark for all scenarios.

- Cancer risks from consumption of backyard and commercial beef and poultry and backyard dairy range from the low end of the risk range to a factor of 40 above the EPA risk range. Noncancer HIs typically exceed the EPA benchmark, except for those associated with an assumed tPCB EPC of 0.5 mg/kg.

- Risks for specific agricultural parcels may vary from predicted values presented in this assessment, depending on differences between assumed and actual tPCB soil concentrations and management practices. However, the results are presented in a format that allows the determination of risk for any parcel.

With respect to the TEQ concentration from dioxin-like PCB, dioxin, and furan congeners associated with the example of an assumed tPCB soil concentration of 2 mg/kg and a fraction of agricultural land in the floodplain equal to 1, the important findings were:

- Total TEQ cancer risk is primarily from dioxin-like PCB congeners, especially PCB-126.

- RME TEQ cancer risks for all commercial animal product scenarios exceed EPA's cancer risk range. The RME TEQ cancer risk also exceeds EPA's risk range for backyard dairy, beef, and egg scenarios. TEQ cancer risks for commercial and backyard produce are within the risk range.

- Milk fat TEQ concentrations predicted for commercial dairy farms are similar to or slightly greater than mean TEQ concentrations measured in the U.S. food supply.

- Predicted TEQ concentrations for commercial beef and poultry and for backyard dairy, beef, and poultry are higher than TEQ concentrations measured in the U.S.

food supply. In part, these differences reflect differences between farm management practices assumed in this assessment and management practices typical of U.S. farms.

- Cancer risks from consumption of agricultural products from the floodplain are likely underestimated by not simultaneously accounting for risk from tPCBs and from TEQ.
- Risks vary approximately linearly with soil tPCB concentration and fraction of agricultural land in the floodplain, and therefore, would be proportionately higher for EPCs greater than 2 and proportionately lower for fractions in the floodplain less than 1.

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 below 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 sediment, 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. 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 1-5a 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. Figure 1-5b presents in more detail the CSM for agricultural product and other terrestrial food exposure pathways.

This report, Agricultural Product Consumption Risk Assessment (Appendix D), 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 B – Phase 2 Direct Contact Risk Assessment (Volumes IIIA and IIIB)–***This report provides risk assessments for all soil and sediment areas in which the PCB concentrations exceeded the screening criteria used in Appendix A. Although all contaminants of potential concern (COPCs) were included in the hazard identification, PCBs and polychlorinated dioxins and furans were retained for evaluation in the Phase 2 report. The exposure scenarios included residential, commercial/industrial, agricultural, and a variety of recreational scenarios. Assumptions regarding current and future expected use patterns, particularly use patterns that would be reasonably expected in the absence of the known contamination, were incorporated into the exposure assessment. Probabilistic exposure analyses of the recreational scenarios are also included.

- ***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.

1.4 OVERVIEW OF AGRICULTURAL PRODUCT CONSUMPTION RISK ASSESSMENT

This assessment of agricultural and other terrestrial food exposures was conducted in accordance with applicable EPA policy and guidance listed in Section 1 of the HHRA. Variations from work proposed in the Supplemental Investigation Work Plan (SIWP) for the site are summarized in Attachment D.1.

The focus of this assessment is on current and potential future food production and gathering activities within the 1-ppm tPCB isopleth of the Housatonic River floodplain. The COPCs are tPCBs, dioxins, and furans. Other contaminants (e.g., pesticides and metals) were screened out of this assessment because they were not detected in floodplain soil at concentrations that are likely to result in agricultural product concentrations associated with significant risk.

In Figure 1-5b, a conceptual site model illustrates potential exposure pathways evaluated in this assessment that link people to site-related contaminants in agricultural products, wild edible plants, home garden produce, and deer meat. The report presents conservative point estimates and probabilistic estimates of potential human health cancer risk and noncancer hazard associated with exposure conditions in the Housatonic River floodplain. These estimates are based on tPCB concentration data for floodplain soil, milk, animal feeds (corn and grass), garden vegetables (squash, beets, and turnips), and wild edible plants (fiddlehead ferns). This assessment also incorporates PCB congener concentration data for animal feed (grass).

An important component of this assessment is the evaluation of commercial dairy cattle operations because this is the most common farming activity in the Housatonic River floodplain. In addition to commercial dairy farms, commercial beef, free-range poultry, sheep, goats, and produce-growing operations are evaluated. Consideration is also given to the homeowner who might keep a small number of backyard animals for food production. Although not strictly an agricultural issue, deer hunting is included in this analysis because exposure and bioaccumulation factors are similar to those applicable to beef. Consumption of wild plants also is evaluated because people harvest fiddlehead ferns and perhaps other wild edible plants from the floodplain.

Individuals might be exposed directly to soil during food production and gathering. These direct contact exposures are evaluated in Appendix B of the HHRA. Cumulative risks from soil and food exposure pathways are discussed in the HHRA. Aquatic food exposure pathways (e.g., fish consumption) are evaluated in Appendix C of the HHRA.

1.5 REPORT ORGANIZATION

The report is organized into the following sections:

- ***Section 2 – Hazard Identification*** – Defines the conceptual site model, including current and potential future agricultural product and other terrestrial food exposure pathways. It includes a description of agricultural product and wild edible plant data collected during the site investigation, including associated floodplain soil samples, and identifies the COPCs that are evaluated in the risk assessment of agricultural products and other terrestrial food exposure pathways.
- ***Section 3 – Dose-Response Assessment*** – Presents the approach to evaluating potential cancer risks and noncancer health effects and presents the toxicity factors that are used for the COPCs identified in Section 2.
- ***Section 4 – Exposure Assessment*** – Presents current and potential future exposure scenarios, the methodology for estimating floodplain soil exposure point concentrations, the methodology for estimating exposure point concentrations in foods, and all exposure parameter values required to calculate contaminant intake for individuals consuming food from the Housatonic River floodplain.
- ***Section 5 – Point Estimate Risk Characterization*** – Integrates the toxicity assessment and the exposure assessment to estimate cancer risk and noncancer hazard for individuals consuming food items from the Housatonic River floodplain.
- ***Section 6 – Probabilistic Risk Characterization –*** Presents the exposure assessment and risk characterization using a probabilistic approach 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 risk assessment results and probabilistic analyses.

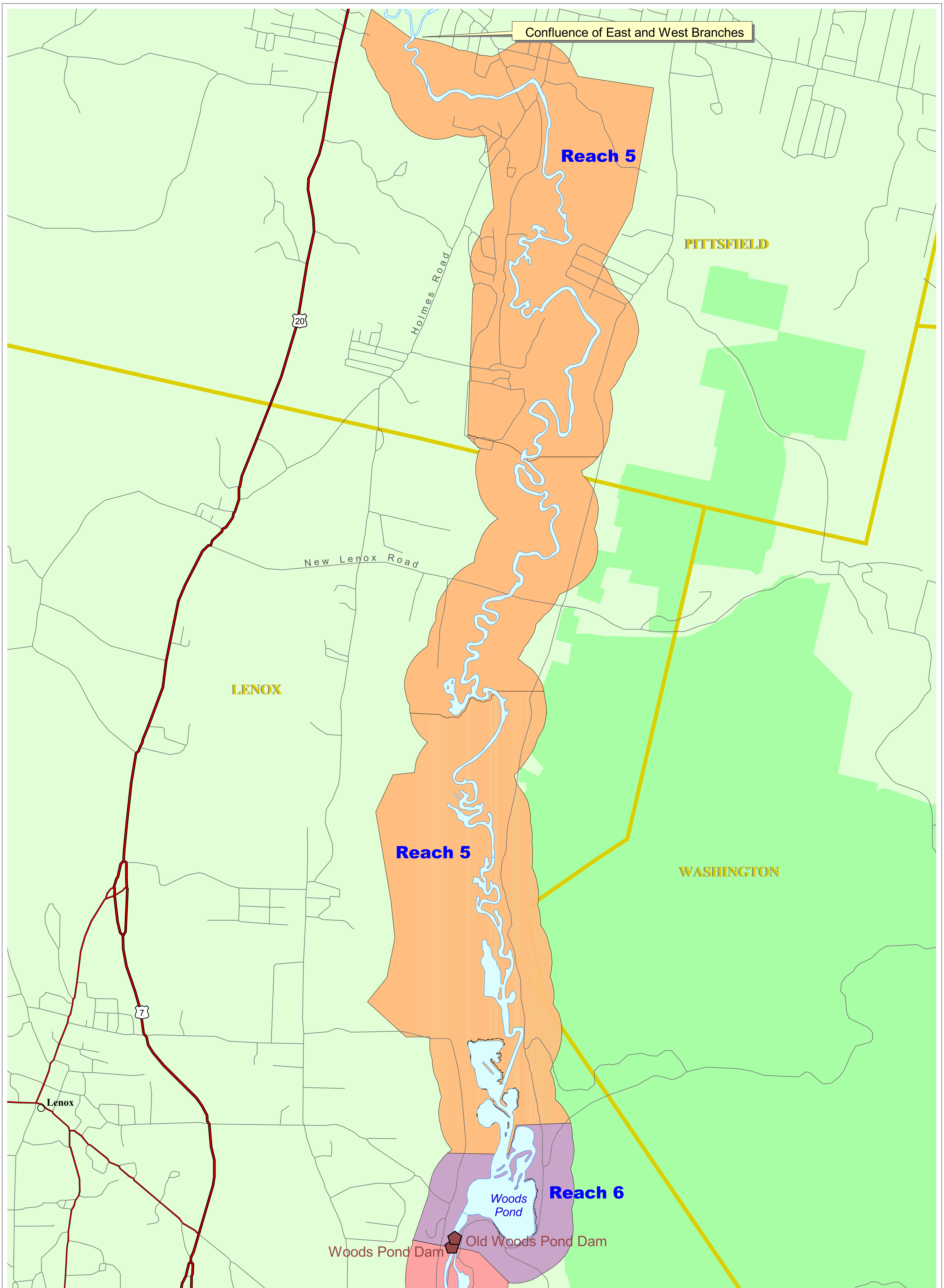
1.6 REFERENCES

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.

SECTION 1

FIGURES



LEGEND:

- Town/City
- Roads
- Housatonic River
- State Park
- Municipal Boundary
- Reach 5
- Reach 6

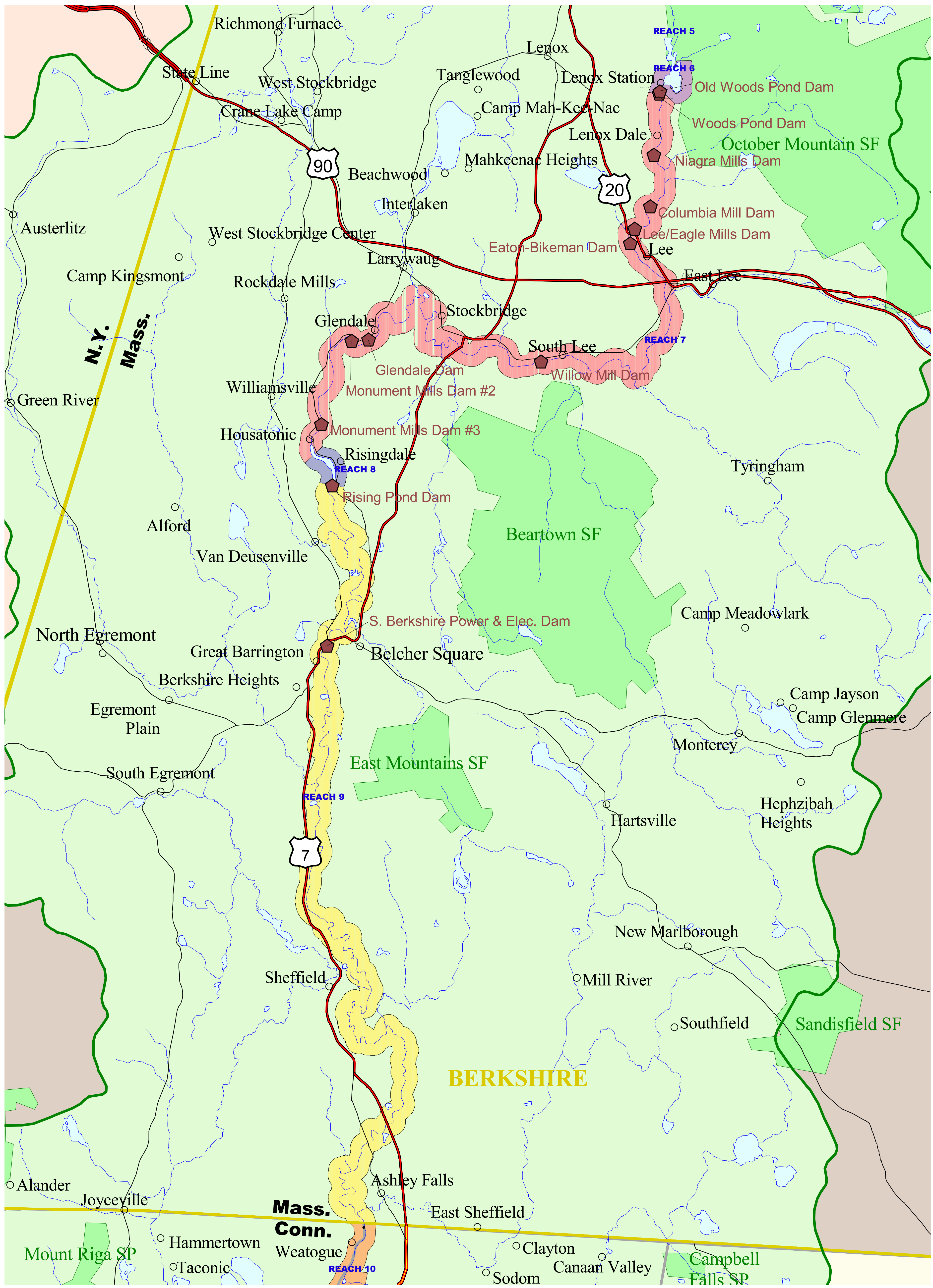
N W E S

0.25 0 0.25 0.5 Miles

1500 0 1500 3000 Feet

Agricultural Product Consumption
Risk Assessment
GE/Housatonic River Site
Rest of River

FIGURE 1-1
REACHES 5 AND 6



LEGEND:

- Town/City
- Dam
- Roads
- Housatonic River
- Housatonic Watershed
- State Park
- County Boundary
- Reach 7
- Reach 8
- Reach 9

N
W E
S

1 0 1 2 Miles

Agricultural Product Consumption
Risk Assessment
GE/Housatonic River Site
Rest of River

FIGURE 1-2
REACHES 7 TO 9

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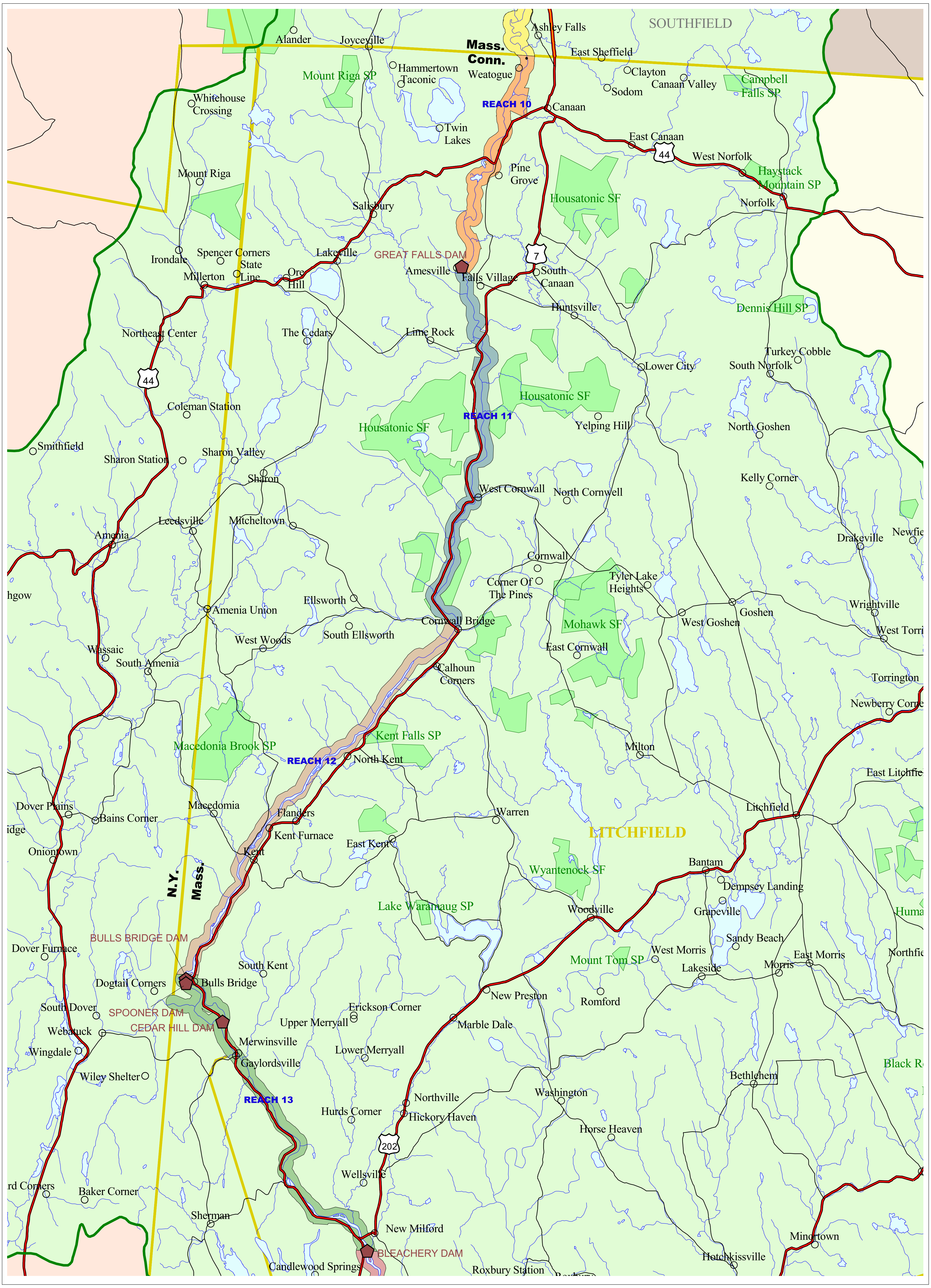

LEGEND:

○	Town/City
⬟	Dam
	Roads
	Housatonic River
	State Park
	County Boundary
	Housatonic Watershed
	Reach 10
	Reach 11
	Reach 12
	Reach 13

N W E S

1 0 1 2 3 4 Miles

Agricultural Product Consumption
Risk Assessment
GE/Housatonic River Site
Rest of River

FIGURE 1-3
REACHES 10 TO 13

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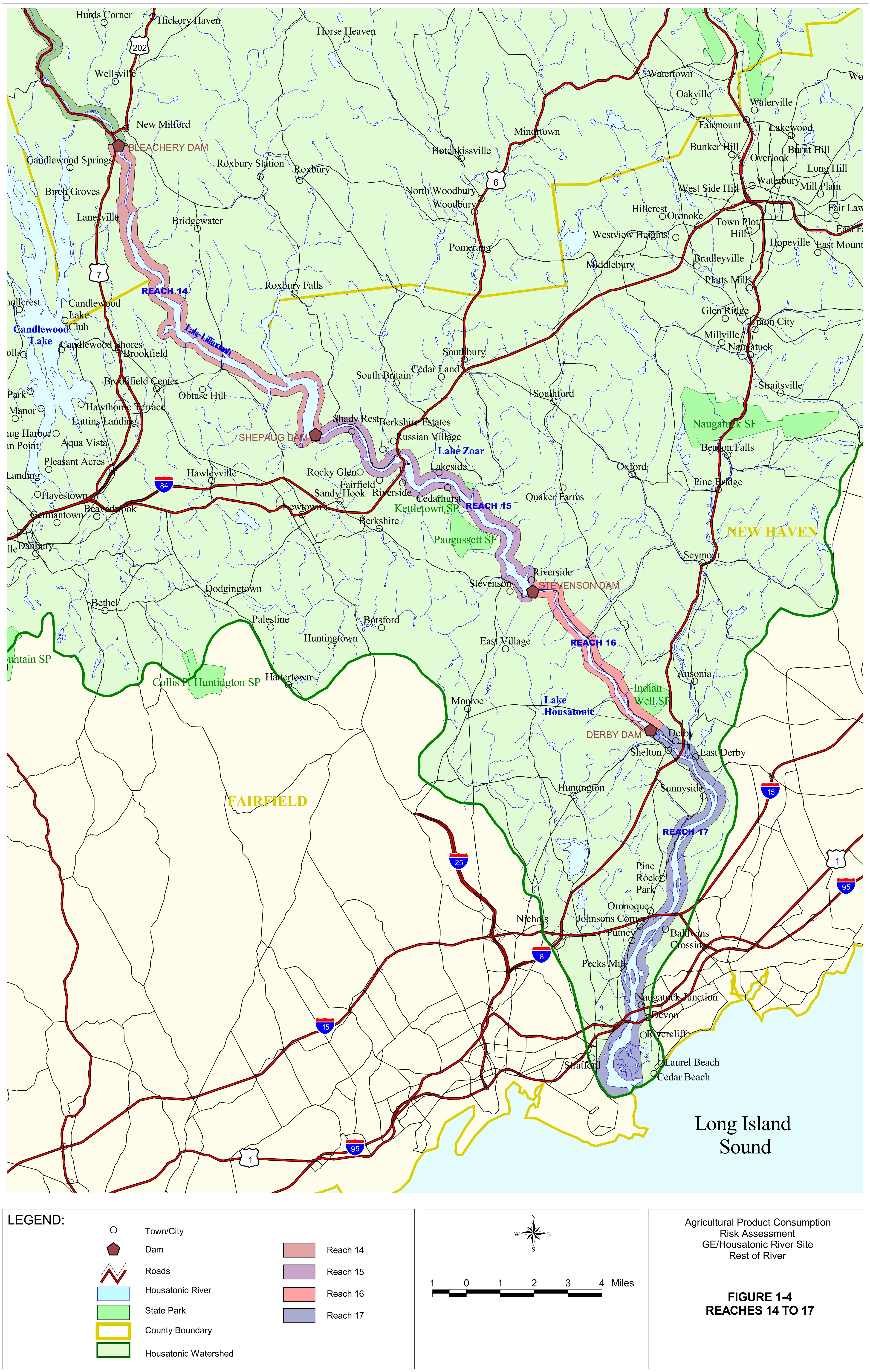

Agricultural Product Consumption
Risk Assessment
GE/Housatonic River Site
Rest of River

FIGURE 1-4
REACHES 14 TO 17

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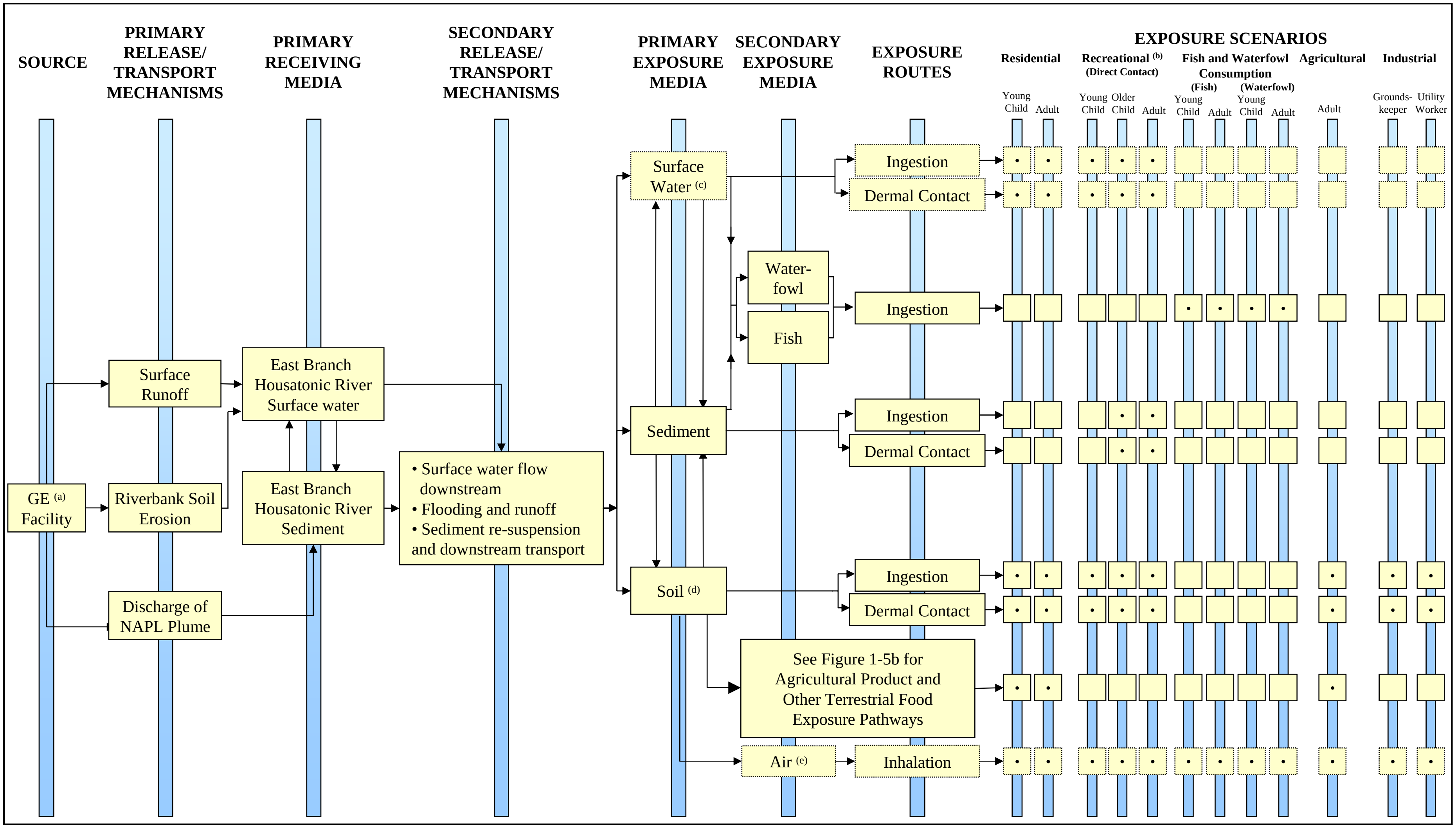

• = Complete exposure pathway

= Incomplete exposure pathway

= Not evaluated quantitatively.

NAPL = nonaqueous phase liquid.

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

(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.

Human Health Risk Assessment
GE/Housatonic River Site
Rest of River

Figure 1-5a

Conceptual Site Model

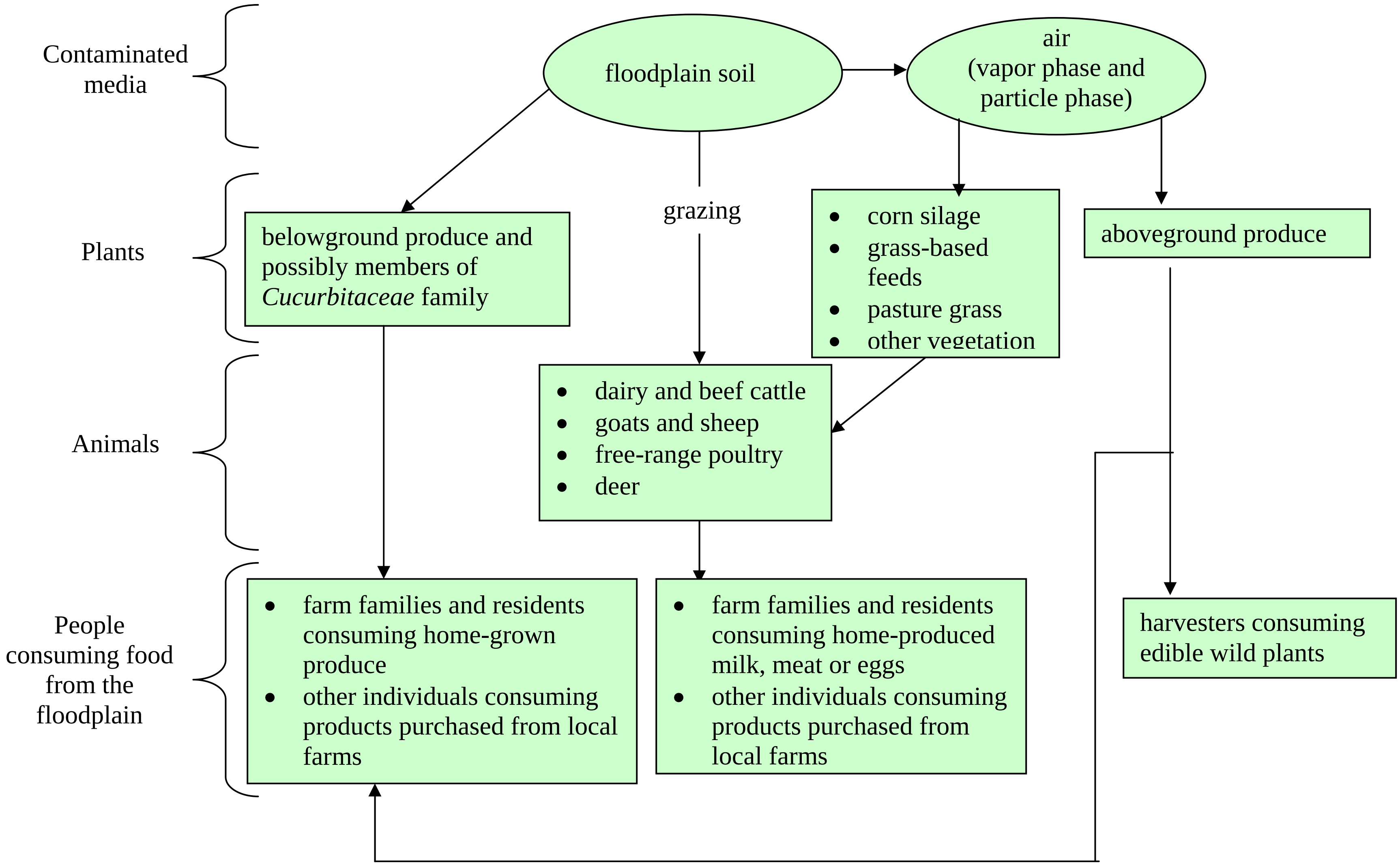

Figure 1-5b
Conceptual Model of Agricultural Product and Other Terrestrial Food Exposure Pathways in the Housatonic River Floodplain

2. HAZARD IDENTIFICATION

This section defines the conceptual model of current and potential future exposure via agricultural product and other food pathways. It also summarizes the process used to select contaminants of potential concern (COPCs). A description of agricultural product and wild edible plant data collected during the site investigation, including associated floodplain soil samples, is also provided.

2.1 CONCEPTUAL SITE MODEL FOR AGRICULTURAL PRODUCT AND OTHER TERRESTRIAL FOOD EXPOSURE PATHWAYS

The conceptual site model for agricultural product and other terrestrial food exposure pathways within the GE/Housatonic River Site, Rest of River, is illustrated in Figure 1-5b. Table 2-1 is a summary of the current and potential future pathways that were evaluated in this assessment. Receptors of concern include individuals who consume foods from local farms or home gardens, deer hunters, and wild plant harvesters.

Persistent organic pollutants such as PCBs, dioxins, and furans accumulate in fat and fat-containing products of animals. Individuals can be exposed to contamination by consuming dairy, meat, or egg products from animals that eat contaminated feed (e.g., corn silage and grass-based feeds) grown in the floodplain or that inadvertently ingest soil while grazing in the floodplain. Lactating dairy cows were not observed grazing in the Housatonic River floodplain, but may be fed corn or hay that was grown in the floodplain. Poultry are fed grain that is not likely to be grown in the floodplain, but portable confinement pens may at times be located in the floodplain, or the birds may not be confined. Thus, soil ingestion, not feed, is the major pathway of poultry exposure.

In theory, animals grazing on pastures with contaminated soil also could be exposed via inhalation of compounds volatilized from the soil and by dermal absorption when lying on contaminated soil. However, these pathways are generally considered insignificant compared to ingestion of soil or plant material (McLachlan, 1993; McLachlan et al., 1990; Thomas et al., 1999).

Animals that have access to the river and use it as a water source could ingest contaminants in river water and sediment. Such access occurs currently on only one commercial dairy farm along Reach 9, where non-lactating dairy cows were observed grazing in the floodplain, and historically on one farm in Reach 5, which is no longer in operation. Lactating dairy cows on all commercial farms in the Rest of River area are confined and do not have access to the river. In addition, existing farms in Reach 5 have buffers between cultivated areas and the river consisting of shrub swamps, transitional floodplain forest, and high terrace floodplain forest. These habitats limit, but would not prevent, animal access to the river if the adjoining cropland were converted to pasture. On a backyard farm along Reach 7, beef cattle were not observed accessing the river. In general, farm animals are not likely to experience significant river sediment and surface water exposures, relative to floodplain soil and feed exposures, if they are provided with an adequate water supply, particularly in the presence of vegetative barriers or steep slopes.

Individuals eating commercial produce, home garden produce, or edible wild plants growing in the floodplain also might be exposed to contamination. However, PCBs, dioxins, and furans do not accumulate in plants to the extent that they accumulate in animal products. Soil-based contamination can deposit on aboveground vegetation (e.g., leaves and fruits) as a result of soil splashing onto plants during rain events. Dust generated by erosion or harvesting activities can adhere to plants. Sorption of vapor-phase contamination to aboveground vegetation also might occur, and soil-bound contaminants can partition to belowground vegetation (e.g., roots and tubers).

2.1.1 Current Exposure Pathways

Information about current agricultural products and other food production practices was compiled from the following sources:

- Interviews with local farmers.
- Aerial photographs.
- Observations by EPA, contractor field personnel, and risk assessors.
- Interviews with staff at the Pittsfield office of the United States Department of Agriculture (USDA) Farm Services Agency.

- Interviews with staff at the Massachusetts Department of Food and Agriculture (MADFA).
- Interviews with regional agricultural groups (e.g., Berkshire Grown) and grocery stores that sell animal products and produce from area farms.
- Information gathered in the Massachusetts Department of Public Health Housatonic River Area Exposure Assessment Study (MDPH, 1997 and 2001).
- United States Census of Agriculture statistics on agricultural trends in Berkshire County.

Table 2-1 contains a list of current agricultural product and other terrestrial food exposure pathways along Housatonic River Reaches 5 through 9. Dairy farming has historically been and continues to be the dominant commercial agricultural activity, although the number of dairy farms decreased between 1974 and 1997 (Holm et al., 2000). Dairy farms grow corn silage and, to a lesser extent, grass-based feed in the floodplain to support their operations.

Locations of current agricultural activities are shown in Figures 2-1a through 2-1j, and the index for these figures (Figure 2-1) defines the river reaches. These figures also show the 1-ppm tPCB isopleth delineated between Pittsfield and Woods Pond, the 100-year floodplain delineated between Woods Pond and the Connecticut border, vegetation sampling locations, and surface soil tPCB concentrations (see Attachment 3 of the HHRA Volume I for a description of these data).

Agricultural activities along Reach 5 include a commercial dairy farm, corn silage production, and hay production. One farmer along Reach 5 grew squash in the floodplain at the beginning of the SI and could grow vegetables in the floodplain again in the future. No agricultural activities were identified along Reach 6. Agricultural activities along Reach 7 are dominated by corn silage production with some hay production, and one residential property with a herd of beef cattle. No agricultural activities were identified along Reach 8. Most of the agricultural acreage along Reach 9 is devoted to commercial dairy farms and corn silage production, followed by commercial production of vegetables and free-range poultry. Corn silage and hay produced along Reaches 5, 7, and 9 are typically used on the farm where they are produced, but they might also be sold to other local farms for use as animal feed. Lactating dairy animals were not observed grazing in the floodplain, but some consume feed crops grown in the floodplain. Non-lactating animals graze in one area along Reach 9. In addition to these commercial agricultural activities, home gardening, edible wild plant harvesting, and deer hunting occur in the floodplain (MDPH, 1997).

Total PCB concentrations measured in current agricultural areas shown in Figures 2-1a through 2-1j are reported by reach and agricultural use in Table 2-2. Concentrations generally decline from Reach 5 to Reach 9. The total acreage and fraction of total acreage within the floodplain across individual agricultural areas are also listed in Table 2-2. These agricultural areas typically do not fall entirely within the 1-ppm tPCB isopleth along Reaches 5 and 6, or the 100-year floodplain along Reaches 7, 8, and 9, but have a wide range of extent of floodplain use. For example, in Reach 9 one corn cultivation area is almost entirely outside of the floodplain, with a fraction of cultivated acreage in the floodplain of 0.004, while another corn cultivation area is entirely within the floodplain with a fraction of 1. Total acreage estimates for individual Reach 9 corn parcels range from 1 to 111 acres.

2.1.1.1 Dairy

One commercial dairy farm ("Farm 2") currently operates between the confluence of the East and West branches of the Housatonic River and Woods Pond (Reach 5). Activities in the floodplain on this farm are limited to corn silage and hay production. A second farm in Reach 5 ("Farm 1") was a dairy operation until the dairy cattle were dispersed around 1999. This farm continues to produce corn silage for sale to nearby farms, which may include dairy operations. Therefore, any floodplain contamination on these farms that affects the corn silage might reach animal products produced on farms entirely outside of the Rest of River if farmers purchase and feed these crops to their animals. Another property along Reach 5 was a dairy farm until taken out of production several years ago (the "DeVos farm"). It is not likely to return to agricultural production under current GE ownership. No dairy farms are located in the area surrounding Woods Pond (Reach 6).

Dairying is the major livestock production activity along Reaches 7 and 9 of the river downstream of the PSA to the Connecticut border (Williams, 2000). No dairying activities were identified along Reach 8 (Rising Pond). One farm along Reach 7 produces and sells a range of dairy products, including milk, cottage cheese, sour cream, and butter. No part of this farm operation appears to be in the floodplain, but it is possible that the dairy cattle are provided with purchased feed grown in floodplain areas. Along Reaches 7 and 9, corn silage is the major crop along with some hayfields. Some of the cornfields may belong to Connecticut farmers who confine and house their cows elsewhere (Williams, 2000). Until recently, one resident along Reach 7 kept Jersey cattle, possibly to produce milk for home consumption (Williams, 2000). Otherwise, no non-commercial dairying activities were identified.

The feeding and management practices on all commercial dairy farms located along the Housatonic River are typical of practices in the Northeast. Lactating cows on all farms are confined to a limited area near the farm buildings outside the floodplain that provides shelter, exercise, and feeding facilities. The lactating cows are not pastured and do not have direct contact with floodplain soil or the river (Williams, 2000; Noble, 2000). Thus, potential contaminant intake by lactating animals in amounts greater than background for the area can only occur via the soil-plant-animal pathway in the form of silage or hay.

Non-lactating animals were pastured on the floodplain along Reach 5 in the past on the former DeVos dairy farm. Non-lactating dairy animals were observed grazing in a floodplain area of Reach 9 (between Rising Pond and the Connecticut border). Grazing in the Housatonic River area can occur for only part of the year because of snow cover, and silage or hay would be used for the remainder of the year. These non-lactating animals include replacement animals, which are young females from weaning to initiation of first lactation at 2+ years of age that are raised to replace animals that are removed from the lactating herd due to old age, illness, reproductive failure, or low production.

The principal components of cow diets are roughages and concentrates. Roughages have a high fiber content and consist primarily of plant leaves and stems. In this assessment, the roughage component of the diet is separated into two classes: corn silage and grass-based feeds that include pasture grass, hay, and grass silage. This division was based on the observation of higher soil-to-grass transfer factors than soil-to-corn transfer factors for tPCBs (Section 4.3.3). Corn silage is the primary roughage used in this area, although there is variability among farms regarding roughage composition of the diet (Williams, 2002).

Concentrates are low in fiber and high in energy, and are composed primarily of grains, a protein source, and mineral supplements. The concentrate portion of the diet is generally imported from sources outside of the area and is not expected to contribute to contaminant transfer from floodplain soil to animal product. One possible exception is a farmer who was reported to produce high-moisture corn, which is corn grain harvested before full maturity and stored in a silo without reducing moisture content. For this assessment, high-moisture corn is assumed to have the same characteristics as normal corn grain. Corn grain is protected from airborne contamination by husks. Thus, the concentrations of contaminants in grain produced in the floodplain should not be greater than background concentrations in corn grain grown elsewhere.

2.1.1.2 Beef

Contaminant accumulation under a given set of grazing and feeding conditions would be similar for non-lactating dairy and beef cattle. The contaminant intake for grazing cattle involves both the soil-grass-animal and the soil-animal pathways.

A small herd of beef cattle graze in the floodplain on a residential parcel along Reach 7, and the animals also might consume hay or silage grown in the floodplain. The owner plans to use the cattle for home consumption. At least one commercial beef producer has been identified in the area, but available information indicates that the animals have no access to floodplain soil and are not offered feeds produced in the floodplain.

Surplus or cull dairy animals are often slaughtered for beef. Cull animals are animals removed from the herd because of low production, which might be caused by factors such as old age, illness, or reproductive failure. Surplus animals are healthy productive animals that are removed from the herd because the total number of animals exceeds the capacity of the farm facilities. This could occur, for example, if more replacements were raised than were required. Surplus animals could also be sold either to another farmer who does not have sufficient replacements in his own herd or for slaughter off the farm.

2.1.1.3 Poultry

One farm along Reach 9 raises free-range chickens for meat (broilers). In this system, small pens are moved to several locations during the growing season. Poultry are fed grains that are not likely to be grown in the floodplain, but portable confinement pens may at times be located in the floodplain (Williams, 2000). Thus, soil ingestion, not feed, is the major pathway of poultry exposure. Information from the farm indicates that the broilers on this farm are raised from April to October.

2.1.1.4 Commercial Produce and Home Gardens

Vegetable crops are produced in the floodplain, including a commercial farm along Reach 9 that sells many different vegetables. One of the farms along Reach 5 formerly grew squash in the floodplain for commercial sale. This farm continues to grow strawberries outside of the floodplain. A local organization, Berkshire Grown, has compiled extensive information about locally produced crops at its website (www.berkshiregrown.org). Some residents living along the river likely maintain home gardens.

2.1.1.5 Deer Hunting

MDPH conducted a study of human exposure to PCBs in the Housatonic River area (MDPH 1997). Out of 1,882 respondents, 94 reported “ever hunting” deer, and these respondents reported the frequency at which they consume venison.

2.1.1.6 Edible Wild Plant Harvesting

In the spring of 1999, EPA field personnel met individuals gathering fiddlehead ferns on the east side of the Housatonic River main stem, just below the confluence, with the intention of selling them in Connecticut. Individuals gathering fiddlehead ferns were also observed during the Housatonic River Floodplain Survey sponsored by GE (TER, 2003).

Fiddlehead ferns represent a growth stage of any fern, when new fronds are tightly coiled. The fiddleheads of *Matteucia struthiopteris*, or ostrich fern, are harvested for human consumption. They appear along the eastern coast of the United States and are available at any single location for approximately 2 weeks. They grow throughout the Housatonic River floodplain and are most prominent from the confluence of the East and West branches of the Housatonic River to New Lenox Road (Haines, 2000). It is possible that members of the local community harvest other edible wild crops as well.

2.1.2 Future Exposure Pathways

Table 2-1 contains a list of potential future agricultural product and other terrestrial food exposure pathways along Housatonic River Reaches 5 through 9. Some agricultural areas shown in Figures 2-1a through 2-1j, such as open land areas and horse pastures, could be used to produce agricultural food products in the future. Home gardening may occur on residential parcels. The tPCB concentrations and fraction of acreage in the floodplain for these areas are listed in Table 2-2, excluding areas that are not suitable for agriculture, such as inundated wetlands and steep banks. Recreational properties, not shown in this table, might also be the site of future agricultural activities, such as community gardens.

Future agricultural trends were identified by:

- Consulting agricultural census statistics for Berkshire County.
- Interviewing farmers, USDA Farm Service Agency staff, regional agricultural groups, and grocery stores that sell animal products and produce from local farms.
- Reviewing provisions of the Massachusetts Wetlands Protection Act and associated regulations regarding permissible land uses within the floodplain.

2.1.2.1 United States Census of Agriculture Statistics for Berkshire County

Holm et al. (2000) reviewed the most recent United States Census of Agriculture statistics for the period of 1974 through 1997. They found that the number of farms in Berkshire County increased during this period, from 305 to 387, but the acreage devoted to agricultural activities decreased from 73,110 acres to 62,833 acres.

Dairy products were the major commodity group from 1974 through 1997, followed by nursery and greenhouse products. During this period, the number of dairy farms and dairy farm sales decreased, while the number of nursery and greenhouse farms and associated sales increased.

The number of farms engaged in direct marketing of agricultural products (e.g., roadside stands, farmers' markets, "pick-your-own" crops, and subscription farms also known as community-supported agriculture) increased from 60 to 90 between the years 1978 and 1997. Holm et al. (2000) describe one case study of a farm that shifted from a wholesale commodity dairy farming operation to a direct sales farm with a farm stand, a bakery, and agri-tourism activities (e.g., petting zoo, tractor rides).

The agricultural census did not include non-commercial backyard farm operations, such as homeowners who keep a dairy cow, a small herd of beef cattle, or flock of chickens. No other systematic survey of trends in such activities was found. During the Peer Review of the June 2003 HHRA, a member of the public noted the existence of backyard farms and reported that these families tend to keep farming-related activities outside the floodplain to avoid contamination. The presence of such activities in the floodplain now, and the public comments, suggest that they can reasonably be anticipated in the future.

2.1.2.2 Interviews Regarding Agricultural Land Use Trends

To identify trends in agricultural land use, EPA supplemented its review of agricultural census data by interviewing farmers, USDA Farm Services Agency staff, regional agricultural interest groups, and grocery stores that sell animal products and produce from local farms.

2.1.2.2.1 Farmers and the USDA Farm Services Agency

Local farmers and the USDA Farm Services Agency were the primary sources for information about current agricultural activities. Some also provided their views on agricultural trends. The Farm Services Agency (personal communication with Arthur Williams, 2000 and 2002) and one local former dairy farmer (Mr. George Noble, 2000) noted the same trends as those described by Holm et al. (2000) regarding dairy operations.

Mr. Paul Tawczynski of Taft Farms in Great Barrington believes that agricultural activities are on the decline, with many new houses in the floodplain where there had been farms. He said that it is very hard for farms to be self-sufficient even at the size of Taft Farms. He noted that farms tend to be smaller, many about ¼ acre, and are run by people who have other jobs and farm because they enjoy it. Taft Farms is an example of a farm that markets products directly to consumers, including produce and free-range poultry. Mr. Tawczynski said he expects Taft Farms to continue its operations in the future.

Ms. Rachel Fletcher, Executive Director of Housatonic River Restoration, Inc., also maintains a grass-fed beef cattle farm, but does not obtain feed from or pasture animals in the Housatonic River floodplain. She noted a "huge demand' for grass-fed beef and said that she cannot keep up with demand for this product, and anticipates that demand will continue to grow. She noted the potential for such future activity in the floodplain, given the promotional activities of Berkshire Grown and the New England Heritage Breeds Conservancy.

2.1.2.2.2 Regional Agricultural Organizations

Berkshire Grown promotes locally produced foods. The organization maintains lists of local farms and restaurants that use products from local farms on its website (www.berkshiregrown.com). Ms. Susan May, a spokesperson for Berkshire Grown, reported that the number of participating restaurants is increasing. Berkshire Grown does not maintain statistics on regional farming practices. However, Ms. May noted a trend toward consumer demand for organic foods and foods with less pesticides and herbicides.

The Heritage Breeds Conservancy promotes preservation and breeding of historic breeds of sheep, swine, and cattle among local farms, with the goal of improving the genetic fitness of these breeds. The Conservancy answers questions from local farmers about animal and farm-management practices. A related organization, the New England Livestock Alliance, promotes grass-based agriculture in the New England area, focusing on small to medium farms, with the goal of raising beef cattle and sheep on pastures rather than in pens. The Alliance buys grass-fed animals at a premium and sells them for human consumption. Mr. Ken Kleinpeter, Executive Director, reported that they cannot keep up with demand for grass-fed cattle. He thinks that floodplain land is "excellent" for such pastures because pastures are less likely to erode than tilled cultivated areas. He noted a shift from commodity-based agriculture (e.g., commercial dairy and grain) to small-scale specialty farms and expects this trend to continue because of the affluence and education level of the local population, which is interested in locally produced foods.

The Sheffield Land Trust is interested in protecting farmland, wildlife, and scenery. According to spokesperson, Ms. Kathy Orlando, they do "all they can" to support local farms. The Trust sponsors an agricultural internship program with a local high school and is trying to integrate agriculture into high school curricula (e.g., science, economics, and culinary arts classes). She described the four large dairy operations in Sheffield that are "still going strong." She also described a 247-acre farm that produces pumpkins and corn. She said that some farms use floodplain area even though their farms are outside of the floodplain. For example, one Sheffield dairy farmer uses corn that is grown in the floodplain. She did not know if any beef farmers use crops from the floodplain. The Trust does not maintain statistics on local farming practices. However, Ms. Orlando said that people are trying to "tap into" niche markets. She provided one example of a farmer who grows and directly sells mesclun mixes. She said that there is growing interest in community-supported agriculture and that farmers' markets are "taking off."

2.1.2.2.3 Grocery Stores Selling Local Agricultural Products

Guido's Fresh Marketplace in Pittsfield and Great Barrington sells the entire line of milk and cheese products from a local dairy farm year-round. Because these products come from Jersey cows, the fat content is higher than products from Holstein and many other cattle breeds.

Guido's also stocks a variety of locally grown products, including baby lettuce, greens, corn, tomatoes, and fruits. These products are stocked seasonally as they become available. Ms. Kyle Hartley of the produce department noted that customers are more aware of organic foods and are interested in supporting local farms by purchasing locally produced foods.

Berkshire Coop Market in Great Barrington also "does its best" to support local growers by stocking local products that sell well, including a variety of dairy products and produce. Mike Saber, store manager, did not know the percentage of sales from locally grown/raised products.

2.1.2.3 Massachusetts Wetlands Protection Act Restrictions on Land Use in the Floodplain

The Massachusetts Wetlands Protection Act (WPA, 310 CMR 10.00) restricts some activities in wetland resource areas, including floodplains and the "riverfront area." The "riverfront area" is "that area of land situated between a river's mean annual high-water line and a parallel line located two hundred feet away, measured outward horizontally from the river's mean annual high-water line." However, the definition of riverfront area does not include any area beyond 100 ft of a river's mean annual high water in which agricultural land use or aquacultural use occurs.

The preface to the WPA regulations makes it clear that the WPA should not interfere with or further limit ongoing agricultural activity in the state:

> "The Legislature has recognized the value of preserving agriculture in Massachusetts by including in the Wetlands Protection Act exemptions for normal maintenance and improvement of land in agricultural use, including cropland and pastureland."

Agriculture is defined (310 CMR 10.04) broadly to include raising of animals and plants of virtually any kind, whether edible or not; forest products; maintenance and improvement of structures; and improvements to ancillary "structures" such as access roads, sand pits, water transport facilities, etc. Agricultural land may also lie inactive for as long as 5 years before it loses that distinction under the WPA. The preface to the WPA regulations indicates that "Expanded or new agricultural activities, because they can result in new, temporary, or permanent impacts to wetlands, should be subject to review to ensure that they are conducted in the most environmentally sound manner possible" [310 CMR 10.58(2)(a)(3)(c)]. Therefore, the WPA does not restrict ongoing agricultural uses (i.e., current uses) within the floodplain, and it does not necessarily exclude expanded or new agricultural activities.

2.1.2.4 Summary of Potential Future Agricultural Activities In the Housatonic River Floodplain

Current commercial and backyard farming activities, deer hunting, home gardening, and wild plant harvesting are assumed to continue in the future. In addition, small-scale commercial beef production can be reasonably envisioned on some farms if dairying is discontinued in the future.

The Northeast is a high-cost area for animal production systems that require feeding high levels of concentrate because of the cost of importing feed grains from other areas. Dairy production has functioned in this area to some extent because the Northeastern Milk Marketing Order administered by the United States Department of Agriculture has provided an advantage to local producers. These regulatory advantages are not available for other animal products. Thus, for competitive reasons, future changes to large-scale production systems comparable to the beef, pork, and poultry operations in the Midwest and South are unlikely. Any change in animal production that involves beef, poultry, sheep, or goats would likely fall into one of two categories. The first, production of special niche products such as free-range poultry and organic beef might be economically viable in the Housatonic River area because of the ability to command higher prices based on local demographics. The other possibility is the non-commercial backyard farm where a few animals, or a small flock of hens, are used to produce products for home consumption. Such a backyard farm with a small herd of beef cattle already exists along Reach 7. Future backyard animals could occur on any property that has the acreage required to provide adequate housing, exercise, and feeding facilities for animals.

2.2 CONTAMINANTS OF POTENTIAL CONCERN

The methods and results of the COPC selection process are presented in detail in the Direct Contact Risk Assessment (Appendix B of the HHRA). Only a brief summary of the selection process is provided in this section, along with additional analysis of contaminants that might bioaccumulate in agricultural food chains.

2.2.1 COPC Screening

Soil throughout the floodplain from the confluence to and including Woods Pond (Reaches 5 and 6) was sampled for tPCBs (analyzed as the sum of Aroclors). Approximately 10% of the PCB samples were also analyzed for dioxins/furans, PCB congeners, and/or a modified list of Appendix IX compounds. Total PCBs and PCB congeners were selected as COPCs given the history of release of PCBs from the facility, the level of PCB contamination throughout the study area, and the results of the Phase 1 screening. Dioxins and furans were also selected as COPCs based on levels of contamination, site-wide occurrence, and the association of these compounds, particularly furans, with environmental mixtures of PCBs including those analyzed from the facility. Therefore, PCBs, dioxins, and furans were selected as COPCs.

Most floodplain locations were sampled at two soil depths: 0 to 6 inches (0 to 15 cm) and 6 to 12 inches (15 to 30 cm). A comparison of the results for tPCBs by soil depth indicated little difference between depths. For the purposes of COPC selection, the results of these analyses for the two soil depths were combined, producing a single combined set of results for soil between 0 to 12 inches (0 to 30 cm) depth.

The results of the analyses were summarized for all detected contaminants in soil samples (0 to 1 ft), including the frequency of detection and range of detected concentrations (HHRA Volume IIA). The values were then compared with the most recent EPA Region 9 residential soil preliminary remediation goal (PRG) for each contaminant (EPA, 2002) available at the time the screening was performed, and the number of detected samples that exceeded the PRG for each contaminant was determined. The PRGs were based on either a cancer risk of 1E-06 or a hazard index of 0.1.

The following COPCs were not eliminated based on the initial screen of less than 10% frequency of detection and no exceedance of PRGs: 4,4'-DDE, 4,4'-DDT, several polycyclic aromatic hydrocarbons (PAHs), arsenic, and thallium. However, arsenic was not detected above site-specific background, and thallium was not detected above site-specific background or generic background concentrations determined by the Massachusetts Department of Environmental Protection (MDEP). Thus, arsenic and thallium do not appear to be site-related. Potential risks from these inorganic contaminants were not quantitatively assessed.

PAH concentrations exceeded the MDEP generic background concentration for PAHs in soil (2 mg/kg) at only six locations throughout the site. PAHs, therefore, are not considered a sitewide contaminant. Thus, potential risks from exposure to PAHs were not quantitatively evaluated.

4,4'-DDE and 4,4'-DDT were eliminated as COPCs based on the following considerations:

- 4,4'-DDE – low frequency of detection (12/110 samples, or approximately 11%); low frequency of PRG exceedance (2/110 samples, or less than 2%); and very low degree of exceedance (maximum detected concentration to PRG ratio of 1.2).

- 4,4'-DDT – low frequency of detection (10/85 samples, or 12%); low frequency of PRG exceedance (3/85 samples, or approximately 3.5%); and very low degree of exceedance (maximum detected concentration to PRG ratio of 1.6).

2.2.2 Additional COPC Screening for Agricultural Exposure Pathways

Although not designed to be protective for agricultural food chain exposure pathways, the residential PRGs used to screen COPCs for Direct Contact exposure pathways are likely to be sufficient for those classes of Appendix IX contaminants that do not bioaccumulate because of rapid excretion or metabolic degradation. Based on these criteria and professional judgment, semivolatile organic compounds (SVOCs), PAHs, metals, and some pesticide/herbicides can be screened using residential PRGs.

The residential PRGs may not be adequate for persistent lipophilic compounds, such as chlorinated pesticides, that would bioaccumulate in animal tissues and products. However, chlorinated pesticides were infrequently detected in Housatonic River floodplain soil and at low concentrations except for three non-agricultural parcels with elevated 4,4-DDE and 4,4-DDT concentrations (maximum concentrations of 2 mg/kg and 2.8 mg/kg, respectively). Excluding these three parcels, maximum detected concentrations for all pesticides fell below residential PRGs by at least a factor of 8 with one exception. The maximum concentration of endrin aldehyde was a factor of 2.6 less than the residential PRG; however, this pesticide was detected only once in 101 samples. Thus, all chlorinated pesticides were eliminated from consideration in the agricultural assessment. PCBs, dioxins, and furans were retained as COPCs for agricultural product and other terrestrial food exposure pathways. The primary COPCs are PCBs, specifically Aroclor 1260 and, to a lesser extent, Aroclor 1254.

2.3 ANIMAL PRODUCT AND VEGETATION DATA FROM THE HOUSATONIC RIVER FLOODPLAIN

This section summarizes PCB concentration data for animal product and vegetation samples collected from the floodplain. Data were available for three agricultural products (acorn squash, corn grown for silage, and milk), one edible wild plant (fiddlehead ferns), and grass. Milk samples were collected in 1993, and all other samples were collected between 1998 and 2001. With the exception of four milk samples, all agricultural samples were collected along Reach 5 upstream from Woods Pond.

2.3.1 Data Useability and Validation

Data useability is the process of ensuring that the quality of the data is appropriate for the intended uses and satisfies the data quality objectives (DQOs) established for sampling and analysis. DQOs are qualitative and quantitative statements that specify the quality of data required to support decisions during remedial response activities, and are derived from the concept that the end uses of the data should determine the type and quantity of data to be collected. DQOs for this project are specified in the Final Quality Assurance Project Plan (QAPP) (WESTON, 1998, updated 2003) and in the SIWP (WESTON, 2000). Data validation was completed in compliance with applicable EPA guidance (WESTON, 1998, updated 2003). Also, historical data were subjected to an extensive data quality review, as described in Attachment 8 of HHRA Volume I.

With the exception of milk data and MDEP fiddlehead fern data, all data types collected as part of the Housatonic River Rest of River study were validated by EPA. Details of the analytical procedures are described in the QAPP (WESTON, 1998, updated 2003), and analytical methods are summarized in Attachment 7 of HHRA Volume I. Laboratory records are not available for milk samples analyzed by USFDA. Through interviews, it was determined that the laboratory used the USFDA *Pesticide Analytical Manual* to analyze the milk samples. The results of these interviews are described in Section 2.3.2.2.

2.3.2 Milk Data

In 1993, the Massachusetts Department of Food and Agriculture (MADFA) and the U.S. Food and Drug Administration (USFDA) collected bulk tank milk samples from active dairy farms in the Housatonic River Basin from Pittsfield to the Connecticut border and analyzed them for tPCBs. Table 2-3 includes a summary of the farms that were sampled and dairy-related activities occurring in the floodplain of each farm at the time of sampling.

This 1993 sampling program was prompted by "renewed interest on the part of the Department of Environmental Protection and the Department of Public Health to determine the P.C.B. [*sic*] status of the Housatonic river basin and the foods produced by agricultural enterprises in the area" (Sheldon, 1993). This concern arose from elevated concentrations of PCBs detected in whole milk samples collected in the early 1970s from the DeVos farm in Lenox, Massachusetts along Reach 5 (Connecticut Agricultural Experiment Station, 1970a,b,c,d,e; New England Milk Producers' Association, 1970). These data are subject to some uncertainty because there is limited documentation of the milk sampling procedures and of farm management practices in the early 1970s. The data are described in detail in Attachment D.2, where measured milk concentration data are compared with predicted milk concentrations from this assessment.

2.3.2.1 Sampling

MADFA collected bulk milk samples on April 20, 1993, from seven dairy farms. One MADFA staff person reported that cows were not "pasturing" at the time of sampling (Thayer, 2000). Of the seven dairy farms, three are no longer dairy farming and one farm is reportedly not in the floodplain (Williams, 2000). MADFA planned to collect a milk sample from an eighth farm in Sheffield, but no milk was left in the bulk milk tank when MADFA staff arrived at the farm.

2.3.2.2 Laboratory Analysis and Results

The USFDA Winchester Engineering and Analytical Center (WEAC) laboratory analyzed all samples. WEAC did not detect PCBs or organochlorine pesticide in any samples (Table 2-3), but available records do not indicate the analytical method or detection limit (Finkelson, 1993). USFDA's Records Division shreds records that are 5 or more years old (Finkelson, 2000). MADFA's records do not include information about the analytical method (Hines, 2000). The only analytical record available for these samples is a letter from the USFDA laboratory to the Massachusetts Department of Public Health Division of Food and Drugs (Finkelson, 1993). In this letter, USFDA reports the concentration of "PCBs" in each sample as "none." Therefore, a USFDA analytical chemist knowledgeable about USFDA analytical practices in 1993, Charles Parfitt, was consulted to obtain information about the analytical practices typically used at the time.

According to Mr. Parfitt (2000), USFDA would have followed some variation of the fatty foods analytical procedure described in the *Pesticide Analytical Manual* (USFDA, 1990). Section 105 of this manual describes the procedure for calculating limits of quantitation (LOQ). Assuming the laboratory followed standard laboratory procedures for 1993, Mr. Parfitt said the LOQ would have been ≤ 10 μg/L on a whole milk basis, with a limit of detection (LOD) ≤ 5 μg/L. He explained that these are the highest LOD and LOQ values that might be expected, given the variations in analytical methods that might have been used by WEAC.

The 1993 sampling program represents a snapshot of milk concentrations. It is possible that dairy cows were consuming corn silage near the time of sampling, but this could not be confirmed.

2.3.3 Corn Data

Corn samples (*Zea mays*) were collected from the two Reach 5 farms. These corn samples were from crops used for corn silage. Tables 2-4 and 2-5 include tPCB results from these sampling efforts, and sampling locations are shown in Figures 2-1b and 2-1c.

2.3.3.1 Sampling

October 1998—On October 27 and 28, 1998, samples of corn being grown for silage were collected from a former dairy farm along Reach 5 (Farm 1), which continues to produce silage for sale to local farmers. Samples were not washed prior to analysis.

September 1999—On September 13 and 20, 1999, corn samples being grown for corn silage were collected from a dairy farm along Reach 5 (Farm 2). Two samples were collected from each of four areas with PCB-contaminated soil, and two samples were collected from a reference area. Samples were not washed prior to analysis.

2.3.3.2 Laboratory Analysis and Results

For corn samples collected in 1998, separate semidry samples of kernels and cobs were submitted for analysis. Results were reported on a dry weight basis (Table 2-4). All corn and corresponding soil concentrations were below detection limits; however, many of these samples were inadvertently collected from areas outside the 1-ppm isopleth.

For corn samples collected in 1999, the corn cobs (i.e., husked ears) and corn stalks were analyzed separately using the California Department of Food and Agriculture (CDFA) multiresidue extraction procedure and EPA SW-846 Method 8082 (Aroclor analysis). PCB patterns in samples most closely resembled Aroclor 1260. Results were reported on a wet weight (ww) basis (Table 2-5). Tier II validation was performed on the corn cob and corn stalk samples.

2.3.4 Squash

Squash (*Cucurbita pepo*) was grown in the floodplain on one of the Reach 5 farms (Farm 1) and could be grown again in the future. In September 1999, four acorn squash samples were collected from a squash field on this farm. Total PCB results are presented in Table 2-6, and sampling locations are shown in Figures 2-1a and 2-1b. The squash field was subsequently replanted with corn.

2.3.4.1 Sampling

Three squash samples were collected from portions of the squash field within the floodplain, and one squash sample was collected from a portion of the squash field outside the floodplain. Squash samples were not washed prior to delivery to the analytical laboratory.

2.3.4.2 Laboratory Analysis and Results

All squash samples were analyzed by EPA SW-846 Method 8082. Samples were not washed prior to analysis. Percent solids were determined for each sample, and PCB concentration data were reported on a dry weight basis. Tier II data validation was performed on all squash data.

Some data were rejected due to low percent solids (Table 2-6). However, PCBs were detected in some squash samples; however, these detected concentrations may be biased low because of the low percent solids.

A definitive conclusion cannot be made regarding the transport mechanism for PCBs in squash because the squash were not washed prior to analysis. It is possible that the flesh and seed/pulp fractions were contaminated with PCBs on the surface or “peel” of the squash in the process of slicing the squash. However, the data do provide concentration data, albeit with a potentially low bias, applicable to an exposure scenario involving people who do not wash squash prior to consuming the vegetable.

2.3.5 Fiddlehead Fern Data

Fiddlehead fern samples were collected in 1999 and 2000. Because all 1999 fiddlehead fern data were rejected due to low percent solids, a second round of sampling was conducted in the spring of 2000. Table 2-7 includes a summary of results from this second round of fern sampling, and sampling locations are shown in Figures 2-1a through 2-1c.

2.3.5.1 Sampling

May 1999—On May 14, 1999, three composite fiddlehead fern samples were collected from three locations (Figure 2-1a through 2-1d). These three areas were chosen to represent high, medium, and low levels of PCB contamination in the soil. Areas with PCB soil concentrations generally less than 1 mg/kg were not sampled. The papery-brown scales were removed before putting ferns in a plastic bag. Otherwise, the ferns were not rinsed or cleaned.

May 2000—On May 9 and 11, 2000, fiddlehead fern samples and co-located surface soil samples were collected from the three 1999 sampling locations and one reference area.

At each sampling location, field personnel filled three 1-liter amber jars with fiddlehead fern tissue. Fiddleheads were plucked off the fern stem by hand. Soil (0- to 6-inch depth) was collected from three different areas at the sampling location (the same area where ferns were sampled) and mixed in a stainless steel bowl before transferring to jars.

Field duplicate samples (one additional jar of ferns and one additional soil sample) were collected at VG000011. All sampling locations were flagged so that the exact sampling location could be located and recorded using GPS. After collection, samples were placed on ice in a cooler until reaching the field office in Pittsfield, where samples were placed under refrigeration.

2.3.5.2 Laboratory Analysis and Results

Fern samples collected in 1999 were analyzed for PCBs using EPA SW-846 Method 8082. Sulfur cleanup was performed using EPA Method 3660B, and a Tier II validation was performed. No PCBs were detected; however, all data were rejected due to low percent solids (i.e., 12.9 to 13.4% solids).

Fern samples collected in 2000 were analyzed for PCB homolog groups (i.e., monochlorinated biphenyls, dichlorinated biphenyls, etc.) using EPA Method 680. Laboratory personnel split samples from each location into two aliquots and rinsed one aliquot from each location. All samples were then put in frozen storage at the lab. Tier II validation was performed on all fern data and corresponding soil samples, and the results are summarized in Table 2-7. Some fiddlehead samples were assigned "J" or "UJ" qualifiers because surrogate standard recovery criteria were not met. Matrix spike recoveries for ferns were below the lower control limit.

2.3.5.3 MDEP Fern Study

Table 2-8 includes results from a 1995 study of fiddlehead ferns growing in the Housatonic River floodplain conducted by MDEP (Potter, 1995). In the MDEP study, PCB concentrations were measured in composite fern samples (15 ferns each) that were collected by cutting heads from the plants and storing them on ice for transport to the laboratory. Corresponding soil samples (n=24) were collected from the same location.

PCBs were detected in all soil samples from the floodplain at concentrations ranging from 26.7 to 108 mg/kg (dry weight), and the chromatograms most closely resembled the profile for Aroclor 1260. Potter (1995) also collected soil samples from "control" areas, defined as areas not impacted by known PCB contamination. PCBs were not detected in these control samples. For these samples, Potter reports a practical quantitation limit (PQL) of 0.05 mg/kg (dry weight). PCB concentrations exceeded the method PQL in only one fern sample (0.06 mg/kg dw). Fourteen other fern samples had chromatographic profiles, indicating PCBs present below the method PQL. Concentrations ranged from 0.05 to 0.06 mg/kg (dry weight).

Potter (1995) notes that "Although the fiddleheads themselves were not extensively rinsed following harvesting, the different congener profiles noted between the corresponding soil and fern samples suggests that the fern PCB contamination is not due to soil carryover but may be due to direct uptake and/or indirect deposition of volatilized PCBs on the plant surfaces."

2.3.6 Grass Data

Dairy and beef cattle may be exposed to contamination when they ingest contaminated soil during grazing or when they ingest grass, hay, and corn grown in contaminated soil. Grass data were collected to provide site-specific soil-to-plant transfer factors for the pasture, hay, and grass silage components of animal diets. Currently, there are no cattle pastures with elevated PCB concentrations in the floodplain, so grass samples were collected from a former Reach 5 dairy farm cattle pasture.

Reed canary grass (*Phalaris arundinacea*) and co-located soil samples were collected from the floodplain to estimate transfer of PCB, dioxin, and furan congeners from soil to grass. This information was used for estimating transfer rates in grass harvested as hay or grass silage or consumed by grazing animals. Grass concentrations also provide verification for the estimated transfer factors for corn silage, which is the most important feed currently grown in the floodplain. Grass can be expected to have a higher contaminant concentration than corn silage relative to soil because it has a higher surface area to mass ratio than corn. For the less volatile PCB congeners, variability of congener concentrations among different grass species is expected to be relatively low, perhaps less than a factor of 4 (Bohme et al., 1999).

Table 2-9 shows tPCB results from the grass and soil analysis, and sampling locations are shown in Figure 2-1c. Tables 2-10a and 2-10b provide summary statistics for grass and soil samples, respectively.

2.3.6.1 Sampling

Ten pairs of pasture grass and soil samples were collected from the former dairy farm in Reach 5 in early July 2001 when hay harvesting typically occurs. Samples were collected from areas known to have relatively high PCB concentrations to avoid obtaining many results below detection limits so that plant-to-soil concentration ratios could be calculated. Sampling was not conducted during or immediately following a heavy rain or very elevated air temperatures.

Grass samples consisted of 80 to 100 g, excluding dead and decaying material from a previous season. Samples were collected from dense stands of grass that were 4 to 5 ft (1.2 to 1.5 m) in height in areas where recent inundation with floodwaters was evident. Grass was cut to within about 3 inches (8 cm) of the ground to simulate grazing patterns. Soil samples were collected from the top 3 inches in the immediate vicinity of the grass sample. Grass samples were not washed prior to laboratory analysis.

2.3.6.2 Laboratory Analysis and Results

PCB congeners in soil and grass were analyzed using gas chromatography/electron capture detection (GC/ECD, GERG SOP 9810), including a charcoal:silica cleanup step (GERG SOP 9811) for better quantification of PCB congeners PCB-77, PCB-81, PCB-126, and PCB-169. One hundred and twenty-five PCB congeners, including the dioxin-like congeners, were quantified. There were numerous co-eluting pairs and triplets among the PCB congeners.

Table 2-9 shows tPCB results from the grass and soil analysis. Tables 2-10a and 2-10b provide summary statistics for grass and soil samples, respectively. With the exception of octochlorodibenzo-*p*-dioxin (OCDD), no dioxins or furans were detected in grass, but detection limits were high. Seventy-six PCB congeners were detected in all grass and soil samples. The two most toxic dioxin-like PCB congeners (PCB-126 and PCB-169) were detected frequently in soil (9/10 and 10/10, respectively) and grass (6/10 and 9/10, respectively).

2.3.7 Other Site-Related Data Regarding PCBs in Vegetable Crops

Sawhney and Hankin (1984) conducted a field study of PCB transfer to plants by growing crops in soil amended with Woods Pond sediment. The crops included:

- Beets (*Beta vulgaris*) – leaves and roots (May to October) harvested and washed with warm water and brushed to remove adhering soil particles.
- Turnips (*Brassica rapa*) – leaves harvested three times during season; roots (peeled and unpeeled).
- Snap Beans (*Phaseolus vulgaris*) – leaves, stems, pods, seeds.

Woods Pond sediment (756 L at about 30% solids) was poured on the surface of a 2-m by 2-m soil plot isolated in the field by wooden boards inserted in the ground. When the plot appeared dry, the top 15 cm was mixed and the vegetables planted. Unlike samples collected by EPA in the Housatonic area, all vegetable samples were washed with warm water while scrubbing with a brush prior to laboratory analysis.

Table 2-11 summarizes concentrations of Aroclors 1248, 1254, and 1260 in soil and corresponding plants. Plant-to-soil concentration ratios were highest for Aroclor 1248, followed by Aroclor 1254 and then Aroclor 1260. This result is not surprising given that volatility and solubility decrease with increasing chlorination of the PCB mixture. Therefore, lighter (less-chlorinated) PCB mixtures are generally more mobile than heavier PCB mixtures.

Similar to Iwata et al. (1974) and other studies, concentrations in unpeeled turnips exceeded concentrations in peeled turnips (>90% of Aroclor 1248 and Aroclor 1260 removed with peeling; >60% of 1254 removed with peeling).

Beans and turnips were planted in the same soil during the next season. Concentrations of Aroclor 1260 in turnip leaves were greater in the second season than in the first, but soil concentration data were not available for the second season. Assuming turnip roots were not peeled in the first season, the concentration of Aroclor 1260 in turnip root also was greater in the second season than the first. While PCBs are relatively persistent, the study provided no details regarding treatment of soil between seasons or other information that could reveal how concentrations and bioavailability of PCBs might have changed over this time. The authors reported one soil concentration and one plant concentration for each crop. Without replicates, it was not possible to determine what part of the variation observed in study results, including between seasons, could be attributable to measurement error.

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SECTION 2

TABLES

Table 2-1

Current and Potential Future Agricultural Product and Other Terrestrial Food Exposure Pathways in the Housatonic River Floodplain

Agricultural Product or Other Terrestrial Food	Exposure Pathways[1] (within the 1-ppm tPCB isopleth along Reaches 5 and 6 or within the 100-year floodplain along Reaches 7, 8, and 9)	Scenario	
		Current	Future
Commercial Activities			
Dairy cattle: milk and/or beef (surplus or cull dairy animals)[2]	animal consumption of corn silage[3]	Reaches 5 and 9[4]	Reaches 5, 7, 9
	animal consumption of grass-based feeds[3]	Reach 5	Reaches 5, 7, 9
	grazing (non-lactating animals): pasture grass consumption and incidental soil ingestion	Reach 9	Reaches 5, 7, 9
Beef cattle: meat	animal consumption of corn silage[3]	none observed	Reaches 5, 7, 9
	animal consumption of grass-based feeds[3]	none observed	Reaches 5, 7, 9
	grazing: pasture grass consumption and incidental soil ingestion	none observed	Reaches 5, 7, 9
Free-range poultry: meat and eggs	incidental soil ingestion by animals	Reach 9	Reaches 5, 7, 9
Goats: milk	animal consumption of grass-based feeds[3]	none observed	Reaches 5, 7, 9
	grazing: pasture grass consumption and incidental soil ingestion	none observed	Reaches 5, 7, 9
Sheep: lamb's meat	animal consumption of grass-based feeds[3]	none observed	Reaches 5, 7, 9
	grazing: pasture grass consumption and incidental soil ingestion	none observed	Reaches 5, 7, 9
Produce: home garden on commercial farm	consumed directly by people	Reach 9	Reaches 5, 7, 9
Non-Commercial Activities			
Dairy cattle: milk and/or beef (cull animals)[2]	animal consumption of grass-based feeds	none observed	Reaches 5, 7, 9
	grazing (lactating animals): pasture grass consumption and incidental soil ingestion	none observed	Reaches 5, 7, 9
Beef cattle: meat	animal consumption of grass-based feeds	none observed	Reaches 5, 7, 9
	grazing: pasture grass consumption and incidental soil ingestion	Reach 7	Reaches 5, 7, 9
Free-range poultry: meat and eggs	incidental soil ingestion by animals	none observed	Reaches 5, 7, 9
Goats: milk	animal consumption of grass-based feeds	none observed	Reaches 5, 7, 9
	grazing: pasture grass consumption and incidental soil ingestion	none observed	Reaches 5, 7, 9
Sheep: lamb's meat	animal consumption of grass-based feeds	none observed	Reaches 5, 7, 9
	grazing: pasture grass consumption and incidental soil ingestion	none observed	Reaches 5, 7, 9
Produce: home garden	consumed directly by people	Reach 7	Reaches 5, 7, 9
Deer hunting: meat	feeding: grasses, browse[5], forbs[5], and incidental soil ingestion	all reaches	all reaches
Wild edible plant harvesting: e.g., fiddlehead ferns	consumed directly by people	Reach 5	all reaches

Notes:

[1] Some animals consume grains, fruits and/or nuts, but these items are excluded from the compilation of exposure pathways because negligible concentrations of PCBs, dioxins, and furans are expected in these plant parts. Hulls or husks protect them from atmospheric deposition or sorption of contaminants, and PCBs, dioxins, and furans are not effectively translocated from root systems to aboveground plant parts.

[2] Surplus or cull dairy animals could be slaughtered for beef. Cull animals are animals removed from the herd because of low production, which might be caused by factors such as old age, illness, or reproductive failure. Surplus animals are healthy productive animals that are removed from the herd because the total number of animals exceeds the capacity of farm facilities. This could occur, for example, if more replacements were raised than were required.

[3] Corn silage and grass-based feeds are produced in the floodplain along Reaches 5, 7, and 9, typically on the farm where they are used. However, these feeds also might be sold to other local farms for use as animal feed.

[4] A commercial dairy farm along Reach 7 might feed dairy cattle corn silage that is grown in the floodplain.

[5] Browse: leaves and shoots of woody plants; forbs: broad-leafed weeds and flowering plants.

Table 2-2

Current and Potential Future Agricultural Areas:
Total Acreage, Fraction of Acreage within the Floodplain, and Total PCB Concentrations in Soil (0-6 inches)[1]

	Reach 5			Reach 7			Reach 9		
	Total PCBs mg/kg, dw	*Fraction of acreage within floodplain*	*Total Acreage*	*Total PCBs mg/kg, dw*	*Fraction of acreage within floodplain*	*Total Acreage*	*Total PCBs mg/kg, dw*	*Fraction of acreage within floodplain*	*Total Acreage*
Current Agricultural Areas									
Commercial Farming Activities									
Corn or Corn Silage	see Dairy Farms			0.5 U to 3.02	0.61 to 1.0	0.74 to 32	0.503 U to 0.32	0.004 to 1	1.0 to 111
Hay	see Dairy Farms			0.019 U to 0.712 U	0.07 to 1.0	6.0 to 17	0.314 J to 0.605	0.83 to 1	2.4 to 111
Dairy Farms[2]									
Farm 1 - former dairy farm)									
Corn silage (sells corn silage to local farmers)	1.2	0.12	90.3	-	-	-	-	-	-
Hay (horse feed)	no data; <1 ppm nearby	0.00016	12.9	-	-	-	-	-	-
Farm 2 - current dairy farm									
Corn silage (uses on farm)	22	0.13	30.6	-	-	-	-	-	-
Hay (uses on farm)	21	0.12	24.2	-	-	-	-	-	-
Non-lactating dairy cattle grazing	-	-	-	-	-	-	0.503 U to 0.801	1	7.5 to 8.9
Free-Range Poultry	-	-	-	-	-	-	no data; U to <2 ppm nearby	0.95	67
Produce: Fruits and Vegetables	-	-	-	-	-	-	0.131 U to 0.42	0.27 to 1	7.0 to 67
Backyard Farming Activities									
Beef (grazing)	-	-	-	1.68 to 2.2	0.85	9.6	-	-	-
Potential Future Agricultural Areas									
Sod field	-	-	-	-	-	-	0.036 U to 0.37 [3]	1	11
Open land/not in use/unknown	-	-	-	no data; U to <10 ppm nearby	0.67 to 1	3.2 to 22	no data; U nearby	0.03 to 1	6.1 to 20
Horse/Horse Pasture	-	-	-	no data; U to <10 ppm nearby	1	5	no data; U nearby	0.03 to 0.8	11 to 21
Residential – high contact [4]	ND - 133	0.06 to 0.94	0.23 - 7.9	ND - 32	0.04 to 1	0.24 - 16	0.6 [5]	[5]	[5]

Notes

[1] Total acreage represents the total contiguous acreage devoted to each category of agricultural use. Along Reach 5, fractions of agricultural areas within the 1-ppm tPCB isopleth are reported. Along Reaches 7 and 9, fractions of agricultural areas within the 100-year floodplain are reported. Total PCB concentrations are ranges of detected concentrations, or EPCs where available, across all areas devoted to each category of agricultural use.

[2] Farm-specific information.

[3] Gates, R.W. February 3, 2000. Letter from Richard W. Gates of General Electric Company to Ms. J. Lyn Cutler of the Massachusetts Department of Environmental Protection regarding soil sampling results for the Sheffield Sod Farm in Sheffield, Massachusetts.

[4] Residential information for Reach 5 includes some Reach 6 parcels, and information for Reach 7 includes some Reach 8 parcels. All information is from the Phase I Direct Contact Report (HHRA Volume 2).

[5] Total PCB concentration is an EPC that is based on 194 samples and 11 duplicate samples of 0-1 ft floodplain soil in Reach 9 that are not limited to residential parcels.

"U" = results were below analytical detection limits.

"-" = Activity not observed along this river reach.

Table 2-3

Summary of 1993 MADFA Milk Sampling Program

Dairy Farm Locations[1]	Activities in Floodplain at Time of Sampling (as Reported by Farmer)[2]	Milk Sample Collected in 1993?[4]	PCBs Detected?[5]	Continues to Dairy Farm?[6]
Pittsfield Farm 1	• corn grown for silage • heifers pastured	yes	no	no
Pittsfield Farm 2	• corn grown for silage • heifers pastured • milking animals exercise lot?[3]	yes	no	yes
Sheffield Farm 1	• corn grown for silage • heifers and dry cows pastured	yes	no	yes
Sheffield Farm 2	• no information provided	no	NA	no
Sheffield Farm 3	• no information provided	no	NA	yes
Sheffield Farm 4	• no activities reported	yes	no	yes
Sheffield Farm 5	• corn and hay grown for silage • heifers and dry cows pastured • milking animals exercise lot? [3]	yes	no	no
Ashley Falls Farm 1	• corn and hay grown for silage • heifers and dry cows pastured • milking animals exercise lot? [3]	yes	no	yes
Ashley Falls Farm 2	• corn and hay grown for silage • heifers and dry cows pastured • milking animals exercise lot? [3]	yes	no	no

[1] Massachusetts Department of Food and Agriculture (MADFA) planned to sample all of these farms, but did not sample Sheffield Farm 2 and Sheffield Farm 3.
[2] Activities documented on MADFA forms completed by farmers at the time of sampling.
[3] Farmer reported that the exercise lot was not in the floodplain but that it flooded each spring.
[4] MADFA, 1993 (Sampling certification form).
[5] Finkelson, 1993.
[6] Williams, Noble, Cermak, Hines, 2000, personal communication.
NA = not analyzed

Table 2-4

PCB Concentrations in Corn Cobs, Corn Kernels, and Corresponding Soil Samples Collected from Farm 1

October 1998 Corn Samples		Associated Soil Samples	
Location Identification	**PCB Concentration[1] (mg/kg, semidry weight)[2]**	**Location Identification**	**PCB Concentration[1] (mg/kg, dry weight)**
Floodplain			
VG000001	0.026 U	SL000648	0.628 U
		SL000649	0.622 U
		SL000650	0.637 U
VG000002	0.026 U	SL000651	0.596 / 0.605 U[3]
		SL000652	0.623 U
		SL000653	0.606 U
VG000003	0.024 U / 0.024 U[3]	SL000654	0.605 U
		SL000655	0.611 U
		SL000656	0.61 U
Non-floodplain			
VG000004	0.027 U	SL000657	0.598 U
		SL000658	0.598 U
		SL000659	0.585 U
VG000005	0.026 U	SL000660	0.578 U
		SL000661	0.59 U
		SL000662	0.578 U
VG000006	0.03 U	SL000664	0.557 U
		SL000665	0.551 U
		SL000666	0.553 U
VG000007	0.023 U	SL000667	0.561 U
		SL000668	0.565 U
		SL000669	0.563 U
VG000008	0.026 U	SL000673	0.57 U
		SL000674	0.567 U
		SL000675	0.561 U
VG000009	0.028 U	SL000670	0.564 / 0.566 U[3]
		SL000671	0.568 U
		SL000672	0.571 U

[1] Quantified as Aroclor 1260.
[2] Corn reported as semidry weight.
[3] Duplicate sample results.
U = not detected.

Table 2-5

PCB Concentrations in Corn Cobs, Corn Stalks, and Corresponding Soil Samples Collected from Farm 2

September 1999 Corn Samples			Associated Soil Samples[1]	
Location Identification		**PCB Concentration[2] (mg/kg, wet weight)**	**Location Identification**	**PCB Concentration[2] (mg/kg, dry weight)**
VG000017	E	0.057 U	FL000859	15.6
	S	0.067 U	FL000881	18.3
VG000018	E	0.057 U	FL000859	15.6
	S	0.067 U	FL000881	18.3
VG000019	E	0.057 U	FL000860	5.46
	S	0.0103 J	FL000882	5.9
VG000020	E	0.057 U	FL000860	5.46
	S	0.067 U	FL000882	5.9
VG000021	E	0.057 U	FL000861	31.6
	S	0.0104 J	FL000883	41.6
VG000022	E	0.057 U	FL000861	31.6
	S	0.015 J	FL000883	41.6
VG000023	E	0.057 U	FL000862	36.6
	S	0.024 J	FL000884	38.6
VG000024	E	0.057 U	FL000862	36.6
	S	0.018 J	FL000884	38.6
Reference Area				
VG000025	E	0.057 U	FL000885	0.503 U
	S	0.067 U	FL000885	0.503 U
VG000026	E	0.057 U	FL000885	0.503 U
	S	0.067 U	FL000885	0.503 U

[1] Samples taken at the shallowest sample depth (0 to 6 inches).
[2] Quantified as Aroclor 1260.
J = Estimated concentration.
U = Not detected.
E = Ear.
S = Stalk and leaf material.

Table 2-6

PCB Concentrations in Acorn Squash from Farm 1

September 1999 Squash Samples					Associated Soil Samples		
		PCB Concentration[1]				PCB Concentration[1]	
Location Identification		**mg/kg, dry weight**	**mg/kg, wet weight**		**Location Identification**	**mg/kg, dry weight**	
Floodplain							
VG000014	F	1.400	0.13	R	FL000856	0.501	U
	W	1.100	0.099	J	FL000856	0.501	U
VG000015	F	0.740	0.058	J	FL000857	4.130	
	P	0.740	0.072	J	FL000857	4.130	
	W	0.980	0.112	J	FL000857	4.130	
VG000016	F	0.550	0.040	J	FL000858	3.720	
	W	1.200	0.124	J	FL000858	3.720	
Reference Area							
VG000013	F	0.170	0.016	UJ	FL000855	0.399	J
	W	0.120	0.017	R	FL000855	0.399	J

[1]Quantified as Aroclor 1260.
U = Not detected.
J = Estimated.
UJ = Not detected/estimated detection limit.
R = Rejected.
W = Whole squash.
F = Flesh portion of squash only (outside rind and inside pulp/seed removed).
P = Pulp and seed mass of squash.

Table 2-7

PCB Concentrations in Fiddlehead Ferns Collected in 2000

Fiddlehead Fern Samples				Associated Soil Samples	
Location Identification		PCB Concentration[1] (mg/kg)		Location Identification	PCB Concentration[1] (mg/kg)
		Dry Weight	Wet Weight		Dry Weight
Floodplain					
VG000010	UW[2]	ND	ND	FL001450	8.03[c]
	W[3]	ND	ND		
VG000011	UW[4]	ND / ND[a]	ND / ND[a]	FL001448	21[d] / 22[a,d]
	W	0.015[b] / 0.069[a,c]	0.0019[b] / 0.0083[a,c]		
VG000012	UW[5]	ND	ND	FL001449	6.0[c]
	W[6]	ND	ND		
Reference Area					
VG000027	UW[7]	ND	ND	FL001451	0.14[c]
	W[8]	ND	ND		

[1] Quantified as the sum of homologs.

[2] Homolog detection limit range is 0.004-0.020 mg/kg.
[3] Homolog detection limit range is 0.004-0.021 mg/kg.
[4] Homolog detection limit range is 0.004-0.018 mg/kg.
[5] Homolog detection limit range is 0.004-0.021 mg/kg.
[6] Homolog detection limit range is 0.004-0.020 mg/kg.
[7] Homolog detection limit range is 0.004-0.021 mg/kg.
[8] Homolog detection limit range is 0.005-0.025 mg/kg.
[a] Duplicate sample results
[b] Hexachlorinated biphenyls detected in sample.
[c] Penta- and hexachlorinated biphenyls detected in sample.
[d] Tetra-, penta-, hexa-, hepta-, octa- and nonachlorinated biphenyls detected in sample.
W = washed sample.
UW = unwashed sample.
ND = not detected.

Table 2-8

PCB Concentrations in Fiddlehead Ferns Collected by MDEP in 1995

Fiddlehead Ferns PCB Concentration[1] (mg/kg, wet weight)	Associated Soil Samples PCB Concentration (mg/kg, dry weight)	Fern-to-Soil Ratio (ww/dw)
Floodplain		
0.00525	156.8	0.00003
0.00435	61.3	0.0001
0.00519	43.6	0.0001
0.00559	66.3	0.0001
0.00119	29	0.00004
0.00106	26.7	0.00004
NA	65.8	NA
0.00555	71.6	0.0001
0.00337	73.4	0.00005
0.00582	94.7	0.0001
0.00483	52.5	0.0001
0.00471	48.1	0.0001
0.00828	42.9	0.0002
0.01526	108	0.0001
0.00228	37.9	0.0001
NA	47.8	NA
0.00124	56.5	0.00002
NA	51.5	NA
0.00364	63.6	0.0001
0.00251	76.6	0.00003
0.00377	NA	NA
0.01564	NA	NA
0.00259	64.9	0.00004
Reference Areas		
0.00425	0.05 U	NA
NA	0.05 U	NA
0.00635	0.05 U	NA
0.00222	0.05 U	NA
0.00523	0.05 U	NA
0.00084	0.05 U	NA
0.00034	0.05 U	NA

[1] Quantified as the sum of homologs.
NA = not available.
U = not detected.
MDEP = Massachusetts Department of Environmental Protection.
Source: Potter (1995).

Table 2-9

PCB Concentrations in Grass and Corresponding Soil Samples from a Former Reach 5 Dairy Farm

July 2001 Grass Samples		Associated Soil Samples	
Location Identification	**tPCB Concentration (mg/kg, wet weight)**	**Location Identification**	**tPCB Concentration (mg/kg, dry weight)**
VG000028	0.112	FL001799	11.3
VG000029	0.136	FL001800	21.3
VG000030	0.109	FL001801	14.5
VG000031	0.131 / 0.0945 [1]	FL001802	2.87 / 4.62 [1]
VG000032	0.105	FL001803	6.77
VG000033	0.118	FL001804	15.0
VG000034	0.060	FL001805	7.73
VG000035	0.100	FL001806	7.39
VG000036	0.109	FL001807	11.7
VG000037	0.051	FL001808	16.0

[1] Field duplicate sample results

Table 2-10a

Summary Statistics for Grass Data Collected During Grass Study

Analyte	Detection Frequency	Minimum Concentration		Median Concentration	Mean Concentration	Maximum Concentration		Minimum TEQ		Median TEQ	Mean TEQ	Maximum TEQ	
Dioxins/Furans (pg/g, ww)													
1,2,3,4,6,7,8-HPCDD	0/10	2.3	U	NC	NC	2.5	U	0.023	U	NC	NC	0.025	U
1,2,3,4,6,7,8-HPCDF	0/10	2.3	U	NC	NC	2.5	U	0.023	U	NC	NC	0.025	U
1,2,3,4,7,8,9-HPCDF	0/10	2.3	U	NC	NC	2.5	U	0.023	U	NC	NC	0.025	U
1,2,3,4,7,8-HXCDD	0/10	2.3	U	NC	NC	2.5	U	0.23	U	NC	NC	0.25	U
1,2,3,4,7,8-HXCDF	0/10	2.3	U	NC	NC	2.5	U	0.23	U	NC	NC	0.25	U
1,2,3,6,7,8-HXCDD	0/10	2.3	U	NC	NC	2.5	U	0.23	U	NC	NC	0.25	U
1,2,3,6,7,8-HXCDF	0/10	2.3	U	NC	NC	2.5	U	0.23	U	NC	NC	0.25	U
1,2,3,7,8,9-HXCDD	0/10	2.3	U	NC	NC	2.5	U	0.23	U	NC	NC	0.25	U
1,2,3,7,8,9-HXCDF	0/10	2.3	U	NC	NC	2.5	U	0.23	U	NC	NC	0.25	U
1,2,3,7,8-PECDD	0/10	2.3	U	NC	NC	2.5	U	2.3	U	NC	NC	2.5	U
1,2,3,7,8-PECDF	0/10	2.3	U	NC	NC	2.5	U	0.115	U	NC	NC	0.125	U
2,3,4,6,7,8-HXCDF	0/10	2.3	U	NC	NC	2.5	U	0.23	U	NC	NC	0.25	U
2,3,4,7,8-PECDF	0/10	2.3	U	NC	NC	2.5	U	1.15	U	NC	NC	1.25	U
2,3,7,8-TCDD	0/10	0.5	U	NC	NC	0.5	U	0.5	U	NC	NC	0.5	U
2,3,7,8-TCDF	0/10	0.5	U	NC	NC	0.5	U	0.05	U	NC	NC	0.05	U
OCDD	2/10	2.3		2.45	2.53	3.4	U	0.00023		0.000245	0.000253	0.00034	U
OCDF	0/10	4.7	U	NC	NC	5	U	0.00047	U	NC	NC	0.0005	U
Organic													
PERCENT LIPIDS (GC) (%, ww)	10/10	0.6		0.95	0.965	1.5		NA		NA	NA	NA	
PERCENT LIPIDS (GC/MS) (%, ww)	10/10	0.6		0.95	0.965	1.5		NA		NA	NA	NA	
PCB Congeners (ng/g, ww)													
PCB-1	0/10	0.0048	U	NC	NC	0.005	U	NA	U	NA	NA	NA	U
PCB-101/90	8/10	4.18		4.58	4.11	5.72		NA		NA	NA	NA	
PCB-105	10/10	0.299		0.527	0.524	0.643		0.0000299		0.0000527	0.0000524	0.0000643	
PCB-107	4/10	0.33		0.155	0.231	0.399		NA		NA	NA	NA	
PCB-110	10/10	1.68		3.36	3.13	4.12		NA		NA	NA	NA	
PCB-114	0/10	0.0048	U	NC	NC	0.005	U	0.0000024	U	NC	NC	0.0000025	U
PCB-118	9/10	0.949		1.56	1.44	1.94		0.0000949		0.000156	0.000144	0.000194	
PCB-119	10/10	0.642		0.848	0.814	0.921		NA		NA	NA	NA	
PCB-126	6/10	0.018		0.0185	0.0182	0.051		0.0018		0.00185	0.00182	0.0051	
PCB-128	10/10	0.404		0.792	0.768	1.02		NA		NA	NA	NA	
PCB-129	10/10	0.125		0.282	0.264	0.344		NA		NA	NA	NA	
PCB-130	10/10	0.14		0.232	0.216	0.254		NA		NA	NA	NA	
PCB-135	10/10	1.05		1.98	1.87	2.47		NA		NA	NA	NA	
PCB-136	10/10	0.614		1.14	1.1	1.43		NA		NA	NA	NA	
PCB-138/160	10/10	3.42		8.48	7.9	11.6		NA		NA	NA	NA	
PCB-141/179	10/10	1.24		2.72	2.47	3.42		NA		NA	NA	NA	
PCB-146	10/10	0.862		1.88	1.8	2.39		NA		NA	NA	NA	
PCB-149/123	10/10	3.19		6.89	6.48	8.58		0.000319		0.000689	0.000648	0.000858	
PCB-15	0/10	0.0048	U	NC	NC	0.005	U	NA	U	NA	NA	NA	U
PCB-151	10/10	1.79		3.57	3.31	4.26		NA		NA	NA	NA	
PCB-153/132	10/10	5.52		14	12.9	17.5		NA		NA	NA	NA	
PCB-156	10/10	0.179		0.43	0.431	0.701		0.0000895		0.000215	0.0002155	0.0003505	

Table 2-10a

Summary Statistics for Grass Data Collected During Grass Study

Analyte	Detection Frequency	Minimum Concentration	Median Concentration	Mean Concentration	Maximum Concentration	Minimum TEQ	Median TEQ	Mean TEQ	Maximum TEQ
PCB-158	9/10	0.522	1.01	0.932	1.35	NA	NA	NA	NA
PCB-16/32	7/10	0.0395	0.0585	0.0461	0.081	NA	NA	NA	NA
PCB-166	10/10	0.042	0.0623	0.0645	0.126	NA	NA	NA	NA
PCB-167	10/10	0.103	0.369	0.328	0.451	0.00000103	0.00000369	0.00000328	0.00000451
PCB-169	9/10	0.018	0.035	0.0433	0.112	0.00018	0.00035	0.000433	0.00112
PCB-170/190	10/10	0.913	2.16	2.15	3.6	NA	NA	NA	NA
PCB-171/202	10/10	0.358	0.884	0.847	1.18	NA	NA	NA	NA
PCB-172	10/10	0.203	0.494	0.47	0.695	NA	NA	NA	NA
PCB-174	10/10	0.924	2.1	2.02	2.81	NA	NA	NA	NA
PCB-175	1/10	0.281	0.126	0.132	0.281	NA	NA	NA	NA
PCB-176/137	10/10	0.127	0.449	0.442	0.661	NA	NA	NA	NA
PCB-177	10/10	0.671	1.46	1.36	1.91	NA	NA	NA	NA
PCB-178	10/10	0.309	0.721	0.673	0.913	NA	NA	NA	NA
PCB-18/17	10/10	0.177	0.264	0.247	0.293	NA	NA	NA	NA
PCB-180	10/10	2.13	5.45	5.11	7.77	NA	NA	NA	NA
PCB-183	10/10	0.637	1.55	1.46	2.05	NA	NA	NA	NA
PCB-185	10/10	0.192	0.413	0.394	0.544	NA	NA	NA	NA
PCB-187	10/10	1.58	3.8	3.59	5	NA	NA	NA	NA
PCB-189	10/10	0.109	0.161	0.152	0.179	0.0000109	0.0000161	0.0000152	0.0000179
PCB-191	10/10	0.08	0.142	0.157	0.292	NA	NA	NA	NA
PCB-193	10/10	0.124	0.311	0.31	0.507	NA	NA	NA	NA
PCB-194	10/10	0.268	0.803	0.742	1.19	NA	NA	NA	NA
PCB-195/208	10/10	0.141	0.405	0.391	0.615	NA	NA	NA	NA
PCB-197	9/10	0.06	0.114	0.107	0.159	NA	NA	NA	NA
PCB-199	10/10	0.378	0.929	0.898	1.36	NA	NA	NA	NA
PCB-200	10/10	0.031	0.0995	0.0962	0.179	NA	NA	NA	NA
PCB-201/157/173	10/10	0.221	0.363	0.346	0.404	0.0001105	0.0001815	0.000173	0.000202
PCB-203/196	10/10	0.404	1.1	1.04	1.6	NA	NA	NA	NA
PCB-205	6/10	0.024	0.029	0.0253	0.055	NA	NA	NA	NA
PCB-206	9/10	0.081	0.186	0.168	0.278	NA	NA	NA	NA
PCB-207	9/10	0.01	0.024	0.0231	0.04	NA	NA	NA	NA
PCB-209	0/10	0.0048 U	NC	NC	0.005 U	NA U	NA	NA	NA U
PCB-22/51	10/10	0.09	0.146	0.143	0.179	NA	NA	NA	NA
PCB-24/27	10/10	0.4	0.535	0.522	0.623	NA	NA	NA	NA

Table 2-10a

Summary Statistics for Grass Data Collected During Grass Study

Analyte	Detection Frequency	Minimum Concentration	Median Concentration	Mean Concentration	Maximum Concentration	Minimum TEQ	Median TEQ	Mean TEQ	Maximum TEQ
PCB-25	1/10	0.375	0.0898	0.121	0.375	NA	NA	NA	NA
PCB-26	10/10	0.445	0.598	0.604	0.916	NA	NA	NA	NA
PCB-28	6/10	0.226	0.235	0.188	0.327	NA	NA	NA	NA
PCB-29	10/10	0.05	0.09	0.094	0.135	NA	NA	NA	NA
PCB-30	0/10	0.0048 U	NC	NC	0.005 U	NA U	NA	NA	NA U
PCB-31	10/10	0.012	0.095	0.0847	0.121	NA	NA	NA	NA
PCB-33/20	0/10	0.0048 U	NC	NC	0.005 U	NA U	NA	NA	NA U
PCB-39	0/10	0.0048 U	NC	NC	0.005 U	NA U	NA	NA	NA U
PCB-40	10/10	0.039	0.062	0.07	0.132	NA	NA	NA	NA
PCB-41/64	9/10	0.064	0.125	0.12	0.184	NA	NA	NA	NA
PCB-42/59/37	0/10	0.12 U	NC	NC	0.0049 U	NA U	NA	NA	NA U
PCB-44	10/10	0.263	0.394	0.4	0.523	NA	NA	NA	NA
PCB-45	2/10	0.039	0.00245	0.0131	0.072	NA	NA	NA	NA
PCB-46	0/10	0.225 U	NC	NC	0.005 U	NA U	NA	NA	NA U
PCB-47/75	10/10	1.37	3.47	3.25	4.69	NA	NA	NA	NA
PCB-48	0/10	0.0048 U	NC	NC	0.005 U	NA U	NA	NA	NA U
PCB-49	10/10	0.817	1.7	1.68	2.35	NA	NA	NA	NA
PCB-52	10/10	0.803	1.43	1.39	1.77	NA	NA	NA	NA
PCB-53	10/10	0.407	0.651	0.658	0.964	NA	NA	NA	NA
PCB-56/60	9/10	0.277	0.32	0.299	0.397	NA	NA	NA	NA
PCB-63	0/10	0.0048 U	NC	NC	0.005 U	NA U	NA	NA	NA U
PCB-66	10/10	0.209	0.429	0.412	0.548	NA	NA	NA	NA
PCB-67	10/10	0.401	0.94	0.878	1.23	NA	NA	NA	NA
PCB-69	4/10	1.33	0.00248	0.587	1.66	NA	NA	NA	NA
PCB-7/9	0/10	0.0048 U	NC	NC	0.005 U	NA U	NA	NA	NA U
PCB-70	2/10	0.923	0.393	0.483	1.2	NA	NA	NA	NA
PCB-72	0/10	0.0048 U	NC	NC	0.005 U	NA U	NA	NA	NA U
PCB-74/61	10/10	0.067	0.138	0.136	0.202	NA	NA	NA	NA
PCB-77	10/10	0.006	0.0385	0.0364	0.065	0.0000006	0.00000385	0.00000364	0.0000065
PCB-8/5	10/10	0.579	0.666	0.716	0.913	NA	NA	NA	NA
PCB-81	0/10	0.002 U	NC	NC	0.124 U	0.0000002 U	NC	NC	0.0000124 U
PCB-82	10/10	0.109	0.192	0.186	0.264	NA	NA	NA	NA
PCB-83	10/10	0.356	0.46	0.445	0.525	NA	NA	NA	NA
PCB-84	9/10	0.243	0.422	0.384	0.564	NA	NA	NA	NA
PCB-85	10/10	0.244	0.541	0.502	0.648	NA	NA	NA	NA
PCB-87/115	10/10	1.66	2.2	2.19	2.65	NA	NA	NA	NA
PCB-91/55	10/10	0.729	1.44	1.37	1.81	NA	NA	NA	NA
PCB-92	10/10	0.867	1.46	1.4	1.68	NA	NA	NA	NA
PCB-95/80	8/10	2.62	2.96	2.67	3.82	NA	NA	NA	NA
PCB-97	10/10	0.326	0.616	0.617	0.861	NA	NA	NA	NA
PCB-99	10/10	0.825	1.7	1.62	2.11	NA	NA	NA	NA
TOTAL DCB	0/10	4.8 U	NC	NC	5 U	NA U	NA	NA	NA U
TOTAL DICB	10/10	0.6	0.65	0.705	0.9	NA	NA	NA	NA
TOTAL HPCB	10/10	8.5	20.7	19.4	27.7	NA	NA	NA	NA

Table 2-10a

Summary Statistics for Grass Data Collected During Grass Study

Analyte	Detection Frequency	Minimum Concentration		Median Concentration	Mean Concentration	Maximum Concentration		Minimum TEQ		Median TEQ	Mean TEQ	Maximum TEQ	
TOTAL HXCB	10/10	19.2		44.2	40.9	55.9		NA		NA	NA	NA	
TOTAL MCB	1/10	5		2.45	2.7	5		NA		NA	NA	NA	
TOTAL NCB	9/10	0.1		0.2	0.435	0.3		NA		NA	NA	NA	
TOTAL OCB	10/10	1.5		3.75	3.64	5.5		NA		NA	NA	NA	
TOTAL PECB	10/10	12.5		22	20.8	25.6		NA		NA	NA	NA	
TOTAL TCB	10/10	6.7		13.9	13.6	18.2		NA		NA	NA	NA	
TOTAL TRICB	0/10	1.7	U	NC	NC	2.4	U	NA	U	NA	NA	NA	U
PCBS (ng/g, ww)													
AROCLOR-1242	0/10	4.8	U	NC	NC	5	U	NA	U	NA	NA	NA	U
AROCLOR-1248	10/10	4.7		9.8	8.74	13.6		NA		NA	NA	NA	
AROCLOR-1254	10/10	21.1		49.2	44.2	54.4		NA		NA	NA	NA	
AROCLOR-1260	10/10	23.1		51.9	48.7	68		NA		NA	NA	NA	
PCB, TOTAL	10/10	51.3		109	101	136		NA		NA	NA	NA	
Total TEQ (ng/kg ww) [a]								0.00264		0.00352	0.00350802	0.00793	

Summary statistics were calculated using one-half the detection limit when congeners were not detected in a sample.

NC = Not Calculated. Summary statistics were not calculated for congeners that were never detected. The reported minimum and maximum values represent the range of detection limits.

U = Not detected.

NA = Not Applicable; no TEQ concentration was calculated because no TEF is available for the compound.

[a] Total TEQ is the sum of TEQ for dioxin-like PCB congeners. Two dioxin-like PCB congeners (123 and 157) co-eluted with other congeners, and the total estimated concentration was used to estimate TEQ. This resulted in overestimates of TEQ for these congeners. TEQ from dioxin and furan congeners were not included due to elevated detection limits.

Table 2-10b

Summary Statistics for Soil Data Collected During Grass Study

Analyte	Detection Frequency	Minimum Concentration	Median Concentration	Mean Concentration	Maximum Concentration	Minimum TEQ	Median TEQ	Mean TEQ	Maximum TEQ
Dioxins/Furans (pg/g, dw)									
1,2,3,4,6,7,8-HPCDD	10/10	154	234	257	508	1.54	2.34	2.57	5.08
1,2,3,4,6,7,8-HPCDF	10/10	181	340	342	529	1.81	3.4	3.42	5.29
1,2,3,4,7,8,9-HPCDF	9/10	13.4	20.8	20.2	32.1	0.134	0.208	0.202	0.321
1,2,3,4,7,8-HXCDD	5/10	1.9	1.65	2.18	4.1	0.19	0.165	0.218	0.41
1,2,3,4,7,8-HXCDF	7/10	40.9	46.5	65.6	195	4.09	4.65	6.56	19.5
1,2,3,6,7,8-HXCDD	8/10	2.5	11.2	11.2	26.7	0.25	1.12	1.12	2.67
1,2,3,6,7,8-HXCDF	10/10	15.4	27.3	31.4	48.5	1.54	2.73	3.14	4.85
1,2,3,7,8,9-HXCDD	6/10	2	3	3.54	9	0.2	0.3	0.354	0.9
1,2,3,7,8,9-HXCDF	8/10	0.7	4.4	6.49	16	0.07	0.44	0.649	1.6
1,2,3,7,8-PECDD	0/10	2.5 U	NC	NC	7.6 U	2.5 U	NC	NC	7.6 U
1,2,3,7,8-PECDF	10/10	53.9	97.4	104	182	2.695	4.87	5.2	9.1
2,3,4,6,7,8-HXCDF	10/10	23.7	36.1	42	75.9	2.37	3.61	4.2	7.59
2,3,4,7,8-PECDF	10/10	39.1	71	81.1	165	19.55	35.5	40.55	82.5
2,3,7,8-TCDD	5/10	1.3	0.8	1.43	4.4	1.3	0.8	1.43	4.4
2,3,7,8-TCDF	10/10	69.7	93.7	114	214	6.97	9.37	11.4	21.4
OCDD	10/10	1300	2080	2240	4260	0.13	0.208	0.224	0.426
OCDF	10/10	174	278	289	499	0.0174	0.0278	0.0289	0.0499
Inoganics									
PERCENT SOLIDS (%)	10/10	29.7	49	51.1	73.8	NA	NA	NA	NA
Organic									
TOTAL ORGANIC CARBON (mg/kg)	10/10	26500	52600	53100	99700	NA	NA	NA	NA
PCB Congeners (ng/g, dw)									
PCB-1	6/10	1.14	1.33	1.74	7.09	NA	NA	NA	NA
PCB-101/90	10/10	110	374	369	699	NA	NA	NA	NA
PCB-105	10/10	11.3	45.9	52.1	93.7	0.00113	0.00459	0.00521	0.00937
PCB-107	10/10	4.8	12.9	13.2	28.1	NA	NA	NA	NA
PCB-110	10/10	76.3	258	261	455	NA	NA	NA	NA
PCB-114	0/10	0.0067 U	NC	NC	0.0159 U	0.00000335 U	NC	NC	0.00000795 U
PCB-118	10/10	37.1	110	114	197	0.00371	0.011	0.0114	0.0197
PCB-119	10/10	10.6	31.5	31.3	60.5	NA	NA	NA	NA
PCB-126	9/10	0.07	0.329	0.365	1.11	0.00700	0.0329	0.0365	0.111
PCB-128	10/10	26.9	77.2	80.6	136	NA	NA	NA	NA
PCB-129	10/10	6.03	19.6	19.1	34.2	NA	NA	NA	NA
PCB-130	10/10	6.16	16.8	18.1	36.5	NA	NA	NA	NA
PCB-135	10/10	67	193	197	360	NA	NA	NA	NA
PCB-136	10/10	42.3	142	140	258	NA	NA	NA	NA
PCB-138/160	10/10	304	879	907	1550	NA	NA	NA	NA
PCB-141/179	10/10	128	364	364	661	NA	NA	NA	NA
PCB-146	10/10	65.3	176	179	311	NA	NA	NA	NA

Table 2-10b

Summary Statistics for Soil Data Collected During Grass Study

Analyte	Detection Frequency	Minimum Concentration	Median Concentration	Mean Concentration	Maximum Concentration	Minimum TEQ	Median TEQ	Mean TEQ	Maximum TEQ
PCB-149/123	10/10	292	850	866	1570	0.0292	0.085	0.0866	0.157
PCB-15	10/10	5.84	10.9	12.5	30	NA	NA	NA	NA
PCB-151	10/10	125	358	358	673	NA	NA	NA	NA
PCB-153/132	10/10	432	1270	1320	2280	NA	NA	NA	NA
PCB-156	10/10	16.6	53.1	53.4	90.6	0.00830	0.02655	0.0267	0.0453
PCB-158	10/10	29.2	84.7	84.7	157	NA	NA	NA	NA
PCB-16/32	10/10	1.44	6.98	7.81	20.2	NA	NA	NA	NA
PCB-166	10/10	0.467	1.33	1.46	3.18	NA	NA	NA	NA
PCB-167	10/10	13	29.7	32	54.8	0.000130	0.000297	0.00032	0.000548
PCB-169	10/10	0.09	0.126	0.15	0.28	0.000900	0.00126	0.0015	0.00280
PCB-170/190	10/10	116	388	401	764	NA	NA	NA	NA
PCB-171/202	10/10	47.7	140	147	292	NA	NA	NA	NA
PCB-172	10/10	27.5	71.9	73.4	130	NA	NA	NA	NA
PCB-174	10/10	152	429	441	794	NA	NA	NA	NA
PCB-175	10/10	9.34	25.4	25.3	42.4	NA	NA	NA	NA
PCB-176/137	10/10	15.4	41.5	43.7	70.3	NA	NA	NA	NA
PCB-177	10/10	90.4	250	259	465	NA	NA	NA	NA
PCB-178	10/10	37.3	102	103	182	NA	NA	NA	NA
PCB-18/17	10/10	1.41	4.45	5.33	15.1	NA	NA	NA	NA
PCB-180	10/10	306	999	999	1860	NA	NA	NA	NA
PCB-183	10/10	72.1	231	231	439	NA	NA	NA	NA
PCB-185	10/10	24.8	67.8	69.9	127	NA	NA	NA	NA
PCB-187	10/10	195	564	572	1060	NA	NA	NA	NA
PCB-189	10/10	6.22	14.2	14.2	22.5	0.000622	0.00142	0.00142	0.00225
PCB-191	10/10	7.72	22.9	23.5	43.5	NA	NA	NA	NA
PCB-193	10/10	26	57.4	60.4	99.8	NA	NA	NA	NA
PCB-194	10/10	71.7	229	230	437	NA	NA	NA	NA
PCB-195/208	10/10	38.5	115	117	212	NA	NA	NA	NA
PCB-197	10/10	4.9	8.7	9.01	15.7	NA	NA	NA	NA
PCB-199	10/10	97.5	255	259	464	NA	NA	NA	NA
PCB-200	10/10	15.7	39.1	40.9	71.1	NA	NA	NA	NA
PCB-201/157/173	10/10	17.1	45.6	49.6	89.4	0.00855	0.0228	0.0248	0.0447
PCB-203/196	10/10	91.4	283	283	535	NA	NA	NA	NA
PCB-205	10/10	7.26	13.1	14.4	27.4	NA	NA	NA	NA
PCB-206	10/10	22.3	61.1	60.1	99.8	NA	NA	NA	NA
PCB-207	10/10	6.01	12.8	12.9	20.1	NA	NA	NA	NA
PCB-209	10/10	3.54	8.21	7.87	10.2	NA	NA	NA	NA
PCB-22/51	10/10	1.07	2.29	2.46	3.66	NA	NA	NA	NA
PCB-24/27	10/10	1.73	4.07	5.15	15	NA	NA	NA	NA

Table 2-10b

Summary Statistics for Soil Data Collected During Grass Study

Analyte	Detection Frequency	Minimum Concentration	Median Concentration	Mean Concentration	Maximum Concentration	Minimum TEQ	Median TEQ	Mean TEQ	Maximum TEQ
PCB-25	10/10	1.31	3.64	4.49	9.61	NA	NA	NA	NA
PCB-26	10/10	1.31	4.89	6.08	15.3	NA	NA	NA	NA
PCB-28	10/10	2.59	7.62	9.02	19	NA	NA	NA	NA
PCB-29	10/10	3.85	10.8	10.4	19.2	NA	NA	NA	NA
PCB-30	10/10	0.501	1.02	1.03	1.54	NA	NA	NA	NA
PCB-31	10/10	1.63	3.94	4.73	10.2	NA	NA	NA	NA
PCB-33/20	5/10	0.544	0.276	0.413	1.3	NA	NA	NA	NA
PCB-39	10/10	0.063	0.589	0.586	1.43	NA	NA	NA	NA
PCB-40	10/10	1.09	3.36	3.74	7.88	NA	NA	NA	NA
PCB-41/64	10/10	1.68	4.47	4.51	7.57	NA	NA	NA	NA
PCB-42/59/37	10/10	3.27	14.4	15	32.7	NA	NA	NA	NA
PCB-44	10/10	4.95	17.8	21	48.6	NA	NA	NA	NA
PCB-45	9/10	0.675	1.7	1.58	3.57	NA	NA	NA	NA
PCB-46	10/10	2.05	5.71	6.86	15.9	NA	NA	NA	NA
PCB-47/75	10/10	32.9	205	226	573	NA	NA	NA	NA
PCB-48	0/10	0.0067 U	NC	NC	0.0159 U	NA U	NA	NA	NA U
PCB-49	10/10	28.8	111	127	328	NA	NA	NA	NA
PCB-52	10/10	27.3	91.1	103	245	NA	NA	NA	NA
PCB-53	10/10	6.79	38.1	42.8	121	NA	NA	NA	NA
PCB-56/60	10/10	6.38	11.6	12.7	26	NA	NA	NA	NA
PCB-63	0/10	0.0067 U	NC	NC	0.0159 U	NA U	NA	NA	NA U
PCB-66	10/10	9.46	22.7	29.4	53.4	NA	NA	NA	NA
PCB-67	10/10	11.9	46.8	52.2	120	NA	NA	NA	NA
PCB-69	10/10	1.15	2.22	2.77	7.15	NA	NA	NA	NA
PCB-7/9	10/10	0.715	1.57	1.83	5.03	NA	NA	NA	NA
PCB-70	10/10	13.3	32.9	33	68.8	NA	NA	NA	NA
PCB-72	10/10	0.645	2.43	3.27	6.94	NA	NA	NA	NA
PCB-74/61	10/10	3.26	6.69	7.61	16.4	NA	NA	NA	NA
PCB-77	10/10	0.352	0.811	0.83	1.73	0.0000352	0.0000811	0.000083	0.000173
PCB-8/5	10/10	1.76	2.91	2.99	6.41	NA	NA	NA	NA
PCB-81	10/10	0.065	0.212	0.211	0.449	0.00000650	0.0000212	0.0000211	0.0000449
PCB-82	10/10	5.83	13.6	14.9	23.3	NA	NA	NA	NA
PCB-83	10/10	5.97	11.7	13.4	22.1	NA	NA	NA	NA
PCB-84	10/10	10.4	39.1	35.7	71.2	NA	NA	NA	NA
PCB-85	10/10	15.8	27	27.4	47.7	NA	NA	NA	NA
PCB-87/115	10/10	25.9	66.6	66.8	118	NA	NA	NA	NA
PCB-91/55	10/10	24.8	97.1	103	222	NA	NA	NA	NA
PCB-92	10/10	29.6	88.7	86.8	155	NA	NA	NA	NA
PCB-95/80	10/10	73.2	231	223	449	NA	NA	NA	NA

Table 2-10b

Summary Statistics for Soil Data Collected During Grass Study

Analyte	Detection Frequency	Minimum Concentration	Median Concentration	Mean Concentration	Maximum Concentration	Minimum TEQ	Median TEQ	Mean TEQ	Maximum TEQ
PCB-97	10/10	15.3	41.9	42.1	74.9	NA	NA	NA	NA
PCB-99	10/10	36.8	138	134	233	NA	NA	NA	NA
TOTAL DCB	10/10	3.55	8.2	7.87	10.2	NA	NA	NA	NA
TOTAL DICB	10/10	9.7	15.1	17.2	37.8	NA	NA	NA	NA
TOTAL HPCB	10/10	1130	3400	3460	6390	NA	NA	NA	NA
TOTAL HXCB	10/10	1550	4510	4620	8160	NA	NA	NA	NA
TOTAL MCB	6/10	1.1	3.95	3.79	7.1	NA	NA	NA	NA
TOTAL NCB	10/10	28.4	77.7	73	112	NA	NA	NA	NA
TOTAL OCB	10/10	344	990	1000	1850	NA	NA	NA	NA
TOTAL PECB	10/10	469	1510	1480	2700	NA	NA	NA	NA
TOTAL TCB	10/10	184	721	809	1910	NA	NA	NA	NA
TOTAL TRICB	10/10	18.3	48.1	57.5	129	NA	NA	NA	NA
PCBs (ng/g, dw)									
AROCLOR-1242	0/10	6.7 U	NC	NC	15.9 U	NA U	NA	NA	NA U
AROCLOR-1248	1/10	1070	5.28	111	1070	NA	NA	NA	NA
AROCLOR-1254	10/10	937	2870	2780	4260	NA	NA	NA	NA
AROCLOR-1260	10/10	2810	8610	8650	16000	NA	NA	NA	NA
PCB, TOTAL	10/10	3750	11500	11500	21300	NA	NA	NA	NA
Total TEQ (ng/kg ww) [a]						0.102	0.256	0.276	0.559

Summary statistics were calculated using one-half the detection limit when congeners were not detected in a sample.
NC = Not Calculated. Summary statistics were not calculated for congeners that were never detected. The reported minimum and maximum values represent the range of detection limits.
U = Not detected.
NA = Not Applicable; no TEQ concentration was calculated because no TEF is available for the compound.
[a] Total TEQ is the sum of TEQ for dioxin-like PCB congeners. Two dioxin-like PCB congeners (123 and 157) co-eluted with other congeners, and the total estimated concentration was used to estimate TEQ. This resulted in overestimates of TEQ for these congeners. TEQ from dioxin and furan congeners were not included due to elevated detection limits.

Table 2-11

Sawhney and Hankin (1984) PCB Study Results

1981 Growing Season

Aroclor	Soil (mg/kg, dw)	Beet Roots (mg/kg, dw)	Beet Leaves (mg/kg, dw)	Turnip Roots (mg/kg, dw)	Turnip Leaves (mg/kg, dw)
1248	0.08	0.015	0.022	0.03	0.032
1254	1.88	0.016	0.094	0.016	0.040
1260	14.44	0.035	0.052	0.02	0.027
Total	16.4	0.066	0.168	0.066	0.099

1982 Growing Season

		Turnips (mg/kg, dw)					Beans (mg/kg, dw)			
		Leaves			Roots					
	Soil	Harvest Date								
Aroclor	**(mg/kg, dw)**	**31-Jul**	**04-Aug**	**12-Aug**	**Unpeeled**	**Peeled**	**Leaves**	**Stems**	**Pods**	**Seeds**
1248	NA	0.027	0.031	0.02	0.032	0.003	0.044	0.037	0.044	0.013
1254	NA	0.059	0.049	0.091	0.061	0.022	0.04	0	0.022	0.004
1260	NA	0.052	0.079	0.156	0.204	0.01	0.107	0.036	0.098	0

Source: Sawhney and Hankin (1984), Table 2 and Table 3.
NA = not available.

Go to Section 2 Figures

SECTION 2

FIGURES

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 below.

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 non-cancer 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.

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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

The exposure assessment component of a risk assessment provides quantitative estimates of the amount of each contaminant that can potentially reach an individual. Exposure scenarios were developed to provide upper (RME) and average (CTE) estimates of exposure to individuals who may be exposed to COPCs from the site as a result of consumption of animal products or plants from the floodplain. The scenarios include information about the amount, frequency, duration, and route of exposure to estimate the average daily dose (ADD) for assessing noncancer health effects and the lifetime average daily dose (LADD) for assessing cancer risk.

For each exposure scenario, both the RME and CTE doses were calculated. Consistent with EPA guidance (EPA, 1989), the RME approach used a mix of high-end, or upper, and average values from exposure parameter distributions to arrive at an upper-bound risk estimate. The CTE approach used average values for exposure parameters, and thus yielded estimates of average risk.

This section includes a description of:

- Current and potential future exposure scenarios.
- Methodology for estimating food exposure point concentrations.
- Exposure parameter values used for estimating ADDs and LADDs for people consuming food items from the Housatonic River floodplain.

4.1 NON-PARCEL-SPECIFIC EXPOSURE SCENARIOS

Because management practices and animal types on any given farm may change over time, a farm-specific assessment would become obsolete when these changes occur and any future use of non-agricultural parcels could not be evaluated. To address this concern, hypothetical scenarios were assessed that reflect the range of current and potential future farm types, management practices (e.g., animal housing and feed) in the floodplain, and PCB concentrations; thus, this assessment can be used to assess risk as the practices and/or uses for a given parcel change over time.

Table 4-1 lists the exposure scenarios evaluated in this assessment. Management practices were described in Section 2.1.

Exposure estimates were based on tPCB soil exposure point concentrations (EPCs) that reflect the range of concentrations measured in current and potential future agricultural areas and on a range of fractions of agricultural area within the floodplain (i.e., the 1-ppm tPCB isopleth along Reaches 5 and 6, and the 100-year floodplain along Reaches 7, 8, and 9) (see Table 2-2), with the exception of some residential properties. Although tPCB concentrations outside this range have been measured on some recreational properties, no plans to convert these areas to agricultural uses in the future were identified.

PCB, dioxin, and furan congener concentrations associated with tPCB EPCs were predicted using linear regression models listed in Table 4-2. Development of these regression models is described in Attachment 2 of HHRA Volume I. The models were developed using tPCB concentration data in the range of tPCB concentrations being evaluated in this assessment.

In Section 5, cancer risk and noncancer hazard estimates are presented in matrix format for different combinations of tPCB EPCs in floodplain soil and fractions of cultivated land or pasture that is in the floodplain. A separate matrix is provided for each agricultural scenario, with cancer risk and noncancer hazard estimates reported for four tPCB soil EPCs (0.5, 2, 10, and 25 mg/kg) and four fractions of cultivated fields and pastures in the floodplain (0.25, 0.5, 0.75, and 1.0), resulting in a total of 16 combinations of the two factors. The 2-mg/kg concentration is the cleanup concentration established in the Consent Decree for residential properties. Using these matrices, risk can be estimated for each agricultural scenario for the applicable combination of tPCB soil EPC and fraction of farmland in the floodplain for a parcel of interest. An underlying assumption of this approach is that the tPCB concentration in farm soil outside the floodplain is zero. This assumption is likely to underestimate risk slightly, depending upon site-specific background concentrations of tPCBs.

All scenarios listed in Table 2-1 were evaluated in this assessment; however, scenarios that reflect current activities, represent bioaccumulative pathways, and/or involve relatively high potential exposure to floodplain soil were subject to a full quantitative assessment. These scenarios are:

- Commercial dairy, beef, poultry, and produce.
- Backyard dairy, beef, poultry, and produce (i.e., home gardens).

The levels of possible animal exposure and human health risk associated with other exposure scenarios (i.e., sheep, goats, deer, and wild edible plants other than fiddleheads) were evaluated relative to the scenarios assessed quantitatively. Section 4.4 discusses exposure and Sections 5.6, 5.7, and 5.8 discuss risk from the sheep, goat, and deer scenarios, respectively.

4.2 MODELS USED TO PREDICT AGRICULTURAL PRODUCE AND ANIMAL PRODUCT CONTAMINANT CONCENTRATIONS

In Section 2, contaminant concentration data for animal products (milk) and plants (squash, fiddlehead ferns, corn stalks and ears, and grass) from the floodplain were described. These data were used in conjunction with models to predict animal product and plant produce contaminant concentrations for estimating human health risk from consumption of these foods. The general models for predicting produce and animal product contaminant concentrations are shown in Figures 4-1 and 4-2, respectively. All food concentrations were predicted on an "as consumed" basis. Sections 4.3 and 4.4 describe these models in greater detail along with discussion and selection of each model input value.

4.3 TRANSFER OF PCBs, DIOXINS, AND FURANS FROM SOIL TO PLANTS

This section summarizes mechanisms by which PCBs, dioxins, and furans migrate from soil to plants and describes the methodology used to predict concentrations in corn silage, grass-based feeds, and home garden produce.

4.3.1 Mechanisms of Transfer to Plants

Transfer of PCBs, dioxins, and furans from soil to plants is a surface phenomenon, occurring by the following mechanisms:

- Deposition of particle-phase contaminants on or sorption of vapor-phase contaminants to aboveground vegetation (e.g., leaves and fruits).

- Partitioning from contaminated soil to belowground vegetation (e.g., roots or tubers).

Concentrations in plants are influenced by a number of variables:

- Chemical and physical properties of congeners (vapor pressure, partition coefficients).
- Environmental conditions (organic carbon content of soil).
- Plant characteristics (growing period, height, surface-area-to-volume ratio, lipid content).
- Crop management (canopy density).

Aroclor 1260 is a mixture of congeners, many of which are highly chlorinated, with low vapor pressures, low solubilities, and high octanol:water partition coefficients (K_{OW}). Deposition/sorption on aboveground plant parts is a function of partitioning between soil and air and between air and plant tissue; therefore, congener vapor pressures and octanol-air partition coefficients (K_{OA}s) can be predictive for this transfer pathway. The outer surfaces of plant leaves and of most fruits and stems are covered by a waxy layer, or cuticle, which provides a barrier to water loss. Highly lipophilic contaminants can strongly sorb to this cuticle layer, preventing their absorption into the plant (Simonich and Hites, 1995).

Figure 4-3 illustrates the influence of congener vapor pressure on transfer of PCB congeners from soil to grass collected along Reach 5 (see discussion of grass data in Section 2.3.6). While most published data strongly suggest that PCBs, dioxins, and furans are not translocated to other plant parts and that metabolism is not significant, some recent research suggests that members of the Cucurbitaceae family might exude a chemical that facilitates absorption and translocation from the roots (Hulster et al., 1994).

4.3.2 Approach for Estimating Concentrations in Plants

Plant concentrations were predicted by defining the quantitative relationships between plant and soil concentrations using site-specific field data collected by EPA, supplemented with site-specific field data from the scientific literature (Sawhney and Hankin, 1984). With this quantitative information, soil-to-plant transfer factors (TFs) were defined for the following animal feed and human food categories:

- Corn silage.
- Grass-based feeds.
- Produce: exposed vegetables, root vegetables, and exposed fruits.

The TFs selected for use in this assessment are summarized in Table 4-3. They were used to predict concentrations in plants used for animal feed (i.e., corn silage and grass-based feed) on a dry weight basis and concentrations in plants consumed by people (i.e., produce) on a wet weight, "as consumed" basis. These TFs were developed based on a review of site-specific information as well as information from the scientific literature, including measurement studies and models for predicting plant concentrations (e.g., Travis and Arms, 1988). Assignment of a single soil-to-plant TF to each category was based on the assumption that these factors are constant across the range of concentrations measured in floodplain soil.

- The scientific literature includes laboratory and field studies demonstrating soil-to-plant transfer of PCBs, dioxins, and furans. This literature is extensive, dating back to the early 1970s, but limited congener-specific information and other information relevant to exposure scenarios in the floodplain are available. Recent studies focus more on air-to-plant transfer than soil-to-plant transfer, and results cannot be readily converted to soil-to-plant TFs. To estimate TFs for tPCBs, data for PCB mixtures similar to the mixture in the floodplain were favored over data for individual congeners or dissimilar PCB mixtures. Field and laboratory conditions in these studies can vary significantly, and do not necessarily reflect conditions in the Housatonic River floodplain. Field studies were preferred over laboratory studies because they are typically more relevant to actual growing conditions in the floodplain. For example, field studies account for losses due to wind, rain, and photolysis, and laboratory studies typically do not. For these reasons, site-specific field data were used to estimate TFs for tPCBs and congeners.

- Site-specific tPCB data are available for corn, squash, fiddlehead ferns, and grass (Section 2.3), and PCB congener data are available for grass. Site-specific data for tPCBs are summarized in Table 4-4, and literature-based data for tPCBs relevant to the PCB mixture in the floodplain are summarized in Table 4-5. No site-specific data for calculation of transfer factors are available for dioxins and furans, but literature-based data are summarized in Table 4-6. All site-specific tPCB TFs are within the range of values reported in the scientific literature for field studies of similar PCB mixtures with a variety of plant species, soil characteristics, and other site-specific conditions that influence contaminant transfer to plants.

Using information for 29 organic chemicals, Travis and Arms (1988) developed a screening model for estimating plant TFs (referred to as bioconcentration factors, or BCFs, in Travis and Arms, 1988):

$$\log TF = 1.588 - 0.578 \log K_{OW} \quad (n=29, r = 0.73)$$

The predicted TF is inversely proportional to K_{OW} and represents the ratio of the concentration in aboveground parts (mg of compound/kg of dry plant) to the concentration in soil (mg of compound/kg of dry soil). The inverse relationship to K_{OW} occurs because transport from soil to aboveground plant parts is dependent on the solubility in water of a chemical, which is inversely proportional to K_{OW}. EPA used this model in the Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (EPA, 1998) to estimate a TF (called a biotransfer factor in EPA, 1998) for Aroclor 1254 of 0.01. If the log K_{OW} for Aroclor 1260 of 6.8 (ATSDR, 2000) is substituted into the model equation, a TF of 0.0046 results.

The PCB mixture in floodplain soil most closely matches Aroclor 1260, with a smaller fraction of Aroclor 1254. Therefore, if the Travis and Arms (1988) model is applicable to site conditions, one would expect site-specific TFs to be between the predicted TF for Aroclor 1260 (0.0046) and the predicted TF for Aroclor 1254 (0.01), probably closer to the predicted TF for Aroclor 1260. The range of TFs reported in the literature for Aroclor 1254 and Aroclor 1260 is wider than the range defined by the predicted TF for Aroclor 1260 and the predicted TF for Aroclor 1254. With the exception of squash data and most grass data, site-specific TFs fall within the range of these two predicted TFs. Squash might differ from other plants with respect to soil-to-plant transfer as described in Section 4.3.4.4. Grass TFs are highest among site-specific TFs, most likely due to the proximity of grass samples to the river channel or their relatively high surface area-to-volume ratio. However, comparisons between predicted TFs and site-specific TFs or literature-based TFs are difficult to make because Travis and Arms (1988) do not provide detailed descriptions of data used to develop the screening model.

4.3.3 Corn Silage and Grass-Based Feeds

Soil-to-grass and soil-to-corn silage TFs used in this assessment are listed in Table 4-3. These factors represent the mean “grass-to-soil” and “corn-to-soil” concentration ratios (dry weight plant/dry weight soil basis [dw/dw]) measured in site-specific samples, with no plant lipid or soil organic carbon content normalization. These factors were estimated using only data with results above detection limits.

4.3.3.1 Soil-to-Grass Transfer Factors

Data from the grass samples collected from the floodplain (see Section 2) were used to estimate soil-to-plant TFs for tPCBs and dioxin-like PCB congeners. These grass data were intended to represent an upper bound on exposure concentrations of PCBs for grazing cattle and crops in floodplain areas farther from the river, where floodwater inundation is less frequent. Limited data are available in the literature for comparison (Table 4-5). The tPCB grass TFs are similar to or higher than the TF reported by Strek et al. (1981) for Aroclor 1254 in sorghum, and they are lower than the TFs reported by Trapp et al. (1990) for barley. However, the barley TFs are for a single pentachlorobiphenyl congener, which is more volatile than the PCB mixture in the floodplain. O'Connor et al. (1990) did not detect PCBs in fescue grown in Aroclor 1248-contaminated soil.

Mean grass-to-soil concentration ratios were calculated for tPCBs and 10 of the 12 dioxin-like PCB congeners, and were used as "soil-to-grass" TFs. PCB-81 and PCB-114 were not detected in grass; therefore, soil-to-grass TFs were not estimated for these congeners. PCB-126 was detected in 6 of 10 grass samples. The TF for this congener of 0.25 (dry weight plant/dry weight soil) would decrease slightly if grass results below detection limits were assumed to be present at one-half the detection limit. Other dioxin-like PCB congeners were almost always detected in grass samples (see Table 2-10a). The highest TFs were estimated for three coplanar congeners (i.e., PCB-77, PCB-126, and PCB-169). This may be due to natural stochasticity but also might be due to the structure of these congeners or some other chemical/physical property that causes them to partition to plants to a greater extent than other congeners. For example, Falconer et al. (1995) demonstrated enhanced partitioning of coplanar PCB congeners from vapor to particles relative to multi-ortho PCB congeners with the same subcooled liquid vapor pressure.

To evaluate the relationship between grass and soil concentrations, dioxin-like PCB congener concentrations in grass were regressed against dioxin-like PCB congener concentrations in soil after excluding results below detection limits (Figure 4-4a). A trend of increasing grass concentration with increasing soil concentration was seen in some of these regressions, but a negative trend was seen in others. Regression model fits were not statistically significant at $p = 0.05$. In Figure 4-4b, these regression models were re-fit after normalizing soil concentrations to organic carbon content and normalizing plant concentrations to plant lipid content. These fits were also not statistically significant, but the trend of increasing grass concentration with increasing soil concentration was slightly more apparent for some congeners.

These regression models illustrate the difficulty of relating soil concentrations to plant concentrations when contamination can move from soil-to-air-to-plant and also from soil-to-plant. While soil samples were collected in proximity to the plants from the surface soil layer to address this issue, plants could be affected by soil concentrations over a wider area. This is particularly the case with grass, which was growing adjacent to the river channel where relatively large areas of bank soil and sediment can be exposed during periods of low flow. Therefore, the soil samples might only partially reflect plant exposure. Also, both plants and soil might reflect varying amounts of regional background PCB concentrations in addition to site-related contamination. However, Aroclor patterns in grass were similar to Aroclor patterns in co-located soil samples, but with a shift toward less volatile congeners in grass compared with soil (see Aroclor results in Tables 2-10a and 2-10b). This pattern of a relatively low volatile congener mixture similar to co-located soil samples suggests dominance of the local source.

Dioxin and furan congeners were not detected in grass, with the exception of octachlorodibenzo-p-dioxin (OCDD) in 2 out of 10 samples. The grass-to-soil concentration ratio for OCDD in these two samples was 0.002 on a dry weight plant/dry weight soil basis. Although detection limits were somewhat elevated, data from the grass study suggest that dioxin and furan concentrations are likely to be relatively small contributors to TEQ exposure for cattle compared with PCB concentrations. For these reasons, soil-to-grass TFs were not estimated for dioxins and furans. The uncertainty associated with the lack of soil-to-grass TFs for dioxins and furans and implications for risk estimates are discussed in Section 7.2.2.1.1 and Section 7.2.4.2.

4.3.3.2 Soil-to-Corn Silage Transfer Factors

Results from site-specific corn samples were used to estimate soil-to-corn silage TFs (see discussion of corn data in Section 2.3.3). Corn stalks and ears were analyzed for tPCBs only, which were detected in 5 out of 10 corn stalk samples. PCBs were not detected in any of the 10 corn ears. The five corn stalk samples with detected concentrations of PCBs were used to estimate tPCB soil-to-corn stalk TFs (Table 4-4). These TFs likely overestimate PCB transfer to corn silage because the calculation excludes the protected portion of silage (i.e., corn ears). According to Genter et al. (1970), corn ears contribute about 50% of the dry matter weight of corn silage. Because ears are protected from deposition of vapor or particle-phase PCBs, as evidenced by no detected concentrations in ears, the soil-to-corn stalk TFs based on stalks alone were reduced by ½ to represent soil-to-corn silage TFs.

Webber et al. (1994) and Gan and Berthouex (1994) analyzed corn ear-leaf, grain, and stover (i.e., the dried stalks and leaves) samples grown on sludge-amended coal refuse and soil, respectively. In these studies, tPCBs were either not detected or detected at very low concentrations in corn kernels, which is consistent with the corn ear data collected from the Housatonic River floodplain in which tPCBs were not detected. Total PCBs were detected in corn ear-leaf and stover in the µg/kg range, which is consistent with the µg/kg concentrations detected in corn stalks from the Housatonic River area. However, Gan and Berthouex (1994) report that many of the values might represent "pure random error."

Congener analyses were not performed on the corn samples. Therefore, soil-to-corn silage TFs for PCB congeners were estimated using the soil-to-grass TFs. However, the tPCB soil-to-grass TF exceeds the tPCB soil-to-corn silage TF; therefore, use of grass TFs as surrogates for corn TFs without some adjustment would overestimate corn concentrations. Therefore, the soil-to-corn silage TFs shown in Table 4-3 were estimated by multiplying soil-to-grass TFs by the ratio of the tPCB soil-to-corn silage TF to the tPCB soil-to-grass TF. Soil-to-corn silage TFs were not estimated for dioxins and furans for the reasons provided in Section 4.3.3.2. The uncertainty associated with the lack of soil-to-corn TFs for dioxins and furans and implications for risk estimates are discussed in Section 7.2.2.1.1 and Section 7.2.4.2.

4.3.3.3 Comparison of tPCB Soil-to-Grass Transfer Factor and Soil-to-Corn Silage Transfer Factor Measured at the Site

The tPCB soil-to-grass TF exceeds the tPCB soil-to-corn silage TF measured at the GE/Housatonic River Site. This difference could be due to a number of factors, including:

- Grass was collected during a hotter period of the year (July 2001) than corn (September and October 1998/1999) when greater rates of PCB, dioxin, and furan volatilization would be expected.
- Grass has a higher surface area-to-volume ratio than corn.

- Grass was collected from areas immediately adjacent to the contaminated river channel with evidence of recent floodwater inundation, while corn was collected from a field separated from the river by a vegetated buffer about 50 ft wide. For this reason, the grass might have been subject to more site-related exposure than corn.

4.3.4 Soil-to-Plant Transfer Factors for Home Garden Produce Categories

The soil-to-garden-plant TFs for tPCBs that were used in this assessment are listed in Table 4-3 and were developed using site-specific data as well as relevant data from the scientific literature, which are summarized in Table 4-4. They were selected for three categories of garden produce:

- Exposed vegetables
- Root vegetables
- Exposed fruit.

Fruits and vegetables categorized as "exposed" are foods that can intercept contaminants deposited from the air. In contrast, "protected" fruits and vegetables are foods that are protected from atmospheric deposition or sorption of contaminants. For example, a pea pod protects the peas. Such protected produce was assumed to have concentrations of zero in this assessment.

Rather than assess each home garden food item separately, these general categories were used to account for the limited home-produced food consumption rate data for garden produce and for the sparse database for developing soil-to-garden-produce TFs. The three categories correspond to different mechanisms and extent of PCB transfer to plants, and consumption rate data are available for home-produced foods in these categories.

The tPCB soil-to-garden-plant TFs from Table 4-4 that were selected for use in this assessment are listed in Table 4-3. These factors represent best (in contrast to upper-bound) estimates of "garden produce-to-soil" concentration ratios (ww/dw). Like the corn and grass TFs, they were not normalized to plant lipid or soil organic carbon content. They were based on site-specific data and, where site-specific data were lacking, on data from the scientific literature that were relevant to site-specific conditions (Sawhney and Hankin, 1984). The PCB mixture in the floodplain most closely resembles Aroclor 1260. Therefore, the Sawhney and Hankin (1984) data for Aroclor 1260 are most relevant to this assessment.

Soil-to-garden produce TFs were developed for dioxin-like PCB congeners using the congener data for grass as described in Section 4.3.3.2. TFs were not developed for dioxin and furan congeners because site-specific data were not available for these foods. In addition, dioxins and furans do not bioaccumulate in plants to the degree that occurs in animal products. The uncertainty associated with the lack of soil-to-garden produce TFs for dioxins and furans and implications for risk estimates are discussed in Section 7.2.2.1.1 and Section 7.2.4.2.

4.3.4.1 Exposed Vegetables

Data for grass, beet leaves, turnip leaves, corn, and fiddlehead ferns were evaluated in selecting a soil-to-plant TF for the exposed vegetable category (see Table 4-4). Note that this category includes plants that are commonly referred to as vegetables, despite the fact that they are fruits (e.g., tomatoes). The grass data were eliminated from consideration because grass samples were collected from areas that were immediately adjacent to the river channel and showed evidence of recent floodwater inundation. These conditions would not be expected in a home garden; therefore, use of the grass data would likely overestimate exposure. In addition, grass has a higher surface-area-to-mass ratio than many, but not all, garden vegetables, which would further increase the overestimate of exposure.

The beet leaves and turnip leaves data were of particular interest because they were collected as part of a controlled, site-specific field experiment (Sawhney and Hankin, 1984). These plants are similar to typical home garden plants. Plant-to-soil ratios reported by Sawhney and Hankin (1984) were measured in the first season of growth. The wet weight plant-to-soil concentration ratios for Aroclor 1260 during the first growing season were 2.8×10^{-4} in beet leaves and 1.7×10^{-4} in turnip leaves.

Turnips were planted in the same soil during the next season. Concentrations of Aroclor 1260 in the leaves and roots were greater in the second season than in the first season, but soil concentration data were not available for the second season. While PCBs are relatively persistent, the report provided no details regarding treatment of soil between seasons or other information that could reveal how concentrations and bioavailability of PCBs might have changed over this time. The authors reported one soil concentration and one plant concentration for each crop. Without replicates, it was not possible to determine what part of the variation observed in study results, including between seasons, could be attributable to measurement error. If soil concentrations remained approximately the same in the second season when turnip leaves were measured on three occasions, the wet weight ratio for turnip leaves could have been as high as 3×10^{-4} to 9.8×10^{-4}.

The beet and turnip leaves were washed with warm water and a scrub brush prior to laboratory analysis. This process might have removed PCBs associated with soil particles adhering to the plant surfaces (Cullen et al., 1996), and home gardeners might not wash produce this rigorously prior to consumption. Thus, while the beet and turnip leaf data are appropriate to use as the basis of soil-to-plant TFs, they may underestimate the soil-to-plant transfer appropriate for home gardens.

Corn and fiddlehead fern data were also evaluated for use as the basis of the soil-to-plant TFs. Fiddlehead ferns have growing periods that are shorter than most home garden plants, and they are not typically grown in home gardens. Corn is also less commonly grown in home gardens, samples were not washed prior to analysis, and people do not eat corn stalks. Still, to the extent that the corn stalks might be a surrogate for unwashed exposed vegetables, the maximum wet weight soil-to-plant TF for corn was 1.8×10^{-3}. This value is within the range calculated from the Sawhney and Hankin data, although the second season estimates are uncertain without soil concentration data. The soil-to-corn stalk data were selected instead of the soil-to-grass data for the following reasons:

- The grass data were collected in recently inundated areas adjacent to the river channel and are therefore more applicable to floodplain grazing and grass-based feed production than to home gardening, because residents would avoid planting gardens adjacent to a river channel where the garden could be subject to frequent inundation.
- It was judged that the surface area-to-mass ratio for vegetables grown in New England gardens was better approximated by corn than by grass. This ratio is an important determinant of concentration in the food.

Although beets and turnips were judged to be most relevant to the home garden scenario, the maximum soil-to-plant TF for corn stalks was selected to represent the exposed vegetable category to provide a margin of safety given the beet and turnip data limitations. Use of this TF will likely overestimate concentrations in legume types of vegetables, which have lower surface area to mass ratios than leafy vegetables. However, separate home-produced food consumption rate data were not available for leafy and legume exposed vegetables.

The soil-to-corn stalk TFs in Table 4-4 are similar to and sometimes lower than corn and exposed vegetable TFs reported in the literature (Table 4-5). Some studies report higher TFs, such as Cullen et al. (1996), but these TFs for single congeners do not necessarily represent the PCB mixture in the floodplain. Chaney et al. (1996) recommends a TF for biosolid-treated soil, which is similar in the case of leafy vegetables and lower in the case of legume vegetables. Biosolid-treated soil is likely to have a relatively high organic carbon content that inhibits soil-to-plant transfer of persistent organics that will tend to partition to the organic carbon in soil. Webber et al. (1994), Gosselin et al. (1986), Iwata et al. (1974, 1976), Bacci and Gaggi (1985), and Suzuki et al. (1977) measured similar or higher TFs, although in some cases, the plants or portions of plants being measured are not typically consumed by people (e.g., carrot foliage).

4.3.4.2 Root Vegetables

Sawhney and Hankin (1984) provide the only site-specific PCB transfer data for root vegetables. They measured wet weight plant-to-soil PCB concentration ratios of Aroclor 1260 for beet roots and turnip roots of 3.0×10^{-4} and 1.1×10^{-4}, respectively.

Like the turnip leaves, turnip roots were grown in a second season in the same soil as the first season. However, in the second season, peeled and unpeeled roots were measured. Sawhney and Hankin (1984) did not indicate whether turnip roots were peeled during the first season. Concentrations in peeled turnip roots (10 μg/kg, dw) were slightly lower than concentrations measured in turnip roots during the first season (20 μg/kg, dw). However, unpeeled turnip root concentrations were substantially higher (204 μg/kg, dw). This difference between peeled and unpeeled roots has been observed in several studies, especially with carrots where more than 90% of PCBs are measured in the peel of the carrot (Iwata et al., 1974; O'Conner, 1990). Carrot-root-peel-to-soil concentration ratios around 4×10^{-2} (ww) have been measured (O'Conner, 1990).

Because people often peel produce prior to consuming it, the maximum turnip plant-to-soil concentration ratio of 3.0×10^{-4} was selected as the soil-to-plant TF for the root vegetables. This assumption may underestimate risk for individuals who do not peel vegetables prior to consuming them. This TF is on the low end of the range of values reported for root vegetables in the literature, although many literature values pertain to roots not consumed by people (e.g., tomato roots), individual congeners (Cullen et al., 1996), or carrots, which represent a special case of root vegetables (Table 4-5).

4.3.4.3 Exposed Fruits

Exposed fruits include berries and tree fruits. No site-specific data were available for exposed fruits, and soil-to-plant transfer studies in the literature do not focus on these crops. There are data for tomatoes that might have similar TFs to some plants in this category. Cullen et al. (1996) measured tomato-to-soil concentration ratios of 1×10^{-3} for PCB-153 on a wet weight basis. Chaney et al. (1996) recommends a TF that is about a factor of 100 lower for PCB transfer from biosolid-treated soil. This recommended TF might underestimate transfer for soil with lower organic carbon content than biosolid-treated soil.

Because of the limited soil-to-plant transfer information for exposed fruits, the TF for this category was set equal to the exposed vegetable factor of 1.8×10^{-3}. This value is based on site-specific conditions for plants that likely provide a conservative estimate of fruit concentrations because exposed vegetables often grow closer to the ground, especially compared with tree fruits, and have higher surface-area-to-mass ratios than fruits. Exceptions would be plants such as strawberries that grow in close contact with the ground; however, such perennial plants are unlikely to be grown in the floodplain. Therefore, the exposed fruit category might not be important for the home garden scenario.

This category might be relevant to the assessment of wild edible plants because plants such as wild apples (*Malus pumila*), eastern black currant (*Ribes americana*), and red raspberries (*Rubus idaeus*) grow in the floodplain (WESTON, 2004). However, consumption rate information for exposed fruits might overestimate rates for wild plants because cultivated plants are more readily available for human consumption.

4.3.4.4 Acorn Squash

Acorn squash samples were collected from the site and analyzed for tPCBs (see Section 2.3.4 for a description of these data). Squash-to-soil concentration ratios were higher than other plants collected from the site, with the exception of some grass samples.

Squash was classified by EPA (1997) as a protected vegetable, but a recent study (Hulster et al., 1994) suggested that squash might not belong in this category. Although data strongly suggest that PCBs are not translocated to other plant parts and metabolism is not significant, Hulster et al. (1994) hypothesized that some members of the Cucurbitaceae family might exude a chemical that facilitates absorption and translocation of dioxin from the roots (Hulster et al., 1994). Because PCBs might behave similarly to dioxin, risk associated with squash consumption was evaluated separately from the other home garden categories, using concentration data from site-specific squash samples.

4.4 PREDICTION OF PCB, DIOXIN, AND FURAN CONCENTRATIONS IN ANIMAL PRODUCTS

In this section, the methodology for estimating PCB, dioxin, and furan concentrations in the following animal products is described:

- Dairy cattle (milk and meat).
- Beef cattle (meat).
- Goats (milk).
- Sheep (lamb's meat).
- Free-range poultry (eggs and meat).
- Deer (meat).

The assessment of PCB, dioxin, and furan transfer through animal production systems requires two broad assumptions. First, the amount of contaminant transferred through any step of the process is proportional to concentration. That is, a change in soil concentration results in a proportional change in animal product concentration. Second, the significant toxicological effects are those related to the long-term exposure; therefore, temporal variations in animal product contaminant concentrations caused by variability of contaminant concentrations in farm soil are not significant.

4.4.1 Factors Controlling PCB, Dioxin, and Furan Concentrations in Animal Products

Persistent organic pollutants such as PCBs, dioxins, and furans accumulate in fat and fat-containing products of animals. For this reason, pathways that include meat, milk, and eggs are often considered the most important sources of human exposure when persistent compounds are present in terrestrial environments (Furst et al., 1990; Theelen et al., 1993).

Contaminant concentrations in animal products resulting from contaminated soil are functions of:

- Feeding and management practices that determine the direct and indirect access of animals to the soil.
- Physiological factors that determine the absorption and disposition of the ingested contaminants in the animal (Fries, 1995; Fries, 2001; Sweetman et al., 1999).

The degree to which animals are in direct contact with the soil is the most significant management variable affecting animal exposure to environmental contaminants. Under current commercial farming practices along the river, contact with soil occurs primarily through grazing because no animal housing and holding facilities are located on the floodplain (with the possible exception of poultry in Reach 9). The facilities that were observed had concrete floors rather than earthen floors.

Potential exposure of grazing animals to floodplain soil depends on a number of factors:

- Fraction of the year that the animals are on pasture.
- Amount of forage available per animal.
- Fraction of the diet that consists of feed grown on the floodplain.
- Whether animals are offered feeds other than pasture.

Given the agricultural practices in the area and the fate of PCBs, dioxins, and furans, transfer of contaminants from soil to animal products occurs via two important pathways:

$$\text{Soil} \rightarrow \text{Vapor/Particulate} \rightarrow \text{Plant} \rightarrow \text{Animal} \rightarrow \text{Product} \qquad \text{(a)}$$

and

$$\text{Soil} \rightarrow \text{Animal} \rightarrow \text{Product} \qquad \text{(b)}$$

There is no evidence for the translocation of PCBs, dioxins, and furans directly from soil to animal feed crops. Instead, contamination of feed crops described in the first pathway is a plant surface phenomenon resulting from deposition of soil dust on plants and adsorption of vapor-phase contamination to plant surfaces. Section 4.3 describes the method used to estimate concentrations in corn silage and grass-based feeds. Concentrates, such as grains and protein supplements, were assumed to have zero concentrations because these materials are not produced in the floodplain and are not expected to have contaminant concentrations above background levels. Pathway (b) relates to soil ingestion by grazing animals and poultry with access to floodplain soil. For convenience, such poultry are referred to as "free-range" throughout this assessment.

The absorption and transfer of contaminants to meat, milk, and eggs depend upon the nature of the contaminant and physiological status of the animal. It is generally assumed that absorption of a contaminant from a specific matrix is relatively constant, but the absorption of that contaminant from different matrices, such as normal feed and soil, may vary. High concentrations of organic matter in soil reduce volatilization and transfer of PCBs to plants, but no effect of soil organic matter on animal absorption of PCBs has been demonstrated (Fries, 1995).

A number of complex processes and variables control contaminant absorption and partitioning in animals. For this reason, there are uncertainties in the prediction of contaminant concentrations in a single animal or small group of animals over a short time period. Studies of dairy cattle demonstrate that it is reasonable to use average transfer coefficients for large animal populations (Sweetman et al., 1999). Because the long-term average concentrations of contaminants in milk fat and beef fat are important to the evaluation of cancer risk and chronic hazards, relatively simple transfer coefficients can be used to relate contaminant intake of animals to tissue accumulation or to elimination through milk. However, the variability is important to consider when evaluating backyard farms (single cows) because an individual is exposed to a single location and source, which may represent an extreme when determining product concentrations (Goldman et al., 2000).

Information concerning the absorption and elimination of PCBs, dioxins, and furans by farm animals has increased substantially in recent years (Fries et al., 1999; McLachlan, 1993; McLachlan and Richter, 1999; Stephens et al., 1995; Thomas et al., 1999). However, these observations do not include all PCB congeners and animal species evaluated in this assessment, and it was necessary to predict absorption and transport from physical properties such as log K_{OW} in some cases.

4.4.1.1 Dairy

The transfer coefficients published in the literature and regulatory guidelines to characterize quantitatively the transport of persistent contaminants from diet to milk or milk fat include bioconcentration factors (BCF), biotransfer factors (BTF), and carry-over rates (COR) (Thomas et al., 1999; Fries and Paustenbach, 1990; McLachlan, 1993; Travis and Arms, 1988). The basic assumptions in the measurement and application of these coefficients are that the animals are at steady state and that levels of contamination in the environmental are stable. The coefficients are defined by the following equations:

$$BCF = C_{MF} / C_{Diet} \quad (1)$$

where C_{MF} and C_{Diet} are concentrations of contaminants in milk fat and in diet dry matter, respectively.

$$BTF = C_{Milk} / I \quad (2)$$

where C_{Milk} is the concentration of contaminants in whole milk and I is the intake of contaminants.

$$COR = 100 * Q_{milk} / I \quad (3)$$

where COR is percent (%), Q_{milk} is the quantity of contaminant eliminated in milk, and I is intake of contaminants.

Measurements or reasonable estimates of feed intake, contaminant concentration in feed, milk production, fat content of milk, and contaminant concentration in milk fat are needed to calculate any of the coefficients. All coefficients can be converted to any of the others if values for the five parameters are available. The differences in the underlying assumptions of the coefficients are not important in practice, and conclusions will be similar unless the animals or conditions deviate markedly from normal practice. For example, animals not fed an adequate diet would produce less milk, and the coefficients could be affected differently by this deviation from normal practice.

4.4.1.2 Beef

The accumulation of persistent organic compounds in beef has not been studied as comprehensively as accumulation in milk. Elimination in non-lactating animals is slow. However, contaminant concentrations may be altered because the body fat pool in which the contaminant is distributed increases over the life of the animal due to growth and fattening. With few exceptions, studies of bioaccumulation in beef and other tissues have not been conducted long enough to reach a stable concentration. The equations for BTF and BCF can be adapted for tissues, but COR does not have a tissue analogy unless it is viewed as the body burden divided by lifetime intake (McLachlan, 1994). The BTF approach has been used, but there are limitations in applying it to growing animals since BTFs are based on a constant intake (units/day), whereas feed and residue intake is a function of body weight (Subcommittee on Feed Intake, 1987).

Five long-term studies (>100 days) of accumulation of persistent organic contaminants in fat of growing cattle were identified in reviews (Fries, 1995; Fries, 1996a). Three studies were designed specifically to evaluate chlorinated pesticides. Information regarding the accumulation of Aroclor 1254 and several dioxins and furans was obtained from incidental measurements made during chronic toxicity studies of sewage sludge and pentachlorophenol. In all cases the BCFs in body fat were approximately equal to the BCFs for those compounds in the milk of dairy cows (Fries, 1996a). The general validity of these empirical observations is supported by simulations of feed intake and growth of animals from weaning to slaughter weight (Fries, 1996b). Increases in the quantity of body fat parallel increases in accumulated feed intake so that relatively stable concentrations are attained in body fat if the concentration in the diet is constant during growth. Since most animals are slaughtered for meat at about 2 years of age before reaching maturity, BCFs derived for milk fat are also applicable to beef fat if more specific information is not available.

4.4.1.3 Other Mammalian Species

Sheep, goats, and deer are the other mammalian species evaluated in this assessment. Sheep and goats are not raised in the floodplain at this time, but these species are being evaluated in the event of changes in land use. Deer are known to inhabit the floodplain, and deer hunting is known to occur in this area. There are a few studies available for persistent organic compounds in sheep and goats. The sheep studies involved chlorinated pesticide accumulation in body fat (Fries, 1996a), and a goat study evaluated TCDD excretion in milk (Arstilla et al., 1981). The limited data from sheep and goats provided BCFs comparable to the BCFs for beef and milk, respectively. There is no literature reporting controlled studies evaluating accumulation of persistent organic compounds in deer. Therefore, the BCFs for milk and beef in cattle are used to evaluate potential milk and meat accumulation by these species in this assessment.

4.4.1.4 Poultry

The transfer coefficients for both tissue and eggs in chickens are expressed as BCFs. Literature on accumulation of PCB mixtures in poultry tissues and eggs is fairly extensive (Fries et al., 1977). However, many of the studies involve Aroclors that are less chlorinated than Aroclor 1260. Dioxins and furans were the subject of a long-term feeding study with egg-laying chickens in which the experimental diets contained dioxin- and furan-contaminated soil (Stephens et al., 1995). The findings of this study are directly applicable to the free-range poultry egg scenario in this assessment because soil ingestion is the primary exposure pathway for poultry. Stable concentrations in eggs are generally attained within 6 to 8 weeks after introduction of the contaminant in the diet (Fries et al., 1977; Stephens et al., 1995). Meat from chickens is generally obtained from young growing birds (broilers). A study reporting BCFs of PCB, dioxin, and furan congeners was published recently (Hoogenboom et al., 2004).

Concentrations in eggs have been expressed on both a whole egg and a lipid basis in the literature. Because the lipid content of eggs is generally constant, conversion from one expression to the other is simple and reliable. Expression of concentrations on a whole egg basis is most appropriate for risk assessment because people typically consume the whole egg.

4.4.2 Model Assumptions and Parameter Values Used to Estimate PCB, Dioxin, and Furan Concentrations in Animal Products

The concentration of contaminants in milk fat, body fat, and eggs are estimated using the BCF approach described previously. In a simplified form, the equation for the calculation is:

$$C_{Prod} = BCF*C_{DM} \quad (4)$$

Where:

C_{Prod} = concentration of contaminant in the fat of the animal product

BCF = appropriate BCF for the congener, species, and product

C_{DM} = concentration of the contaminant in the total dry matter of the diet.

Because C_{DM} is a weighted average of the concentrations of all components in the diet, Eq (4) can be expanded to:

$$C_{Prod} = (BCF*BA_{soil}*D_{Soil}*C_{Soil}) + (BCF*D_{Sil}*C_{Sil}) + (BCF*D_{Grass}*C_{Grass}) + (BCF*D_{Con}*C_{Con}) \quad (5)$$

Where:

C_{Prod} = concentration of contaminant in animal fat

BA_{soil} = factor for the reduced bioavailability of contaminants in soil relative to feed (assumed to be 1 in the point estimate assessment). The uncertainty associated with this assumption is discussed in Section 7.

D_{Soil} = fraction of the dry matter intake that is soil

C_{Soil} = the concentration of contaminant in soil (pastured animals only)

D_{Sil} = the fraction of the dry matter intake that is corn silage

C_{Sil} = the concentration of contaminant in corn silage on a dry weight basis

D_{Grass} = the fraction of the dry matter intake that is grass-based feeds

C_{Grass} = the concentration of contaminant in grass-based feeds on a dry weight basis

D_{Con} = fraction of the dry matter intake that is concentrate

C_{Con} = the concentration of contaminant in concentrate

Grass-based feeds (i.e., hay, grass silage, and pasture) were assumed to have the same soil-to-plant TFs. A different TF was used for corn silage because site-specific data indicate that soil-to-grass TFs exceed soil-to-corn silage TFs. See Section 4.3.3 for a detailed discussion of these TFs.

Soil consumption refers to soil, which may or may not be adhering to pasture grass, consumed while grazing. Studies by Thomas et al. (1999) for PCBs, McLachlan (1993), and McLachlan and Richter (1999) for PCBs and PCDD/Fs used the normal background contaminants in feeds, which may have included contaminated soil adhering to the feeds.

Concentrates are grains, protein supplements such as soybean meal and fish meal, and various mineral and vitamin supplements that are produced commercially elsewhere. Thus, the term for concentrates is assumed to be zero because this component is not produced in the floodplain, and the term for soil is assumed to be zero in situations where animals do not have access to floodplain soil.

4.4.2.1 Intake Factors

The BCF approach does not require knowledge of the amounts of feed consumed. Rather, only the fraction of the diet that is contributed by each component must be known in order to calculate the average contaminant concentration of the total diet. The BCF approach does assume that animals have adequate amounts of feed available to support normal growth and production.

Table 4-7 lists annual average relative intake estimates for major feed components and soil for the animal species and production systems evaluated in this assessment. The highest and lowest reasonable estimates are listed along with a central estimate. The values are expressed as percentages of total dry matter intake. Roughages refer to corn silage and grass-based feeds. The intake of soil refers only to animals and free-range poultry exposed to floodplain soil. The quantitative value for animal intake of a given feed type is presented as the yearly average. One factor that determines this average is the fraction of the year that a feed is offered to the animals.

The values in Table 4-7 represent professional judgment based on knowledge of local practices and conditions, generally accepted good feeding and management practices for each species, and adaptation of measurements, such as soil ingestion, in the scientific literature to the local conditions. The following sections provide a brief rationale for intake estimates.

4.4.2.1.1 Commercial Dairy

Intake values for lactating dairy cattle were derived from estimates provided in interviews with a local farmer and a representative of the Farm Service Agency (Noble, 2000; Williams, 2000). The range of values is consistent with the values reported for cows not assigned to experimental diets at the U.S. Department of Agriculture, Beltsville, MD (Fries et al., 1999). Lactating cows are not pastured on any of the commercial farms at this time. Thus, there is no ingestion of floodplain soil. The roughage portion of the diet consists primarily of corn silage, but the proportions of roughages can vary depending on the price and availability of different roughages and on the preferences of the individual farmers. In this assessment, the roughage diet was assumed to consist entirely of corn silage. The practice of substitution of grass-based roughage for the corn silage was examined in a sensitivity analysis for the commercial dairy scenario (see Section 5.1).

Non-lactating replacement animals are expected to attain concentrations of contaminants in body fat that exceed those of the lactating cows on the same farm. This is a result of the increased contaminant intake due to soil ingestion in the case of pastured animals, and because roughage in the form of grass-based feed would be a larger portion of the diet than with lactating animals. The body fat concentrations of contaminants in these animals would be similar to pastured commercial beef cattle. If these animals were slaughtered for beef consumption, the resulting human exposure would be similar to the commercial beef scenario. If the replacement animals were used for milk production, their body fat concentrations would tend to decline to the level of the lactating herd after calving and the initiation of milk production. This phenomenon is only important if the predicted concentrations in the animals entering the herd are significantly greater than the predicted concentrations in the lactating herd.

4.4.2.1.2 Backyard Dairy

The small-scale backyard dairy cattle scenario (consisting of a small number of cows) will differ from commercial operations in several important ways. The animals are more likely to be pastured in the floodplain with associated ingestion of soil, and it is typical that less concentrate will be fed. However, if some concentrates are fed, the soil consumption by the backyard cow will be lower because feeding concentrates reduces soil consumption by cattle (Healy, 1968). The roughage portion of the diet consists entirely of pasture or hay. Silage would not likely be fed for two reasons:

- The high fixed costs for harvesting equipment and storage facilities.
- When silage, an anaerobic product, is exposed to air, mold growth will occur in a few days with a loss in palatability and, on occasion, the production of toxins. With backyard cattle or a herd of small animals (e.g., goats), it might be difficult to remove enough silage every day to prevent mold growth.

4.4.2.1.3 Commercial Beef and Surplus Dairy - Growing Cattle (from Weaning to 2 Years)

Intake estimates for growing cattle apply to non-lactating cattle grazing in the floodplain. Yearly average soil intakes as great as 6% of dry matter intake have been recorded (Healy, 1968; Fries, 1996b). However, it is likely this value is too high for the conditions in the Housatonic River area. First, the grazing season would not exceed 6 months, and soil ingestion values have been reduced accordingly in this assessment. Second, soil ingestion rarely exceeds 2% of dry matter intake if the animals are offered supplemental feed in the form of roughages or concentrates (Healy, 1968). Good management practices include feeding a concentrate to the young dairy replacement animals and offering hay or silage when grass is sparse. The best estimate selected for use in this assessment was based on the assumption that supplemental feed is offered when grass is inadequate, and that the grazing season is limited to 6 months.

4.4.2.1.4 Backyard Beef

Management of both commercial and small-scale backyard beef cattle is expected to be less intense than the management of dairy cattle. Concentrates and corn silage are less likely to be fed to backyard animals, and the greater dependence on grass-based forages could increase the level of contaminant intake. When the animals are not on pasture, roughage could be corn silage or hay for commercial beef herds, but would be only hay for backyard animals (see Section 4.4.2.1.2).

4.4.2.1.5 Commercial and Backyard Free-Range Poultry

No measurements of soil ingestion by free-range poultry were found in the literature. A 10% value was assumed in a study of dioxin and furan absorption by egg-laying hens (Stephens et al., 1995). Experimental data supporting the 10% value are provided by the reported 9% soil intake by wild turkeys, which are the most reasonable surrogate for chickens found in the literature (Beyer et al., 1994). Poultry might also ingest contaminants taken up by soil-dwelling worms and arthropods, but there is no information in the literature to provide an estimate of the significance of this potential source of contamination.

4.4.2.1.6 Commercial and Backyard Goats

Feeding systems for dairy goats are qualitatively similar to those for lactating dairy cows (Ensminger, 1991). Although nutritionally satisfactory, it was assumed that silage would not be fed to commercial or backyard goats for the same reasons given for backyard dairy cattle in Section 4.4.2.1.2. Goats would be housed outside the floodplain because the needed housing and milking facilities would be subject to loss or damage if built in the floodplain. It was assumed that goats would not be pastured in the floodplain because of the distance of the permanent housing from the floodplain. Thus, soil ingestion was not a factor in exposure to floodplain contaminants.

4.4.2.1.7 Commercial and Backyard Sheep

Sheep can be maintained on all-roughage diets under most circumstances (Ensminger, 1991). Concentrates may be fed to lambs being finished for slaughter and ewes in late pregnancy. The reduction in exposure due to concentrate consumption would result in lower body fat concentrations. The soil intake values in Table 4-7 are from a compilation of the extensive literature concerning soil ingestion by grazing sheep (Fries, 1996a). As with cattle, the grazing season was assumed to be 6 months and the published yearly averages were reduced accordingly. It was assumed that other grass-based feeds would be offered to the sheep when pasture grass is inadequate.

4.4.2.1.8 Deer

The diets of deer consist entirely of roughage. Deer are opportunistic in their dietary habits and may consume a variety of plant materials, such as leaves and shoots of woody plants, fruits and nuts, broad-leafed weeds, and grasses (Clancey and Nelson, 1991; Hiller, 1996). Like cattle, deer likely ingest a small amount of soil during feeding. Soil ingestion by white tail deer, the only deer species found in the Housatonic River area, in summer was reported to be <2% of dry matter intake (Beyer et al., 1994). Similarly low values were also found for elk and mule deer, species that have comparable feeding habits. The range of estimates in Table 4-7 reflects the variation that might be found in soil ingestion rates among a group of animals.

4.4.2.2 Bioconcentration Factors

Information regarding BCFs for PCB mixtures and for dioxin-like PCB, dioxin, and furan congeners in tissues and products is reviewed in this section. This information was used to estimate the mammalian and avian BCFs used in this assessment, which are summarized in Table 4-8a.

Data on transfer from diet to milk of dairy cattle are more abundant than data for accumulation in tissues of cattle or other species. However, even in the case of transfer from diet to milk, data are not available for some PCB congeners and mixtures. This section describes the methodology used to predict BCFs in the absence of experimental data.

4.4.2.2.1 Mammalian BCFs: PCB Mixtures

PCB contaminants in soil and other environmental samples from the Housatonic River floodplain have congener compositions that are more typical of Aroclor 1260 than other Aroclors. There are no published data on the transfer from diet to milk or tissues of cattle in which the contaminants are quantified as Aroclor 1260. Tuinstra et al. (1981) dosed cows with Aroclor 1260, but concentrations were reported as individual congeners. BCFs for the congeners ranged from 0 to 6.2.

Data on the behavior of PCB mixtures in cattle are available for Aroclor 1254, which is slightly less chlorinated than Aroclor 1260 (Fries, 1996a; Willett et al., 1990). BCFs were calculated from studies in which animals were dosed with constant concentrations of Aroclor 1254 for 60 days or more. The range of BCFs was from a low of 1.5 to a high of 3.6 with a median value of 3.0 (Fries, 1996a). Some of the reported variations in BCFs are due to the different methods used to quantify PCB mixtures, which can lead to differences in estimated BCFs that vary by two- or three-fold (Willett et al., 1990).

BCFs on the low end of this range were measured when animals were exposed to dietary PCB concentrations of 5 to 50 ppm. BCFs on the high end of this range were measured when animals were exposed to dietary PCB concentrations below 1 ppm. The grass and corn concentrations anticipated on current and possible future agricultural parcels are closer to 1 ppm than 5 to 50 ppm. Therefore, BCFs on the high end of the range measured in the studies of Aroclor 1254 are more applicable to the GE/Housatonic River Site. In this assessment, the maximum BCF value of 3.6 for Aroclor 1254 was adopted for Aroclor 1260 rather than the median value of 3.0 for conservatism because of the limited BCF literature specific to Aroclor 1260. The importance of this assumption, along with assumptions about PCB congener BCFs, is evaluated in the probabilistic risk characterization for the commercial dairy scenario (see Section 6).

4.4.2.2.2 Mammalian BCFs: PCB Congeners

There are no widely recognized BCFs or other transfer coefficients for the individual PCB congeners; however, three studies were identified that contain sufficient diet-to-milk transfer data to allow calculation of BCFs for PCB congeners. None of the studies includes the complete range of dioxin-like PCBs, nor do the studies include all of the other congeners detected in floodplain soil. Travis and Arms (1988) derived equations to predict biotransfer factors in milk and beef based on log K_{OW}. However, these equations are not applicable to compounds with log K_{OW} values > 6 (McLachan, 1993). Because many of the PCB congeners present in Aroclor 1260 have log K_{OW}s greater than 6, it was necessary to develop alternative predictive relationships for use in this assessment.

Two studies of the transfer of PCB congeners from diet to milk measured background concentrations that occur normally in feed (McLachan, 1993; Thomas et al., 1999). The third study involved dosing cows with Aroclor 1260 for 60 days (Tuinstra et al., 1981). This study duration is considered sufficient to provide a stable concentration of many persistent organics in milk (Willett et al., 1990; Fries et al., 1999). The data for all congeners detected in one or more of the studies are summarized in Table 4-8b. In addition to the diet-to-milk transfer data, log K_{OW} values and other information used in developing the prediction equations are presented.

The study of Tuinstra et al. (1981) consisted of a control group and two groups of three cows each that were dosed at two concentrations in the diet. The fraction of each congener transferred to milk was independent of concentration, and the results from the two dose groups were combined. Thus, the BCFs in Table 4-8b were derived from six observations for each congener. This study provided no data on the dioxin-like PCB congeners. Except for the mono- and di-chlorinated congeners with BCFs less than 1.0, coefficients of variation fell within a range of 8 to 12%. The maximum BCF for a congener was approximately 6.0, which is comparable to BCFs for other persistent halogenated compounds when determined by similar methods (Fries, 1996a). However, the BCFs in this study were lower than those calculated from the two studies discussed above in which the contaminants were present in the feed.

McLachlan (1993) used a single cow that was presumed to be in equilibrium with the environment. Mass balance was measured twice with a 1-week interval between measurements. Results were reported by homolog groups and three persistence classes rather than as individual congeners. The identity of the congeners included in the persistent and semi-labile classes was provided, but the labile congeners were not identified. McLachlan reported CORs for the persistent and semi-labile congeners. Information on dry matter intake and fat production was available for calculation of BCFs from these CORs, and these values are presented in Table 4-8b. The amount of contaminant excreted in milk was greater than the amount ingested for at least two homolog groups. This finding suggests that there were measurement errors, or that the cow was mobilizing PCBs from storage in the body.

Five cows fed normal diets were sampled weekly for 15 weeks in the study performed by Thomas et al. (1999). The average CORs for 19 congeners were reported. The coefficients of variation ranged from 14 to 38%. The data in this study, unlike McLachlan (1993), were reported for individual congeners, but fewer congeners were detected. As in McLachlan (1993), several congeners had CORs that exceeded 100% of intake.

Except for the labile congeners with low BCFs, the BCFs determined in the dosing study (Tuinstra et al., 1981) were considerably lower than those determined in the two studies that measured background concentrations of PCBs. This finding might reflect insufficient time for the dosed animals to establish equilibrium, or it might indicate that animals in the other studies were not at equilibrium and were losing PCBs from body stores. There is no basis to determine which of the studies provides the most reliable information. Data from Thomas et al. (1999) were selected as a conservative basis for estimating the BCFs for the dioxin-like PCBs.

The model for fate of lipophilic compounds in cows proposed by McLachlan (1994) suggests that the fraction of an ingested compound absorbed from the gastrointestinal tract is a constant for a given matrix. Both McLachlan (1993) and Thomas et al. (1999) measured absorption across the gut for a number of congeners. If animals are in physiological equilibrium, the amounts excreted in milk cannot exceed the amounts absorbed. The fraction absorbed would provide the basis for calculating the upper limit of the BCF if one assumes there is no net retention or metabolism at equilibrium. The upper limit can be calculated with the equation:

$$BCF_{Max} = A*I_{feed}/F_{milk} \quad (6)$$

where A is the fraction of a compound absorbed, I_{feed} is the amount of dry matter consumed, and F_{milk} is the amount of milk fat produced. Average dry matter intake was 19.3 kg/d and milk fat production was 1.08 kg/d (Thomas et al., 1999). Thus the maximum BCF would be

$$BCF_{Max} = A*19.3/1.08 = A* 17.9 \quad (7)$$

The calculated maximum BCFs for the 19 congeners with absorption data reported by Thomas et al. (1999) are presented in Table 4-8b. The results suggest that the McLachlan values for persistent congeners are at least 50% higher than would be expected if intake and elimination were in balance. The higher values in the Thomas study generally do not exceed the theoretical maximum with the exception of two coplanar congeners (Table 4-8b).

Experimentally derived BCFs are available for only 6 of the 12 coplanar congeners, and values are also lacking for some of the other congeners observed in site data. Thus, it is necessary to develop a predictive methodology for these congeners. Two factors that affect transfer to milk or tissues are the fractional absorption from the gastrointestinal tract and metabolism. Log K_{OW} is often suggested as a method to predict absorption of compounds for which there are no direct measurements. Thomas et al. (1999) and McLachlan (1993) demonstrated an inverse relationship between absorption and the log K_{OW} of PCB congeners. This inverse relationship for the data of Thomas et al. (1999) is shown in Figure 4-5.

PCB congener structure influences metabolism in biological systems and, consequently, BCFs. McLachlan (1993) viewed chlorine substitutions in the 4,4' (para) positions as an important factor that contributed to the persistence of congeners in cows. Because all dioxin-like PCBs have chlorines in the 4,4' positions, little metabolism is expected. Thomas et al. (1999) refined this observation and proposed a classification system based on chlorine substitution pattern for scoring the propensity for PCB congeners to be metabolized. Congeners with a score < 2 had metabolism rates of < 10%, scores of 2 had varying levels of metabolism from 10 to 90%, and congeners scored > 2 were completely metabolized. The metabolism scores calculated by the Thomas et al. (1999) method are listed in Table 4-8b.

The following equation was used to predict BCFs:

$$BCF_{Pred} = A_{Pred} * (I_{Feed}/F_{Milk}) * M \qquad (8)$$

Where:

BCF_{Pred} = predicted BCF
A_{Pred} = predicted fraction of the congener absorbed
I_{Feed} = amount of feed dry matter consumed
F_{Milk} = milk fat production
M = metabolism factor.

The regression equation shown in Figure 4-5 was used to estimate absorption. The feed intake and milk fat production values were derived from Thomas et al. (1999). According to the Thomas et al. (1999) methodology, a metabolism factor of 0.5 was assigned to the four congeners in metabolism class 2, and a factor of 1.0 was assigned to other congeners. Values for log K_{OW} were taken from Brodsky and Ballschmitter (1988), but this study does not provide log K_{OW}s for three congeners. To avoid using K_{OW}s estimated by different laboratories and methods, these three congeners were assigned the average absorption value for congeners with the same number of chlorines because log K_{OW} tends to be correlated with the degree of chlorination (Brodsky and Ballschmitter, 1988). The predicted BCFs are listed in Table 4-8b.

4.4.2.2.3 Mammalian BCFs: Dioxins and Furans

Fries et al. (1999) and EPA (2000) reviewed studies relevant to the evaluation of dioxin and furan transfer to milk. The BCFs for dioxins and furans presented by EPA (EPA, 2000) were based on results with a single animal (McLachlan et al., 1990). Additional data are now available in studies by McLachlan and Richter (1999) and Fries et al. (1999). These additional data also include measures of variation in BCF estimates. The results of other studies (summarized by Fries et al., 1999) are generally consistent with the results of the three studies used for estimating BCFs in this assessment. But the other studies lack data on all dioxins and furans, or do not include all of the necessary information for calculating BCFs, such as the amounts of feed consumed or the milk fat produced.

The results of the three studies used for derivation of the dioxin and furan BCFs in this assessment are shown in Table 4-8c. McLachlan et al. (1990) included measurements of mass balance of dioxins and furans in a single cow with normally occurring background contaminant concentrations. The study by Fries et al. (1999) included four cows of various production levels that were dosed with pentachlorophenol-treated wood. The study by McLachlan and Richter (1999) involved four cows with background concentrations of dioxins and furans for calculation of BCFs. Because the results were expressed as CORs, the BCFs were calculated from the CORs using data on feed intake and milk production provided in the study. The average fat content of milk for the breed of cow used was assumed because this information was not provided.

The results of the three studies are in good agreement, and there are no consistent trends in the differences among the studies. Therefore, the mean values of the three studies were adopted as the BCF values for use in this assessment. Coefficients of variation for the two studies involving four animals per group are also shown in Table 4-8c. Typically, the coefficients ranged from 25 to 40% for individual congeners in each of the studies.

4.4.2.2.4 Poultry BCFs

BCFs for poultry adipose tissue and whole eggs are summarized in Table 4-8a. Literature concerning accumulation of PCB mixtures in poultry tissues and eggs is fairly extensive (Fries et al., 1977). However, the work on mixtures did not include Aroclor 1260, the mixture that most resembles the PCBs in the Housatonic River floodplain soil. Many of the studies involved the less-chlorinated Aroclors, and are not applicable to Aroclor 1260. Generally, persistence increases and absorption decreases with increasing chlorination. Fries et al. (1977) performed long-term feeding studies with Aroclors 1254 and 1268 in egg-laying hens. The average results for these two mixtures were used to estimate the BCFs for Aroclor 1260 in this assessment.

Dioxins and furans were the subject of a long-term feeding study with egg-laying hens (Stephens et al., 1995). The study included two groups: a low-dose group fed soil from a contaminated environmental site, and a high-dose group fed the same soil spiked with some, but not all, of the congeners present in the low-dose soil. Because the dioxins and furans were incorporated in soil, the findings are directly applicable to situations involving free-range poultry, which are exposed directly to soil. The spiked congeners in the high-dose group had BCFs approximately double those of the low-dose group. This finding suggests that aging of contaminants in soil may reduce bioavailability. The BCFs for eggs adopted for this assessment were those determined in the low-dose group, or the average BCF for the two groups when the congeners were not spiked in the high-dose group.

2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) was not detected in the low-dose group soil. The high-dose group soil was spiked with 2,3,7,8-TCDD and, as noted above, the BCF calculated from the high-dose group is expected to be higher than the BCF in the low-dose group soil. Therefore, the 2,3,7,8-TCDD BCF from the spiked soil was reduced to reflect the spiked to non-spiked ratios of other congeners. Results for 1,2,3,7,8-pentachlorodibenzofuran differed significantly between the two-dose groups even though this congener was not spiked. The soil concentrations in both dose groups were near or below the quantification limits; therefore, a BCF was not estimated for use in this assessment. However, the potential contribution of this congener to risk estimates is examined in Section 7.

The BCFs for tPCBs and dioxin-like PCB, dioxin, and furan congeners in adipose tissue were adopted from a study in which contaminated feed was fed to 3-week-old birds for 7 days (Hoogenboom et al., 2004). Although Stephens et al. (1995) obtained adipose tissue data for dioxins and furans, the data from Hoogenboom et al. (2004) were considered more suitable because most poultry meat consumed by the general population is derived from growing birds that are approximately 6 weeks old.

No studies providing information on BCFs for dioxin-like PCBs in eggs were identified. BCFs for PCB congeners in eggs were estimated using the relationship between the BCFs for dioxins and furans in adipose tissue (Hoogenboom et al., 2004) and eggs (Stephens et al., 1995). The regression model and equation expressing this relationship is shown in Figure 4-6. The model fit is reasonably good, although it is not highly statistically significant. A similar analysis involving cross-species extrapolation (Figure 4-7) provides a better fit, but is subject to uncertainties associated with the extrapolation.

Expression of concentrations on a whole egg basis is most appropriate for risk assessment because people normally consume the whole egg; thus, BCFs applicable to whole eggs were used in this assessment. BCFs for tissues or meat that were used in this assessment are based on concentrations in extracted lipid.

4.5 ESTIMATED CONTAMINANT CONCENTRATIONS IN FOOD

Estimated animal product and plant contaminant concentrations are presented in this section and compared to results from recent surveys of the U.S. milk, beef, and poultry meat supply (Winters et al., 1996a and 1996b; Lorber et al., 1998; Ferrario et al., 1997). Two sets of estimates were calculated, assuming tPCB concentrations in soil of 0.5 mg/kg and 2 mg/kg.

In Attachment D.2, estimated dairy concentrations are compared to the detection limit from the 1993 sampling program for Housatonic floodplain area dairy farms (see Section 2 for discussion of these data). Concentrations estimated in this assessment at assumed tPCB concentrations of 0.5 mg/kg and 2 mg/kg with fractions in the floodplain of 1 do not exceed the likely detection limit from this study. Also, the bioaccumulation model used in this assessment was used to predict milk concentrations on the DeVos dairy farm under historic conditions, and results were compared to PCB concentrations measured in milk samples collected from this farm in the early 1970s. The model predictions compare favorably with measured milk concentrations, with predictions differing from measured concentrations by a factor of about five.

4.5.1 Commercial and Backyard Dairy

Tables 4-9a and 4-9b present commercial dairy and backyard dairy predictions, respectively. Concentrations were not predicted for surplus dairy cattle that may be slaughtered for beef, but these concentrations would be expected to be similar to beef cattle concentrations, which are discussed in Section 4.5.2. Lorber et al. (1998) measured dioxins and furans and dioxin-like PCBs (PCB-77, PCB-105, PCB-118, PCB-126, PCB-156, PCB-157, and PCB-169) in the general pasteurized milk supply in the United States, and these mean background concentration data are provided in Tables 4-9a and 4-9b for comparison to predicted concentrations.

The Lorber et al. (1998) survey was not based on a random sample, limiting the ability to extrapolate results to the nation's milk supply (Lorber et al., 1998). However, the study appears to be the largest and most recent survey of the U.S. milk supply. The milk concentrations represent a mean concentration of eight grand composite samples collected from milk-producing facilities across the country (four samples collected over 1 year, with duplicates for each). The contribution of each region-specific milk sample to the grand composite sample was relative to the volume of milk sold in that region of the country. The mean TEQ concentrations from dioxin-like PCBs, dioxins, and furans for the national composite were slightly less than mean concentrations calculated from various sampling locations across the country. Mean concentrations were calculated using one-half the detection limit for non-detects.

For the commercial dairy farms scenario, total estimated milk fat TEQ at 0.5 mg/kg tPCBs was slightly less than mean TEQ concentrations measured in the background samples. Total estimated milk fat TEQ at 2 mg/kg tPCBs was slightly higher than the mean total TEQ in background. Most of the estimated TEQ was from PCB-126, with all exposure resulting from consumption of corn silage.

For backyard dairy operations, total estimated milk fat TEQ was approximately 10 to 30 times greater than the mean total background TEQ in the U.S. food supply (Lorber, 1998), assuming tPCB soil concentrations of 0.5 mg/kg and 2 mg/kg, respectively. Estimates for backyard operations differ from background to a greater extent than commercial farms, reflecting the backyard animals' greater exposure from soil and grass-based feed compared with the commercial farm animals' exposure from corn silage. As with the commercial dairy farm scenario, most of the estimated TEQ was from PCB-126, with about 94% of the intake of PCB-126 coming from grass consumption and 6% from soil consumption.

Schaum et al. (2003) reported average concentrations of persistent, bioaccumulative and toxic pollutants (PBT) in milk samples from the general pasteurized milk supply of the United States. These samples were collected more recently than those reported by Lorber et al. (1998), i.e., samples were collected in 2000 and 2001 versus 1996. Schaum et al. (2003) reported that average TEQ concentrations in the more recent samples were about 50% lower than concentrations in the previous samples. This 50% difference may represent a true decline in concentration because it exceeds relative percent differences (RPDs) of 5 to 16% for TEQ in duplicate samples. However, Schaum et al. (2003) explain that this conclusion is uncertain because of the difficulty in establishing lipid concentrations in both studies, and they do not provide a statistical comparison of the two data sets. Schaum et al. (2003) did not find significant differences in the percent contribution of individual congeners to total TEQ between the two studies.

4.5.2 Commercial and Backyard Beef

Tables 4-9c and 4-9d include commercial beef and backyard beef estimations, respectively.

Winters et al. (1996a; 1996b) measured dioxin-like PCB congeners (PCB-77, PCB-118, PCB-105, PCB-126, PCB-156, PCB-157, and PCB-169) and dioxins and furans in samples of back fat (subcutaneous) from beef animals at U.S. slaughter establishments. Winters et al. (1996a) explained that humans do not typically consume back fat, but concentrations in back fat are likely to be the same as concentrations in other edible, high fat areas of the body. These mean background concentration data are provided in Tables 4-9c and 4-9d for comparison to estimated concentrations.

Winters et al. (1996a; 1996b) studied samples from 63 individual animals, with the number of carcasses sampled per animal class (e.g., steers, bulls, heifers, dairy cows, beef cows) based on the proportion of each class in the total beef production for the study year (1993). This approach allows for extrapolation to a national mean based on this proportion. One-half the detection limit was used for non-detects when calculating the mean, lipid-adjusted TEQ concentration of each coplanar PCB in back fat. Some dioxins and furans were below the detection limit in all samples and many were below the detection limit in many samples. This suggests that using half the detection limit may overestimate background.

The total beef fat TEQ concentration estimated using an assumed floodplain soil concentration of 0.5 mg/kg tPCBs was approximately 10 times higher than mean total TEQ concentration in the U.S. food supply (Winters et al., 1996a). The total beef fat TEQ concentration estimated using an assumed floodplain soil concentration of 2 mg/kg tPCBs was approximately 30 times higher than the mean total TEQ in the U.S. food supply. Note that the non-linear regression models used to estimate congener concentrations result in the non-linear increase in TEQ concentrations relative to tPCB concentrations. Most of the estimated TEQ was from PCB-126, with about 80% of the animals' intake of PCB-126 coming from grass consumption, 15% from soil consumption, and 5% from corn silage consumption.

There are a number of factors that might explain why predicted beef fat total TEQ estimates are higher than the national mean TEQ, some of which apply to other food types, including:

- Use of conservative estimates for the BCFs.
- Body fat change associated with the fattening period prior to slaughter when the diet consists of a high proportion of concentrate.
- Weighting of the national beef sample to represent national production, resulting in a significant proportion of the sample being from the High Plains (Nebraska, Colorado, Kansas, Oklahoma, New Mexico, and Texas), where lower than average ambient PCB concentrations might be expected.
- The national sample included cull dairy cows, which creates a low bias relative to estimates in this assessment because these animals lose some body fat TEQ through lactation.
- Differences between grass-based feed typically used on U.S. farms and site-specific grass data and soil-to-grass TFs (i.e., differences in grass species, proximity to the river channel, soil conditions, potential for flooding, and generally low correlation between soil concentrations and grass concentrations).

For backyard beef operations, total estimated beef fat was approximately 20 to 50 times greater than the mean total background TEQ in the U.S. food supply (Winters et al., 1996a; 1996b), assuming tPCB soil concentrations of 0.5 mg/kg and 2 mg/kg, respectively. Estimates for backyard operations differ from background to a greater extent than commercial farms because backyard animals are assumed to have greater soil and grass-based feed exposures than commercial animals. Most of the estimated TEQ was from PCB-126, with about 92% of the animals' intake of congener PCB-126 coming from grass consumption and 8% from soil consumption.

4.5.3 Commercial and Backyard Poultry

Estimated poultry meat and egg concentrations are presented in Table 4-9e and Table 4-9f. Ferrario et al. (1997) measured dioxin-like PCBs, dioxins, and furans in abdominal fat of poultry collected in slaughter establishments across the United States in 1996, and these data are included in the predicted poultry concentration tables for comparison. No systematic surveys of background concentrations in eggs were found.

Ferrario et al. (1997) included four poultry classes in their analysis (young chickens, light fowl, heavy fowl, and young turkeys), which when combined, comprise over 99% of the total poultry industry. Each class was sampled proportionally to its percent contribution to the poultry industry. The slaughter establishments and animals for each class were chosen randomly. Each sample consisted of poultry abdominal fat from three different animals and was analyzed for 17 dioxin and furan congeners and PCB congeners PCB-77, PCB-105, PCB-118, PCB-126, PCB-156, PCB-157, and PCB-169. All mean concentrations were calculated assuming that results below detection limits were present at one-half the detection limits. Results for each class were lipid-normalized and reported as TEQ concentrations in Table 4-9e. Although all results are presented, the young chickens are most comparable to the free-range exposure scenario evaluated in this assessment.

Estimated poultry meat total TEQ concentrations, assuming a tPCB soil concentration of 0.5 mg/kg and 2 mg/kg, were approximately 5 to 14 times higher than total TEQ concentrations in young chickens from the U.S. food supply, respectively. Two chickens from the U.S. food supply study with high PCB concentrations, which were later confirmed to be affected by contaminated ball clay added as an anti-caking agent to soy meal feed, were excluded from this comparison (Ferrario and Byrne, 2000). Estimates were based on a free-range poultry scenario involving soil exposure which represented 10% of the chickens' diet, whereas the commercial poultry included in the background study typically would have limited, if any, exposure to soil.

4.5.4 Home Gardens

Estimated home garden concentrations are presented in Table 4-9g. Estimates are based on 0.5 and 2 mg/kg in soil, the residential soil cleanup level established at the GE/Housatonic River Site. Site-specific acorn squash and fiddlehead fern concentrations were presented previously in Tables 4-4. Systematically sampled background data from the U.S. food supply are not available for comparison.

4.5.5 Other Exposure Scenarios

Estimated sheep meat, deer meat, and goat milk concentrations are not presented. Instead, potential human health risks associated with these products are discussed relative to the beef and dairy cattle risk estimates in Section 5.

4.6 HUMAN EXPOSURE ASSUMPTIONS FOR ESTIMATING AVERAGE DAILY DOSE AND LIFETIME AVERAGE DAILY DOSE

The first step in calculating noncancer hazard and cancer risk is to estimate ADDs and LADDs, respectively, for children (1 to 7 years old) and adults consuming foods contaminated with PCBs, dioxins, and furans. Infant consumption patterns differ from those of older children and adults, and home-produced food consumption rate information is not available for them (EPA, 1997). Risk to infants from breast milk exposure is addressed in HHRA Volume I, Section 10.

4.6.1 Dose Equations

The measured and estimated PCB, dioxin, and furan concentrations in food were combined with standard and site-specific exposure parameters to estimate doses. For each exposure scenario, RME and CTE doses were calculated. The RME approach used a mix of high-end and average values from exposure parameter distributions to arrive at an upper-bound risk estimate. The CTE approach used average values for exposure parameters and, thus, yielded estimates of average risk.

The general form of the ADD equation for food exposure pathways is:

$$ADD\left(mg/kg-d\right)=\frac{C\ \ x\ CR\ \ x\ (1-Loss)\times\ EF\times ED}{AT} \qquad (9)$$

where:

ADD	=	Average daily dose of tPCBs, dioxin-like PCB congener, dioxin congener, or furan congener from consumption of home-produced food (mg/kg-d)
C	=	Concentration of contaminant in home-produced food (mg/kg); these concentrations are based on a range of assumed tPCB concentrations that occur in agricultural areas within the floodplain
CR	=	Consumption rate of home-produced food (g/kg-d)
1- Loss	=	Factor(s) used to adjust for pre-cooking, cooking, and/or post-cooking loss of contaminants (unitless)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
AT	=	Averaging time (days)

To assess cancer risks, the LADD was calculated by averaging exposure over a 70-year lifetime. To assess the noncancer hazard, the ADD was calculated by averaging over the exposure duration.

4.6.2 Exposure Parameters

This section includes descriptions of exposure parameters listed in Table 4-10 that were used to estimate RME and CTE doses for each exposure scenario.

4.6.2.1 Food Concentrations of PCBs, Dioxins, and Furans

Concentrations of PCBs, dioxins, and furans in eggs and produce were estimated on a whole-food, or "as consumed" wet weight basis. Concentrations in dairy, beef, and poultry meat were estimated on a fat basis and converted to whole-food concentrations using the following equation:

$$C_{whole\ food} = C_{fat} \times Fraction_{fat} \quad (10)$$

RME and CTE fat content assumptions for cooked meat, cooked poultry, and milk are listed in Table 4-10. The mean fat content of milk from Jersey cows was used to estimate milk concentrations because at least one farm in the Housatonic area maintains Jersey cows, and these cows have a higher milk fat content than Holsteins, which also have been observed in the Housatonic River area.

4.6.2.2 Food Consumption Rates

Home-produced food consumption rates from EPA's analyses of the 1987-1988 U.S. Department of Agriculture (USDA) Nationwide Food Consumption Survey (NFCS) were used in this assessment (EPA, 1997).

The survey was conducted between April 1987 and August 1988. Respondents were asked to recall consumption patterns over the previous 7 days and to identify foods that were home-produced (Moya and Phillips, 2001). Consumption rates for consumers (i.e., those who reported consumption of the home-produced form of the food item of interest during the previous 7 days) were used. The reported weekly consumption rates were converted to daily consumption rates by dividing by 7 days and dividing by body weights reported by respondents (EPA, 1997). Therefore, all consumption rates are reported on a body weight-normalized basis (i.e., grams of food consumed each day per unit body weight).

The NFCS data represent the weight of food brought into the household that was used in some manner (EPA, 1997). Not all of this food is consumed. Some is lost during preparation and cooking. These losses were accounted for as described in Section 4.6.2.3.

EPA reports home-produced food consumption rates in several categories (EPA, 1997). Age-specific consumption rates were selected to assess animal product and home garden exposure pathways. Consumption rates were also available for "households who raise animals" and "households who garden, " but these rates were not used because they do not distinguish between child and adult consumption rates. However, the age-specific, home-produced food consumption rates are likely to be representative of members of households who raise animals and households who farm because between 77% and 91% of all respondents who consume home-produced food reported that they raised animals or gardened.

Home-produced food consumption rates were not always provided for all age categories, especially children. However, consumption rates were consistently available for the 20-to-39-year-old age group. Therefore, home-produced consumption rates for this age group and general population consumption rates were used to estimate child consumption rates for home-produced food. Child consumption rates were estimated by multiplying the home-produced food consumption rate for the 20-to-39-year-old age group by the ratio of the consumption rates for each age group within the 1- to 7-year-old range (from the general population) to the consumption rate for 20-to 39-year-olds (in the general population). These general population per capita rates were obtained from the 1989-1991 Continuing Survey of Food Intake by Individuals (CSFII) data (EPA, 1997).

This approach assumes that the child-to-adult consumption rate ratios are similar between the general population (on a per capita basis) and the subset of this population that consumes home-produced foods (consumers only). This assumption was tested by comparing the ratios for the "total meats" and "exposed vegetable" consumption rate categories. The mean child-to-adult ratio for general population per capita intake of total meats was 1.8, while the mean child-to-adult ratio for consumer-only intake of home-produced total meats was 1.7. For exposed vegetables, these values were 1.6 and 2.0, respectively. These results suggest that it was reasonable to use general population consumption rates to estimate home-produced food consumption rates for children. Note that children typically eat smaller quantities of these foods than adults, but the child-to-adult consumption rate ratios are greater than 1 because the rates are normalized to the body weight of survey respondents.

The 75th percentile and mean consumption rates were selected from the NFCS consumption study to represent the RME and CTE, respectively. This study was conducted over a short time interval (i.e., 7 days). Therefore, the mean daily consumption rates may be representative of short-term and long-term consumption patterns, but the tails of the distribution of daily consumption rates do not necessarily reflect the long-term consumption distribution (EPA, 1997). The use of the 75th percentile rather than the 50th percentile or mean provides a degree of conservatism that is appropriate considering the uncertainty in the underlying data, but also does not lead to unreasonable compounding of conservative assumptions.

4.6.2.2.1 Animal Products

The consumption rate of dairy products includes all home-produced dairy products, and it was assumed that farm families consume all home-produced dairy in the form of fluid milk. Assuming an age-specific average body weight of 67 kg, the RME and CTE adult consumption rates correspond to about 1.0 and 0.83 liter per day, respectively. The RME and CTE child consumption rates were also estimated based on an age-specific average body weight of 15 kg and correspond to 1.1 and 0.66 liters per day, respectively. People typically consume dairy at lower rates as they age. As a result, the longer the exposure duration assumed for an adult population, the lower the mean age-weighted consumption rate. In this assessment, the adult resident consumption rates exceed the adult farmer consumption rates for this reason.

The poultry RME and CTE adult consumption rates correspond to about 0.3 and 0.2 pounds of poultry per day, respectively. The child consumption rates for poultry correspond to about a tenth of a pound for both the RME and CTE. The adult consumption rate of eggs corresponds to about one large (2-ounce) egg per day for the RME and one small (1.5-ounce) egg per day for the CTE (AEB, 2002). The child consumption rate of eggs corresponds to eating less than one "peewee" (approximately 1.25 ounce according to AEB, 2002) egg per day for both the RME and CTE.

For beef, the RME and CTE adult consumption rates correspond to about 0.4 and 0.3 per day, respectively. The child consumption rates correspond to 0.16 and 0.12 pounds of beef per day for the RME and CTE, respectively.

Poultry and beef consumption rates do not account for weight loss during cooking or after cooking (e.g., trimming, removal of bones, etc.). Therefore, these rates were adjusted, as described in Section 4.6.2.3.

4.6.2.2.2 Deer

MDPH (2001a) provided information about frequency of deer meat consumption for people living in the Housatonic River area. Because of the survey instrument design, two distributions of deer consumption frequencies were reported. The two estimates for mean number of deer meals per year were similar (35.58 and 37.24 deer meals per year). The two estimates for 75th percentile were less similar (14 and 24 deer meals per year) and lower than the mean frequencies, indicating a highly skewed underlying distribution. There was a large discrepancy between the two 95th percentile estimates (156 and 312 deer meals per year), which was not explained (MDPH, 1997; MDPH, 2001a).

Assuming a meal size of ½-pound (227 grams), 37.24 meals per year, and an adult body weight of 70 kg, the average annual deer consumption rate would be 0.33 g/kg-d. This consumption rate would decrease to 0.17 g/kg-d if the meal size were assumed to be ¼-pound of deer meat. Deer consumption rates would be even lower if they were based on the 75th percentile meal per year estimates given the skewed nature of the underlying distribution. The 95th percentile consumption rates of 156 and 312 meals per year are high and unlikely to represent the true 95th percentile consumption rate. Assuming the lower frequency of 156 meals per year and a meal size of ½-pound would result in an upper-bound average annual consumption rate of 1.4 g/kg-d. MDPH (2001a) provided no information on child consumption rates for deer meat.

Hunters can take only a limited number of deer per year. Therefore, this “bag limit” can be used to provide a likely upper-bound estimate of deer consumption. In Massachusetts, deer hunting is restricted to certain dates from October to December. Hunters are restricted to a seasonal bag limit of two antlered deer, defined as any deer with at least one antler 3 inches long, measured from the center of the front base of the antler burr to the tip. Permits are required to hunt antlerless deer (MassWildlife, 2002). With such permits, hunters in the Housatonic River area are currently limited to two antlerless deer in a season.

The weight of a deer typically depends on the age and sex. For antlered deer, a 1.5-year-old buck weighs between 115 and 120 pounds; a 2.5-year-old weighs between 125 and 130 pounds; a 3.5-year-old weighs approximately 150 pounds; and a 5.5-year-old weighs approximately 185 pounds. On average, a doe weighs about 130 pounds, and a fawn weighs between 50 and 70 pounds. Weight fluctuates from year to year depending on food supply and area of habitation, but these averages provide a good estimation of typical deer size (Keefe, 2002). The typical size of deer hunted differs from year to year depending on the demographics of the herd. In 2001, most deer brought in were in the 1.5-year-old class (Keefe, 2002). For each deer hunted, about 65% of the dressed weight is edible. Dressed weight includes everything except the intestines, stomach, urinary tract, and other parts removed from the deer in the field. Dressed weight is approximately 78% of total deer weight. The remaining 35% of the dressed weight includes the inedible components, such as the bones, hooves, skull, antlers, and hide (Keefe, 2002). Therefore, about 50% of the deer live weight is edible.

Assuming a hunter takes four deer per year with an average weight of 130 pounds, 50% of the animals are edible, and the consumer weighs 70 kg, the annual average consumption rate would be 4.62 g/kg-d. This consumption rate is more than three times higher than the estimate based on the reported 95th percentile estimate of 156 meals/year, assuming a meal size of ½-pound of meat. This consumption rate based on the current bag limit for deer is conservative, in that it assumes the maximum number of deer would be taken and consumed entirely by one adult.

Child consumption rates were not estimated, but the ratio of child-to-adult total meat or beef consumption rates might provide a reasonable basis for estimating a child-deer consumption rate.

4.6.2.2.3 Produce and Edible Wild Plants

Homegrown produce consumption rates were available for several categories of produce. In this assessment, the following produce categories were evaluated: exposed fruit, exposed vegetables, and root vegetables. Squash were assessed separately using site-specific PCB concentrations for these plants.

Age-specific Northeast region consumption rate percentiles are available for "total fruits" and "total vegetables," but these rates are not seasonally adjusted. Seasonally adjusted consumption rate percentiles for the Northeast were available for "total vegetables" and "total fruits"; however, these rates are not necessarily limited to households that garden and are not available for different age ranges. Therefore, adjustment factors (AFs) were estimated to use in adjusting age-specific consumption rates for the three produce categories to reflect consumption patterns in the Northeastern region. These factors were estimated by calculating the ratio between non-age-specific "total vegetable" and "total fruit" consumption rates that are not adjusted for region or season with non-age-specific "total vegetable" and "total fruit" consumption rates for the Northeast region that are seasonally adjusted. The mean ratio for fruit (AF.fruit) was estimated as 0.07, and the mean ratio for vegetables (AF.veg) was estimated as 0.3. The derivation of these AFs is discussed in greater detail in Section 6.

Consumption rates for wild edible plants were generally not available. However, there was limited site-specific information about fiddlehead fern consumption (MDPH, 1997). This study reported a mean fiddlehead consumption rate of 18 meals per year, and a 95th percentile rate of 104 meals per year. The 95th percentile rate does not appear to be consistent with the short 2-week season for this plant, although it is possible that people freeze the ferns for use at other times of the year. Assessment of only fiddlehead ferns might underestimate risk to people who harvest multiple wild plants for consumption.

Home-produced consumption rate data were not available for squash. Therefore, screening risk estimates were calculated for squash assuming that home gardeners would consume one ½-cup meal per week, 12 weeks per year for the RME exposure duration of 45 years. A screening risk estimate also was performed for a child living in a gardening household who consumes one ½-cup squash meal per week, 12 weeks per year in Section 5.5.

4.6.2.3 Preparation and Cooking Losses

NCFS consumption rates apply to the amount of a food item brought into the home, not the amount of the food item that is consumed. Therefore, the NCFS consumption rates were adjusted to account for losses from preparation and cooking, including the weight contributed by inedible portions. Net cooking losses result from drippings and volatile losses, and net post-cooking losses result from cutting, bones, excess fat, scraps, and juices. No adjustment was made for any change in PCB, dioxin, or furan concentration in foods as a result of cooking. It is possible that concentrations could increase or decrease (Schecter et al., 1998).

4.6.2.3.1 Animal Products

Home-produced food intake rates for beef, poultry, and other meats were adjusted to account for mean net cooking loss and mean net post-cooking loss (EPA, 1997). Net cooking loss includes drippings and volatile losses. Post-cooking loss includes losses from cutting, bones, excess fat, scraps, and juices. Both values were averaged across all cuts and cooking methods to obtain a mean loss. Table 4-10 lists these cooking loss values, which were used for both the RME and CTE scenarios. If individuals regularly make gravy or beef stock, the cooking loss estimate could reasonably be reduced to account only for loss from inedible portions. EPA (1997) does not provide cooking loss estimates for only inedible portions. Therefore, the effect of reducing the cooking loss factor is evaluated in the quantitative uncertainty analysis as described in Section 6.5.3.7.

No loss is expected to occur with dairy products and minimal loss is expected with eggs; therefore, these intake rates were not adjusted. However, possible loss for eggs is evaluated in the quantitative uncertainty analysis (see Section 6.5.5.4).

4.6.2.3.2 Produce and Edible Wild Plants

Home-produced produce consumption rates were adjusted to account for mean net cooking loss or mean paring or preparation loss (EPA, 1997). For fruits, the net preparation loss was accounted for, which includes losses from removal of skin or peel, core or pit, stems or caps, seeds and defects, as well as removal of drained liquids from canned or frozen forms. The losses from drained liquids were included in loss estimates for exposed fruit because farm families and residents could freeze and preserve/can homegrown garden produce. For vegetables, the mean net cooking loss includes losses due to paring, trimming, thawing, draining, scraping, shelling, slicing, husking, chopping, and dicing, averaged over various preparation methods.

4.6.2.4 Bioavailability of Food from GI Tract

The fraction of PCB, dioxin, and furan absorption in the gastrointestinal tract (F_{GI}) was assumed to be 1. Use of this value is based on the assumption that absorption in humans is the same as absorption in animals in studies used to develop the RfDs and CSFs.

4.6.2.5 Fraction of Food Item that is Contaminated (FI)

The variable FI is sometimes used to account for the fraction of exposure from the contaminated source. In this case, FI is the fraction of dairy, beef, poultry, or produce from the floodplain that is contaminated. The home-produced food consumption rates used in the HHRA are equivalent to the actual amount of food produced at home or on a farm and not from other sources. The fact that farm operations and home gardens are not always located entirely within the floodplain is addressed by estimating risks for a number of assumed fractions (FS) of cultivated area or pasture in the floodplain instead of using an FI value.

4.6.2.6 Exposure Frequency (EF)

Exposure frequency reflects the number of days per year that a person may be exposed to contaminants via ingestion of home-produced foods. Therefore, assuming a typical vacation period of 2 weeks, an exposure frequency of 350 days per year was assumed for both RME and CTE exposure scenarios on these farms. This exposure frequency assumption does not mean that people eat 350 meals per year. Instead, it is used in conjunction with consumption rates that represent daily consumption averaged over a 1-year period. Therefore, the average daily consumption rate would typically be less than a common meal size assuming home-producers do not consume that food category every day.

On commercial dairy and beef farms, home-produced foods would typically be available each day that farm families and residents were home. For the backyard farm animal scenario, home-produced foods might not be available year-round if only one animal is maintained. Dairy cattle have a 60-day dry (i.e., non-lactating) period each year (Figure 5-1 in Subcommittee on Feed Intake, 1987) during which families may get their milk from another source. This issue is not a concern for backyard beef farms where a single animal can support the maximum consumption rate used in this assessment of approximately 140 pounds per year. A single beef steer weighs about 1,000 pounds and yields about 450 pounds of edible meat (USDA, 2003). The same is true for poultry eggs because the average number of eggs laid by a hen in a year is 259 (U.S. Poultry & Egg Association, 2004, http://www.poultryegg.org/FAQ/). A farmer would need to keep a sizable flock of chickens to support the RME adult farmer consumption rate of approximately 108 lb/year.

Home gardeners might eat home-produced vegetables in-season only or year-round if they preserve (e.g., can or freeze) items for consumption at other times of the year. A seasonally adjusted consumption rate was estimated using the adjustment factor described in Section 4.6.2.2.3.

4.6.2.7 Exposure Duration (ED)

Exposure duration (ED) refers to the number of years that a person may be exposed to contaminants from ingestion of home-produced foods.

The Massachusetts Department of Public Health (MDPH) conducted a PCB Exposure Assessment Study of residents in the Housatonic River Area (HRA) in 1995/1996 (MDPH, 1997). The two objectives of the study were to identify patterns of activities that may have resulted in PCB exposure, and to assess the relationship between potential exposure pathways and serum PCB concentrations among residents at greatest risk of exposure. MDPH screened additional residents on an ongoing basis and updated statistics in August and September 2001 (MDPH, 2001a and 2001b). As part of this study, 1,882 residents reported living at their current residence for a mean of 14.75 years and a 95th percentile of 45 years (MDPH, 2001b). The mean was rounded to 15 years and used with the 95th percentile of 45 years to evaluate CTE and RME exposures to products from backyard farm animals and home gardens.

The MDPH study does not provide information that is specific to farm families. Multiple generations have lived on some local dairy farms (Noble, 2002). Therefore, the RME farm family ED was assumed to be 70 years, and the CTE ED was assumed to be one-half this duration, or 35 years.

Deer hunters were assumed to have RME and CTE EDs of 50 and 23 years, respectively. These estimates also were assumed for waterfowl hunters (see Appendix C, Volume IV). Information more specific to deer hunters was not available.

4.6.2.8 Averaging Time (AT)

The ADD equation used to evaluate noncancer effects incorporated an averaging time equal to 365 days/year multiplied by the exposure duration (EPA, 1989). The LADD equation used to evaluate cancer risk incorporated an averaging time equal to 365 days/year multiplied by an assumed lifetime of 70 years, or 25,550 days (EPA, 1989).

4.6.2.9 Summary of Risk Model Exposure Inputs

RME and CTE exposure input values selected for each scenario are summarized in Table 4-11. For each scenario, these values represent a mixture of upper-bound and mid-range values to avoid compounding conservatism as summarized in Table 4-12.

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SECTION 4

TABLES

Table 4-1

Agricultural Product and Other Terrestrial Food Exposure Pathways Considered in this Assessment[1]

Agricultural Product or Other Terrestrial Food	Current or Future Scenario?	Quantitative or Qualitative Assessment?
Commercial Activities		
Dairy cattle: milk	current/future	quantitative
Beef cattle or surplus dairy: meat	future	quantitative
Free-range poultry: meat and eggs	current/future	quantitative
Goats: milk	future	qualitative
Sheep: lamb's meat	future	qualitative
Produce	current/future	quantitative
Non-Commercial "Backyard" Animals		
Dairy cattle: milk	future	quantitative
Beef cattle: meat	current/future	quantitative
Free-range poultry: meat and eggs	future	quantitative
Goats: milk	future	qualitative
Sheep: lamb's meat	future	qualitative
Other Non-Commercial Activities		
Deer hunting	current/future	qualitative
Wild edible plant harvesting	current/future	fiddlehead ferns: quantitative; other plants: qualitative
Home garden	current/future	quantitative

[1] All scenarios are assessed on a non-parcel-specific basis. Exposures are calculated based on assumed tPCB soil EPCs that reflect the range measured in current and potential future agricultural areas and the fraction of these areas within the floodplain (i.e. the 1-ppm tPCB isopleth along Reaches 5 and 6, and the 100-year floodplain along Reaches 7, 8, and 9).

Table 4-2

Aroclor Versus Dioxin-Like Congener Regression Equations

Congener	Regression Equation (mg/kg PCB vs. mg/kg total Aroclor; pg/g PCDD/F vs. mg/kg total Aroclor, log-log scale)	r^2	p
PCB Congeners			
PCB-105	PCB-105 = -2.4467 + 0.4996x	0.56	<0.001
PCB-114	PCB-114 = -3.8195 + 0.6476x	0.70	<0.001
PCB-118	PCB-118 = -2.0936 + 0.5339x	0.54	<0.001
PCB-123	PCB-123 = -3.4406 + 0.5553x	0.55	<0.001
PCB-126	PCB-126 = -3.7996 + 0.7201x	0.71	<0.001
PCB-156	PCB-156 = -2.4257 + 0.5229x	0.59	<0.001
PCB-157	PCB-157 = -2.9882 + 0.7834x	0.84	<0.001
PCB-167	PCB-167 = -2.6361 + 0.5421x	0.59	<0.001
PCB-169	PCB-169 = -4.5471 + 0.7492x	0.67	<0.001
PCB-189	PCB-189 = -2.8178 + 0.4904x	0.48	<0.001
PCB-77	PCB-77 = -3.6847 + 0.8081x	0.82	<0.001
PCB-81	PCB-81 = -5.3459 + 0.7103x	0.66	<0.001
Furan Congeners			
1,2,3,4,6,7,8-HPCDF	1,2,3,4,6,7,8-HPCDF = 1.6699 + 0.717x	0.69	<0.001
1,2,3,4,7,8,9-HPCDF	1,2,3,4,7,8,9-HPCDF = 0.4965 + 0.6714x	0.75	<0.001
1,2,3,4,7,8-HXCDF	1,2,3,4,7,8-HXCDF = 0.8868 + 0.7284x	0.77	<0.001
1,2,3,6,7,8-HXCDF	1,2,3,6,7,8-HXCDF = 0.671 + 0.7285x	0.73	<0.001
1,2,3,7,8,9-HXCDF	1,2,3,7,8,9-HXCDF = 0.2039 + 0.6789x	0.67	<0.001
1,2,3,7,8-PECDF	1,2,3,7,8-PECDF = 0.8241 + 0.7115x	0.73	<0.001
2,3,4,6,7,8-HXCDF	2,3,4,6,7,8-HXCDF = 0.7462 + 0.6696x	0.69	<0.001
2,3,4,7,8-PECDF	2,3,4,7,8-PECDF = 0.99 + 0.7078x	0.72	<0.001
2,3,7,8-TCDF	2,3,7,8-TCDF = 1.0801 + 0.6621x	0.70	<0.001
OCDF	OCDF = 1.6664 + 0.6658x	0.67	<0.001
Dioxin Congeners			
1,2,3,4,6,7,8-HPCDD	1,2,3,4,6,7,8-HPCDD = 1.5657 + 0.6377x	0.59	<0.001
1,2,3,4,7,8-HXCDD	1,2,3,4,7,8-HXCDD = 0.0602 + 0.5356x	0.62	<0.001
1,2,3,6,7,8-HXCDD	1,2,3,6,7,8-HXCDD = 0.4782 + 0.556x	0.59	<0.001
1,2,3,7,8,9-HXCDD	1,2,3,7,8,9-HXCDD = 0.3128 + 0.492x	0.58	<0.001
1,2,3,7,8-PECDD	1,2,3,7,8-PECDD = 0.0831 + 0.5082x	0.52	<0.001
2,3,7,8-TCDD	2,3,7,8-TCDD = -0.2482 + 0.4614x	0.41	<0.001
OCDD	OCDD = 2.4745 + 0.6557x	0.58	<0.001

Regressions were performed with log-transformed 0 to 1 foot vernal pool and floodplain soil data from Reach 5, excluding distal floodplain soil samples and results below detection limits. Regression models were selected using the procedure described in Attachment 2 of the Human Health Risk Assessment (Volume 1).

Table 4-3

Soil-to-Plant Transfer Factors Used in this Assessment

	Animal Feed		Produce Categories		
	Soil-to-Grass[1]	Soil-to-Corn Silage [2]	Soil-to-Exposed Fruit [3]	Soil-to-Exposed Vegetables [3]	Soil-to-Root Vegetables [3]
	(dw plant/dw soil)	(dw plant/dw soil)	(ww plant/dw soil)	(ww plant/dw soil)	(ww plant/dw soil)
tPCBs	0.036	0.0012	0.0018	0.0018	0.00030
Dioxin-like PCB Congeners					
77	0.19	0.0063	0.0095	0.0095	0.0016
81	NA	NA	NA	NA	NA
105	0.047	0.0016	0.0024	0.0024	0.00039
114	NA	NA	NA	NA	NA
118	0.058	0.0019	0.0029	0.0029	0.00049
123	0.031	0.0010	0.0016	0.0016	0.00026
126	0.25	0.0082	0.012	0.012	0.0021
156	0.033	0.0011	0.0017	0.0017	0.00028
157	0.028	0.00095	0.0014	0.0014	0.00024
167	0.041	0.0014	0.0020	0.0020	0.00034
169	1.3	0.042	0.063	0.063	0.011
189	0.039	0.0013	0.0020	0.0020	0.00033

NA = Not available because PCB congener was not detected in any grass samples.

[1] The soil-to-grass transfer factors for tPCBs and dioxin-like PCB congeners are mean soil-to-grass transfer factors based only on grass and soil results above detection limits.

[2] The tPCB soil-to-corn silage transfer factor was calculated using detected concentrations of Aroclor 1260 in corn stalk samples collected in 1999, while accounting for the fact that corn ears, in which tPCBs were not detected, comprise about 50% of corn silage on a dry matter basis. Corn samples were not analyzed for congeners. Therefore, soil-to-corn silage transfer factors for dioxin-like PCB congeners were estimated using measured grass data, assuming that congeners would be present in corn silage in the same relative proportion as they were measured in grass.

[3] Produce samples were not analyzed for congeners. Therefore, soil-to-produce transfer factors for dioxin-like PCB congeners were estimated using measured grass data, assuming that congeners would be present in produce in the same relative proportion as they were measured in grass.

Table 4-4

Soil-to-Plant tPCB Transfer Factors in the Housatonic River Floodplain [1]

	Plant	Plant[2]	Soil	Transfer Factor	
	(mg/kg, ww)	(mg/kg, dw)	(mg/kg, dw)	(ww/dw)	(dw/dw)
EPA Samples, collected between 1999-2001					
Corn stalk, unwashed[3]	0.0103	0.0343	5.68	1.8E-03	6.0E-03
	0.0104	0.0347	36.6	2.8E-04	9.5E-04
	0.0150	0.0500	36.6	4.1E-04	1.4E-03
	0.0240	0.0800	37.6	6.4E-04	2.1E-03
	0.0180	0.0600	37.6	4.8E-04	1.6E-03
Corn silage[4]	0.0103	0.0343	5.68	9.1E-04	3.0E-03
	0.0104	0.0347	36.6	1.4E-04	4.7E-04
	0.0150	0.0500	36.6	2.0E-04	6.8E-04
	0.0240	0.0800	37.6	3.2E-04	1.1E-03
	0.0180	0.0600	37.6	2.4E-04	8.0E-04
Squash (flesh), unwashed	0.0577	0.740	4.13	1.4E-02	1.8E-01
	0.0396	0.550	3.72	1.1E-02	1.5E-01
Fiddlehead Ferns, washed[5]	0.00504	0.0420	21.5	2.3E-04	2.0E-03
Grass, unwashed	0.112	0.339	11.3	9.9E-03	3.0E-02
	0.136	0.443	21.3	6.4E-03	2.1E-02
	0.109	0.353	14.5	7.5E-03	2.4E-02
	0.113	0.352	3.75	3.0E-02	9.4E-02
	0.105	0.338	6.77	1.6E-02	5.0E-02
	0.118	0.390	15.0	7.9E-03	2.6E-02
	0.0604	0.191	7.73	7.8E-03	2.5E-02
	0.0998	0.323	7.39	1.4E-02	4.4E-02
	0.109	0.427	11.7	9.3E-03	3.6E-02
	0.0513	0.156	16.0	3.2E-03	9.8E-03
MDEP 1995 Study					
Fiddlehead Ferns, washed	0.00530	0.0404	157	3.4E-05	2.6E-04
	0.00440	0.0335	61.3	7.2E-05	5.5E-04
	0.00520	0.0399	43.6	1.2E-04	9.2E-04
	0.00560	0.0430	66.3	8.4E-05	6.5E-04
	0.00120	0.00920	29.0	4.1E-05	3.2E-04
	0.00110	0.00820	26.7	4.1E-05	3.1E-04
	0.00560	0.0427	71.6	7.8E-05	6.0E-04
	0.00340	0.0259	73.4	4.6E-05	3.5E-04
	0.00580	0.0448	94.7	6.1E-05	4.7E-04
	0.00480	0.0372	52.5	9.1E-05	7.1E-04
	0.00470	0.0362	48.1	9.8E-05	7.5E-04
	0.00830	0.0637	42.9	1.9E-04	1.5E-03
	0.01530	0.117	108	1.4E-04	1.1E-03
	0.00230	0.0175	37.9	6.1E-05	4.6E-04
	0.00120	0.0095	56.5	2.1E-05	1.7E-04
	0.00360	0.0280	63.6	5.7E-05	4.4E-04
	0.00250	0.0193	76.6	3.3E-05	2.5E-04
	0.00260	0.0199	64.9	4.0E-05	3.1E-04

Table 4-4

Soil-to-Plant tPCB Transfer Factors in the Housatonic River Floodplain [1]

	Plant (mg/kg, ww)	Plant[2] (mg/kg, dw)	Soil (mg/kg, dw)	Transfer Factor (ww/dw)	Transfer Factor (dw/dw)
Sawhney and Hankin, 1984 (plants grown in soil amended with Woods Pond sediment) [6]					
Beet Roots, washed					
Aroclor 1248	0.00190	0.0150	0.0800	2.4E-02	1.9E-01
Aroclor 1254	0.00200	0.0160	1.88	1.06E-03	8.5E-03
Aroclor 1260	0.00440	0.0350	14.4	3.05E-04	2.4E-03
Total	0.00840	0.0660	16.4	5.1E-04	4.0E-03
Beet Leaves, washed					
Aroclor 1248	0.00170	0.0220	0.0800	2.1E-02	2.8E-01
Aroclor 1254	0.00740	0.0940	1.88	3.9E-03	5.0E-02
Aroclor 1260	0.00410	0.0520	14.4	2.8E-04	3.6E-03
Total	0.0132	0.1680	16.4	8.0E-04	1.0E-02
Turnip Roots, washed					
Aroclor 1248	0.00240	0.0300	0.0800	3.0E-02	3.8E-01
Aroclor 1254	0.00130	0.0160	1.88	6.9E-04	8.5E-03
Aroclor 1260	0.00160	0.0200	14.4	1.1E-04	1.4E-03
Total	0.00540	0.0660	16.4	3.3E-04	4.0E-03
Turnip Leaves, washed					
Aroclor 1248	0.00290	0.0320	0.0800	3.6E-02	4.0E-01
Aroclor 1254	0.00360	0.0400	1.88	1.9E-03	2.1E-02
Aroclor 1260	0.00240	0.0270	14.4	1.7E-04	1.9E-03
Total	0.00880	0.0990	16.4	5.4E-04	6.0E-03

[1] Transfer factors are defined as the ratio of the concentration in plant tissue to the concentration in soil (i.e., plant-to-soil concentration ratios). Transfer factors were calculated only for co-located plant and soil samples that had detectable levels of PCBs.

[2] Sample wet weight concentrations were converted to dry weight concentrations using % solid measurements for each sample: dry weight = wet weight /fraction solids. Percent solids data were not available for corn samples and MDEP fern samples. Therefore, corn silage was assumed to contain 30% solids, and MDEP ferns were assumed to have the % solids content measured in ferns collected by EPA.

[3] Soil values corresponding to unwashed corn were calculated as a mean of the soil samples corresponding to corn ear, and stalk and leaf material samples.

[4] PCBs were not detected in corn ear samples (Table 2-5), however corn ears contribute about 50% of the dry matter weight of corn silage (Genter et al., 1970). Therefore, the soil-to-corn stalk transfer factors were reduced by ½ to represent soil-to-corn silage transfer factors, as described in Section 4.3.3.2 of the text.

[5] Mean concentration of duplicate fern samples.

[6] Converted dry weight plant concentrations reported by Sawhney and Hankin (1984, 99-1197) to wet weight concentrations using crop-specific moisture content data from Table 9-27 in EPA (1997).

Table 4-5

Soil-to-Plant PCB Transfer Factors from the Published Literature

Plant	PCB Type	TOC in (%)	Plant (mg/kg, ww)	Plant (mg/kg, dw)	Soil (mg/kg, dw)	Transfer Factor[1] (ww/dw)	(dw/dw)
Soil-to-Grass Transfer Factors							
Field Studies							
NA							
Laboratory Studies							
O'Connor et al, 1990 (plants grown in pots of sludge-amended soil using two representative southern New Mexico soils)							
Fescue	Aroclor 1248	0.12 - 0.65	<0.02	NR	0 - 2.5	<0.008 - <0.04	-
Trapp et al., 1990 (plants grown in contaminated soil in a closed aerated laboratory apparatus)							
barley - mean	2,2'4,4',6-pentachlorobiphenyl	2.06	2.77	NR	2.16	1.3	-
barley - max	2,2',4,4',6-pentachlorobiphenyl	2.06	2.99	NR	2.2	1.4	-
barley - min	2,2'4,4',6-pentachlorobiphenyl	2.06	2.54	NR	2.12	1.2	-
Strek et al., 1981 (plants grown in pots with treated soil)							
Sorghum	Aroclor 1254	1	0.068	NR	20	0.0034	-
Sorghum	^{14}C-Labeled PCB Study (Aroclor 1254)	1	NA	NR	20	NC	-
Soil-to-Corn Transfer Factors							
Field Studies							
Webber et al., 1994 (plants grown on sludge-treated coal refuse)							
Corn, ear leaf	1242, 1254, 1260 mixture	NR	NR	0.034 - 0.049	1.3 - 2.9	-	0.015 - 0.030
Corn, stover	1242, 1254, 1260 mixture	NR	NR	0.029 - 0.044	1.3 - 2.9	-	0.013-0.022
Grain I	1242, 1254, 1260 mixture	NR	NR	0.015	1.3 - 2.9	-	0.005-0.011
Grain II	1242, 1254, 1260 mixture	NR	NR	0.0018 - 0.0023	1.3 - 2.9	-	0.00082 - 0.0013
Laboratory Studies							
Strek et al., 1981 (plants grown in pots with treated soil)							
Corn	Aroclor 1254	1	0.002	NR	20	0.0001[a]	-
Corn	^{14}C-Labeled PCB Study (Aroclor 1254)	1	0.0003	NR	20	0.000015	-
Protected Vegetable Transfer Factors							
NA							
Protected Fruit Transfer Factor							
NA							
Exposed Vegetable Transfer Factor							
Field Studies							
Webber et al., 1994 (plants grown on sludge-treated coal refuse)							
Cabbage, inner leaves	1242, 1254, 1260 mixture	NR	NR	0.071 - 0.091	1.5 - 3.7	-	0.019 - 0.048
Cabbage, wrapper leaves	1242, 1254, 1260 mixture	NR	NR	0.066 - 0.085	1.5 - 3.7	-	0.021 - 0.044
Carrot, top	1242, 1254, 1260 mixture	NR	NR	0.18	3.6	-	0.050
Gosselin et al., 1986 (plants grown in commercial sewer sludge)							
Potato, leaves	Aroclor 1016 and 1242	NR	NR	<0.0071	0.66	-	<0.011
Potato, leaves	Aroclor 1242	NR	NR	<0.0071	0.87	-	<0.0082
Iwata et al., 1974, 1976 (plants grown in contaminated plots)							
Carrot, foliage	Aroclor 1254 (highest peak only)	0.6	0.61 - 1.6	NR	61 - 100	0.0067 - 0.018	
Cullen at al., 1996 (plants grown in vicinity of New Bedford Harbor Superfund site)							
Tomato	PCB Congener 101	NR	NR	NR	NR	NR	0.23
	PCB Congener 138	NR	NR	NR	NR	NR	0.15
	PCB Congener 153	NR	NR	NR	NR	NR	0.01
Lettuce	PCB Congener 101	NR	NR	NR	NR	NR	1.5
	PCB Congener 138	NR	NR	NR	NR	NR	1.1
	PCB Congener 153	NR	NR	NR	NR	NR	0.74
Chaney et al., 1996 (plants grown on biosolid-applied PCBs soil - transfer factors calculated using unpeeled carrot uptake slope)							
Leafy vegetables	Total PCBs	NR	NR	NR	NR	NR	</= 0.001
Legume vegetables	Total PCBs	NR	NR	NR	NR	NR	0.000075
Laboratory Studies							
Bacci and Gaggi, 1985 (plants grown in glass boxes in treated and non-treated soil)							
Beans, leaves	Fenclor 64 (similar to Aroclor 1260)	0.15	NR	42.6	460	-	0.093
Broad Beans, leaves	Fenclor 64 (similar to Aroclor 1260)	0.15	NR	26.4	460	-	0.057
Tomatos, leaves	Fenclor 64 (similar to Aroclor 1260)	0.15	NR	24.3	460	-	0.053
Cucumbers, leaves	Fenclor 64 (similar to Aroclor 1260)	0.15	NR	13.8	460	-	0.03
Fries and Marrow, 1981 (plants grown in pots with contaminated soil)							
Soybean, upper stem	2,2',5'5-tetrachlorobiphenyl	5.2	NR	NR	3.56	-	0.001
Soybean, upper stem	2,2',4,5,5'-pentachlorobiphenyl	5.2	NR	NR	2.69	-	<0.002
Soybean, lower stem	2,2',5'5-tetrachlorobiphenyl	5.2	NR	NR	3.56	-	0.007
Soybean, lower stem	2,2',4,5,5'-pentachlorobiphenyl	5.2	NR	NR	2.69	-	0.005
Soybean, upper leaves	2,2',5'5-tetrachlorobiphenyl	5.2	NR	NR	3.56	-	0.012
Soybean, upper leaves	2,2',4,5,5'-pentachlorobiphenyl	5.2	NR	NR	2.69	-	0.006
Soybean, lower leaves	2,2',5'5-tetrachlorobiphenyl	5.2	NR	NR	3.56	-	0.073
Soybean, lower leaves	2,2',4,5,5'-pentachlorobiphenyl	5.2	NR	NR	2.69	-	0.115
Soybean, seed pods	2,2',5'5-tetrachlorobiphenyl	5.2	NR	NR	3.56	-	0.005
Soybean, seed pods	2,2',4,5,5'-pentachlorobiphenyl	5.2	NR	NR	2.69	-	<0.002
Soybean, whole plant	2,2',5'5-tetrachlorobiphenyl	5.2	NR	NR	3.56	-	0.018
Soybean, whole plant	2,2',4,5,5'-pentachlorobiphenyl	5.2	NR	NR	2.69	-	0.018
O'Connor et al, 1990 (plants grown in pots of sludge-amended soil using two representative southern New Mexico soils)							
Carrot, top	Aroclor 1248	0.12 - 0.65	<0.02	NR	0 - 2.5	<0.008 - <0.04	-
Lettuce	Aroclor 1248	0.12 - 0.65	<0.02	NR	0 - 2.5	<0.008 - <0.04	-
Suzuki et al., 1977 (plants cultured on contaminated soil)							
Soybean	Aroclor 1242	NR	0.15	NR	100	0.0015	-

Table 4-5

Soil-to-Plant PCB Transfer Factors from the Published Literature

Plant	PCB Type	TOC in (%)	Plant (mg/kg, ww)	Plant (mg/kg, dw)	Soil (mg/kg, dw)	Transfer Factor[1] (ww/dw)	Transfer Factor[1] (dw/dw)
Root Vegetable Transfer Factor							
Field Studies							
Webber et al., 1994 (plants grown on sludge-treated coal refuse)							
Carrot, peel	1242, 1254, 1260 mixture	NR	NR	0.23	3.6	-	0.064
Carrot, core	1242, 1254, 1260 mixture	NR	NR	0.056	3.6	-	0.015
Gosselin et al., 1986 (plants grown in commercial sewer sludge)							
Potato, pulp	Aroclor 1016 and 1242	NR	NR	<0.0071	0.66	-	<0.011
Potato, pulp	Aroclor 1242	NR	NR	<0.0071	0.87	-	<0.0082
Potato, peel	Aroclor 1016 and 1242	NR	NR	0.040	0.66	-	<0.061
Potato, peel	Aroclor 1242	NR	NR	<0.0071	0.87	-	<0.0082
Iwata et al., 1974, 1976 (plants grown in contaminated plots)							
Carrot, unpeeled root	Aroclor 1254 (highest peak only)	0.6	2.0 - 4.4	NR	51 - 100	0.032 - 0.050	-
Cullen at al., 1996 (plants grown in vicinity of New Bedford Harbor Superfund site)							
Potato	PCB Congener 101	NR	NR	NR	NR	-	0.01
	PCB Congener 138	NR	NR	NR	NR	-	0.17
	PCB Congener 153	NR	NR	NR	NR	-	0.08
Carrot	PCB Congener 101	NR	NR	NR	NR	-	0.35
	PCB Congener 138	NR	NR	NR	NR	-	0.38
	PCB Congener 153	NR	NR	NR	NR	-	0.28
Chaney et al., 1996 (plants grown on biosolid-applied PCBs soil - transfer factors calculated using unpeeled carrot uptake slope)							
Potato	Total PCB	NR	NR	NR	NR	-	0.00188
Root vegetables	Total PCB	NR	NR	NR	NR	-	0.03975
Laboratory Studies							
Strek et al., 1981 (plants grown in pots with treated soil)							
Beet	Aroclor 1254	1	0.815	NR	20	0.041	-
Beet	^{14}C-Labeled PCB Study (Aroclor 1254)	1	0.102	NR	20	0.0051	-
Peanut	Aroclor 1254	1	0.473	NR	20	0.02365	-
Peanut	^{14}C-Labeled PCB Study (Aroclor 1254)	1	0.037	NR	20	0.00185	-
Bacci and Gaggi, 1985 (plants grown in glass boxes in treated and non-treated soil)							
Tomato, roots	Fenclor 64 (similar to Aroclor 1260)	0.15	NR	105	460	NR	0.23
Tomato, roots	Fenclor 64 (similar to Aroclor 1260)	0.15	NR	132	460	NR	0.29
Tomato, roots	Fenclor 64 (similar to Aroclor 1260)	0.15	NR	168	460	NR	0.37
O'Connor et al, 1990 (plants grown in pots of sludge-amended soil using two representative southern New Mexico soils)							
Carrot, root	Aroclor 1248	0.12 - 0.65	<0.02	NR	0 - 2.5	<0.008 - <0.04	-
Carrot, peel (from root) -	Aroclor 1248	0.12 - 0.65	NR	NR	0 - 2.5	0.02 - 0.1	-
Exposed Fruit Transfer Factor							
Field Studies							
Chaney et al., 1996 (plants grown on biosolid-applied PCBs soil - transfer factors calculated using a unpeeled carrot uptake slope)							
Garden fruit	Total PCB	NR	NR	NR	NR	-	0.000075
Laboratory Studies							
NA							

Notes:

"-" - paper did not provide data to calculate transfer factor

NR - not reported

NA - not available

[1] Transfer factors are defined as the ratio of the concentration in plant tissue to the concentration in soil (i.e., plant-to-soil concentration ratios).

[a] Transfer factor incorrectly calculated by authors in publication; corrected on table

Table 4-6

Soil-to-Plant Dioxin and Furan Transfer Factors from the Published Literature

Plant	Dioxin/Furan Type	TOC in Soil (%)	Plant (ng/kg, ww)	Plant (ng/kg, dw)	Soil (ng/kg, dw)	Transfer Factor[1] (ww/dw)	Transfer Factor[1] (dw/dw)
Soil-to-Grass Transfer Factors							
Field Studies							
Wipf et al., 1982 (plants grown in contaminated soil resulting from an aerosol cloud of TCDD) [2]							
Grass	TCDD	NR	<2	NR	150	<0.013	-
Millet	TCDD	NR	<0.9	NR	2	<0.45	-
Sage - leaves	TCDD	NR	<5	NR	36	<0.14	-
Laboratory Studies							
NA							
Soil-to-Corn Transfer Factors							
Field Studies							
Wipf et al., 1982 (plants grown in contaminated soil resulting from an aerosol cloud of TCDD) [2]							
Corn - sheaths	TCDD	NR	8	NR	10000	0.0008	-
Corn - cob	TCDD	NR	<1.3	NR	10000	<0.00013	-
Corn - kernels	TCDD	NR	<0.8	NR	10000	<0.00008	-
Laboratory Studies							
NA							
Protected Vegetable Transfer Factors							
Field Studies							
Muller et al., 1994 (plants grown in vicinity of former electric wire scrap incinerator)							
Lettuce, inner leaves	TEQ	8.1	NR	0.3 / 0.2	56	-	0.0054 / 0.0036
Peas, seeds	TEQ	8.1	NR	0.04	56	-	0.00071
Laboratory Studies							
NA							
Protected Fruit Transfer Factor							
Field Studies							
Hulster et al., 1994 (plants grown on chlorine-alkaline-electrolysis contaminated land and in vicinity of former electric wire scrap incinerator)							
Pumpkin, fruits (inner parts)	TEQ	<2	NR	3.1 / 3.4	148	-	0.021 / 0.023
Cucumber, fruits (inner parts)	TEQ	<2	NR	0.2 / 0.2	148	-	0.0014 / 0.0014
Laboratory Studies							
NA							
Exposed Vegetable Transfer Factor							
Field Studies							
Muller et al., 1994 (plants grown in vicinity of former electric wire scrap incinerator)							
Lettuce, outer leaves [3]	TEQ	8.1	NR	0.36 / 0.28	56	-	0.0064 / 0.005
Lettuce, outer leaves	TEQ	8.1	NR	0.17 / 0.21	56	-	0.003 / 0.0038
Lettuce, total crop	TEQ	8.1	NR	0.21 / 0.21	56	-	0.0038 / 0.0038
Peas, pods	TEQ	8.1	NR	0.12	56	-	0.0021
Peas, total crop	TEQ	8.1	NR	0.09	56	-	0.0016
Wipf et al., 1982 (plants grown in contaminated soil resulting from an aerosol cloud of TCDD) [2]							
Silverbeet - leaves	TCDD	NR	<0.9	NR	200	<0.0045	-
Cauliflower	TCDD	NR	<1	NR	10	<0.10	-
Cauliflower leaves	TCDD	NR	<1	NR	10	<0.10	-
Chicory	TCDD	NR	<3.5	NR	10	<0.35	-
Cabbage	TCDD	NR	<0.7	NR	10	<0.070	-
Forage Plant	TCDD	NR	<1.7	NR	38	<0.045	-
Cucumber	TCDD	NR	<0.4	NR	15	<0.027	-
Laboratory Studies							
Schroll et al., 1994 (plants grown in contaminated soil)							
Carrot, shoots (leaves, no stems)	OCDD	NR	NR	544	6400	-	0.085
Root Vegetable Transfer Factor							
Field Studies							
Muller et al., 1994 (plants grown in vicinity of former electric wire scrap incinerator)							
Carrot, peel	TEQ	8.1	NR	2.86 / 3.3	56	-	0.051 / 0.059
Carrot, cortex	TEQ	8.1	NR	0.28 / 0.3	56	-	0.005 / 0.0054
Carrot, stele	TEQ	8.1	NR	0.29 / 0.5	56	-	0.0052 / 0.0089
Carrot - Total crop	TEQ	8.1	NR	0.87 / 1.05	56	-	0.016 / 0.019
Wipf et al., 1982 (plants grown in contaminated soil resulting from an aerosol cloud of TCDD) [2]							
Carrot	TCDD	NR	<0.7 - <0.8	NR	3 - 7	<0.10 - <0.27	-
Sugarbeet	TCDD	NR	<1.8	NR	3 - 7	<0.26 - <0.60	-
Laboratory Studies							
Schroll et al., 1994 (plants grown in contaminated soil)							
Carrot, roots	OCDD	NR	NR	NR	6400	-	0.724

Table 4-6

Soil-to-Plant Dioxin and Furan Transfer Factors from the Published Literature

Plant	Dioxin/Furan Type	TOC in Soil (%)	Plant (ng/kg, ww)	Plant (ng/kg, dw)	Soil (ng/kg, dw)	Transfer Factor[1] (ww/dw)	Transfer Factor[1] (dw/dw)
Exposed Fruit Transfer Factor							
Field Studies							
Hulster et al., 1994 (plants grown on chlorine-alkaline-electrolysis contaminated land and in vicinity of former electric wire scrap incinerator)							
Zucchini, fruits	TEQ	<2	NR	21 / 15.1	148	-	0.14 / 0.1
	TEQ	<2	NR	19.4 / 21.6	148	-	0.13 / 0.15
	TEQ	<2	NR	0.9 / 1.1	0.4	-	2.3 / 2.8
	TEQ	<2	NR	0.5 / 0.7	0.4	-	1.3 / 1.8
	TEQ	8.1	NR	17 / 17.4	328	-	0.052 / 0.053
	TEQ	8.1	NR	54.6 / 55.2	2390	-	0.023 / 0.023
Zucchini, leaves	TEQ	<2	NR	21.4 / 22.6	148	-	0.14 / 0.15
	TEQ	<2	NR	4.4 / 10.2	0.4	-	11 / 26
	TEQ	8.1	NR	29.2 / 26.7	328	-	0.089 / 0.081
Pumpkin, fruits (outer parts)	TEQ	<2	NR	12 / 11.6	148	-	0.081 / 0.078
Pumpkin, leaves	TEQ	<2	NR	3.6 / 2.4	148	-	0.024 / 0.016
Cucumber, fruits (outer parts)	TEQ	<2	NR	2.4 / 2.3	148	-	0.016 / 0.016
Cucumber, leaves	TEQ	<2	NR	3.4 / 2	148	-	0.023 / 0.014
Laboratory Studies							
NA							

Notes:
"-" - paper did not provide data to calculate transfer factor
NR - not reported
TEQ - toxic equivalence
Replicate sample values are separated by a dash (/)
[1] Transfer factors are defined as the ratio of the concentration in plant tissue to the concentration in soil (i.e., plant-to-soil concentration ratios).
[2] Could not determine if plant concentrations were reported in fresh weight or dry weight
[3] These results based on a special treatment where a contaminated plot was covered with a thin 5cm layer of uncontaminated soil

Table 4-7

Animal Diet and Soil Intake Factors

Agricultural Product or Other Terrestrial Food	% Contribution to the Animal's Diet [1]						
	Roughage						
	Corn Silage	**+**	**Grass-Based Feed**	**=**	**Total Roughage**	**Concentrate**	**Soil**
Commercial Activities							
Dairy cattle: milk	55		0		55 (50-60)	45 (40-50)	0
Beef cattle or surplus dairy: meat [2]	44		44		88 (79-97)	10 (0-20)	2 (1-3)
Free-range poultry: meat and eggs	NA		NA		0	90 (88-92)	10 (8-12)
Goats: milk	0		65		65 (60-70)	35 (30-40)	0
Sheep: lamb's meat	0		98		98 (97-99)	0	2 (1-3)
Non-Commercial "Backyard" Animals							
Dairy cattle: milk	0		59		59 (55-63)	40 (35-45)	1 (0-2)
Beef cattle: meat	0		98		98 (97-99)	0	2 (1-3)
Free-range poultry: meat and eggs	NA		NA		0	90 (88-92)	10 (8-12)
Goats: milk	0		65		65 (60-70)	35 (30-40)	0
Sheep: lamb's meat	0		98		98 (97-99)	0	2 (1-3)
Other Non-Commercial Activities							
Deer hunting: meat	NA		NA		98 (97-99)	0	2 (1-3)

NA = Not applicable.

[1] The best estimate of % contribution to the animal's diet is provided, followed by the range of likely values in parentheses. The best estimates were used in risk calculations for these hypothetical exposure scenarios.

[2] The use of a 2% soil ingestion rate implies that the animals are on pasture 50% of the year. Thus, half of the roughage would be grass. This assumption is reasonable for beef and surplus dairy animals that may be slaughtered before the first lactation. Alternatively, an older cull dairy cow slaughtered because she is no longer productive would have been fed more like the lactating dairy cows. However, the meat from these animals is tough and is typically sold for hamburger production. Therefore, the intake factor assumptions used in this assessment apply to surplus dairy animals rather than cull dairy animals slaughtered for beef.

Table 4-8a

Mammalian and Avian Bioconcentration Factors

	Mammalian[1, 2]	Avian	
		Eggs[3,4]	Adipose[3,5]
Dioxin Congeners			
2,3,7,8-CDD	6.1	1.8	2.8
1,2,3,7,8-CDD	5.3	1.3	2.3
1,2,3,4,7,8-CDD	3.6	1.3	1.8
1,2,3,6,7,8-CDD	3.6	1.6	3.1
1,2,3,7,8,9-CDD	2.6	1.1	1.2
1,2,3,4,6,7,8-CDD	0.6	1.3	NA
1,2,3,4,6,7,8,9-CDD	0.1	0.8	1.0
Furan Congeners			
2,3,7,8-CDF	NA	0.5	2.4
1,2,3,7,8-CDF	NA	NA	2.2
2,3,4,7,8-CDF	4.4	1.9	2.1
1,2,3,4,7,8-CDF	3.2	1.9	1.4
1,2,3,6,7,8-CDF	2.8	1.7	1.4
2,3,4,6,7,8-CDF	2.3	0.9	0.9
1,2,3,7,8,9-CDF	NA	NA	NA
1,2,3,4,6,7,8-CDF	0.6	0.9	0.3
1,2,3,4,7,8,9-CDF	1.1	1.1	0.4
1,2,3,4,6,7,8,9-CDF	0.1	0.4	NA
PCB Congeners			
PCB-77	6.4	1.5	2.4
PCB-81	6.4	1.6	3.2
PCB-105	5.9	1.5	2.5
PCB-114	5.5	1.4	2.0
PCB-118	11.2	1.4	2.1
PCB-123	11.0	NA	NA
PCB-126	11.5	1.7	3.5
PCB-156	9.3	1.4	2.3
PCB-157	8.9	1.5	2.7
PCB-167	8.8	1.5	2.5
PCB-169	8.4	1.5	2.7
PCB-189	7.4	1.4	1.9
tPCBs	3.6	0.9	2.5

[1] Mammalian BCFs were estimated on a fat basis. Therefore, predicted food concentrations have units of mg/kg fat.

[2] The mammalian BCF for tPCBs is from Fries 1996a. Mammalian BCFs for dioxins and furans are the mean of values from three studies (See Table 4-8c). Mammalian BCFs for PCB congeners were predicted using the method described in Section 4.3.2.2.2. BCFs listed as "NA," or not available, could not be estimated because the concentrations of these congeners were below the limit of reliable quantification (Table 4-4c).

[3] Avian egg BCFs were estimated on a whole egg basis. Therefore, resulting food predictions have units of mg/kg whole egg. Avian adipose BCFs were estimated on a fat basis. Therefore, predicted food concentrations have units of mg/kg fat.

[4] The avian tPCB egg BCF is from Fries et al. (1977). Avian egg BCFs for dioxins and furans are from Stephens et al., 1995. Avian egg BCFs were not available for PCB congeners; therefore, they were predicted using the relationship between the BCFs for dioxins and furans in adipose tissue (Hoogeboom et al., 2004) and eggs (Stephens et al., 1995). Avian adipose and egg BCFs listed as "NA," or not available, could not be estimated because the concentrations of these congeners were below the limit of reliable quantification.

[5] The avian adipose BCFs for dioxin-like PCBs, dioxins, and furans are from Hoogeboom et al., 2004. Avian adipose BCFs listed as "NA," or not available, could not be estimated because the concentrations of these congeners were below the limit of reliable quantification.

Table 4-8b

Summary of Data on Transport of PCBs to Milk and Predicted BCFs for Dioxin-Like PCB Congeners

	Log Kow[1]	Metabolism Score (Thomas)[2]	Metabolism Class (McLachlan)[3]	BCF (Tuinstra)[4]	BCF (Thomas)[5]	BCF (McLachlan)[6]	Absorbed, % (Thomas)[5]	Maximum BCF[7]	Predicted Absorption	Predicted BCF[8]
Dioxin-like PCB congeners										
PCB77	6.11	2							71	6.4
PCB81		2							71	6.4
PCB105	6.41	2			NA		66.0	11.1	66	5.9
PCB114	6.65	2							61	5.5
PCB118	6.57	1	P		18.3	18.3	69.0	11.6	63	11.2
PCB123	6.64	1	P			18.3			61	11.0
PCB126		0							64	11.5
PCB156	7.13	1	P		12.8	18.0			52	9.3
PCB157		1	P			18.0			49	8.9
PCB167	7.29	0			15.3				49	8.8
PCB169	7.42	0							47	8.4
PCB189	7.72	0							41	7.4
Other PCB Congeners										
PCB1	4.33	11		0.4						
PCB3	4.55	8		NA						
PCB4	4.25	8		NA	NA					
PCB7	5.09	7		0.2						
PCB15	5.03	4		0.1						
PCB18	5.31	7			0.5		84.0	14.1		
PCB28	5.51	3	SP		0.7	0.5				
PCB31	5.46	4			0.8					
PCB33	5.48	4			0.5					
PCB37	5.58	3			1.0					
PCB44	5.61	5			NA					
PCB47	5.93	2	P		4.2	11.4	81.0	13.6		
PCB49	5.86	3			NA					
PCB52	5.81	4		0.9	NA		84.0	14.1		
PCB60	5.89	3	SP		NA	2.0				
PCB66	5.98	2	SP		3.0	2.0				
PCB74	6.10	2	P		7.6	11.4	78.0	13.1		
PCB85	6.18	2	P			18.3				
PCB87	6.14	4		NA	NA		72.0	12.1		
PCB95	5.78	4		1.2						
PCB97	6.25	3		NA						
PCB99	6.41	1	P			18.3				
PCB101	6.36	2		0.5	0.8		65.0	10.9		
PCB107		1	SP			6.2				
PCB110	6.20	3			0.3		70.0	11.8		
PCB115	6.43	2	P			18.3				
PCB128	6.50	2	P	6.2	10.9	18.0	77.0	13.0		
PCB130		1	P			18.0				
PCB136		4		0.0						
PCB138	6.67	1	P	4.5	12.5	18.0	55.0	9.3		
PCB141	6.80	2		0.6	1.0					
PCB146	6.85	0	SP			9.4				
PCB149	6.41	2		0.5	0.8		50.0	8.4		
PCB151	6.38	2		0.5	NA		54.0	9.1		
PCB153	6.84	0	P	4.9	14.0	18.0	55.0	9.3		
PCB158	6.78	1	P			18.0				
PCB170	7.08	1	P	4.2	10.9	12.6	44.0	7.4		
PCB171	6.86	1	P			12.6				
PCB172	7.21	0	SP			2.5				
PCB177	6.73	1	SP			2.5				
PCB178	6.85	0	SP			2.5				
PCB180	7.21	0	P	4.1	11.3	12.6	50.0	8.4		
PCB183	7.02	0	P		10.9	12.6	45.0	7.6		
PCB185	7.01	2		NA						
PCB187	6.92	0	SP	1.5	1.5	2.5	61.0	10.3		
PCB190	7.08	0	P			12.6				
PCB194	7.62	0	P	4.2	NA	9.9	57.0	9.6		
PCB195	7.35	1	P			9.9				
PCB196	7.43	0	P			9.9				
PCB197	7.21	0	P			9.9				
PCB198	7.43	0		1.6						
PCB202	7.01	0	SP			2.2				
PCB203	7.49	0	P			9.9				
PCB205	7.62	0	P			9.9				
PCB206	7.94	0		3.8						
PCB209	8.38	0	P			8.9				

BCFs listed as NA, or not available, could not be estimated because the concentrations of these congeners were below detection lmits in the experimental studies.

[1] Log Kow from Brodsky and Ballschmitter (1988).

[2] Metabolism Score <2 = 1.0; Metabolism score 2 = 0.5; Metabolism score >2 = 0.0. From Thomas et al. (1999, 99-1206).

[3] P = persistent; SP = semi-persistent.

[4] Tuinstra et al. (1981) - Four cows dosed with Aroclor 1260 for 60 days.

[5] Thomas et al. (1999) - Five cows measured weekly for 15 wks. Normal background.

[6] McLachlan (1993) - One cow measured twice. Normal background.

[7] Maximum BCF = Fraction Absorbed * (Dry matter intake/Milk fat). Data from Thomas et al. (1999).

[8] See text for details on predicted BCFs.

Table 4-8c

Derivation of Mammalian BCFs for PCDD/PCDFs

	McLachlan et al. (1990)[1]	Fries et al. (1999)[2]	McLachlan & Richter (1999)[3]	Mean[4]	Coefficients of Variation, %	
					Fries et al.	McLachlan & Richter
Dioxin Congeners						
2,3,7,8-CDD	5.9	7.1	5.4	6.1	58	---
1,2,3,7,8-CDD	5.5	5.0	5.5	5.3	24	25
1,2,3,4,7,8-CDD	2.9	3.1	4.7	3.6	26	28
1,2,3,6,7,8-CDD	2.4	3.7	4.7	3.6	24	23
1,2,3,7,8,9-CDD	3.0	2.6	2.3	2.6	26	35
1,2,3,4,6,7,8-CDD	0.5	0.7	0.5	0.6	32	16
1,2,3,4,6,7,8,9-CDD	0.7	0.1	0.1	0.1	40	38
Furan Congeners						
2,3,7,8-CDF[5]	2.5 [5]	0.11 [6]	NA [7]	--	---	---
1,2,3,7,8-CDF[5]	2.6 [8]	0.31 [6]	NA [7]	--	---	---
2,3,4,7,8-CDF	4.2	3.5	5.6	4.4	19	6
1,2,3,4,7,8-CDF	3.2	3.0	3.4	3.2	23	19
1,2,3,6,7,8-CDF	2.7	3.1	2.6	2.8	24	20
2,3,4,6,7,8-CDF	2.4	1.9	2.7	2.3	26	12
1,2,3,7,8,9-CDF[5]	NA [7]	0.27 [6]	NA [7]	--	---	---
1,2,3,4,6,7,8-CDF	0.5	0.7	0.5	0.6	30	9
1,2,3,4,7,8,9-CDF	1.3	0.9	NA [7]	1.1	31	---
1,2,3,4,6,7,8,9-CDF	0.2	0.1	NA [7]	0.1	35	---

[1] McLachlan et al. (1990) - Single cow, background concentrations.
[2] Fries et al. (1999) - Mean of four cows dosed with PCP-treated wood.
[3] McLachlan & Richter (1999) - Mean of four cows, background concentrations.
Assumed fat content of milk because data not presented in paper.
[4] Mean - Not weighted for number of animals in each study.
[5] Value is not reliable because it includes 2,3,4,8-CDF.
[6] Not detected in milk fat. Value is based on the detection limit.
[7] Not detected in milk fat. Detection limit was not included in paper.
[8] Value is not reliable because it includes 1,2,3,4,8-CDF.

Table 4-9a

Comparison of Predicted Milk Fat Concentrations for Cattle on Commercial Farms to Milk Fat Concentrations Measured in the U.S. Food Supply

Contaminant of Potential Concern (COPC)	0.5 mg/kg tPCBs in Soil				2 mg/kg tPCBs in Soil			
	Milk Fat Concentration (mg/kg fat)	Milk Fat TEQ Concentration[a] (mg TEQ/kg fat)	Background Milk Fat Mean Concentration[b] (mg/kg fat)	Background Milk Fat TEQ Concentration[a] (mg TEQ/kg fat)	Milk Fat Concentration (mg/kg fat)	Milk Fat TEQ Concentration[a] (mg TEQ/kg fat)	Background Milk Fat Mean Concentration[b] (mg/kg fat)	Background Milk Fat TEQ Concentration[a] (mg TEQ/kg fat)
tPCBs	0.0012	NA	NM	NA	0.0048	NA	NM	NA
Dioxin-like PCBs								
77	0.0000026	0.00000000026	0.000011	0.0000000011	0.0000080	0.00000000080	0.000011	0.0000000011
81	0	0			0	0		
105	0.000013	0.0000000013	0.00017	0.000000017	0.000026	0.0000000026	0.00017	0.000000017
114	0	0			0	0		
118	0.000067	0.0000000067	0.00069	0.000000069	0.00014	0.000000014	0.00069	0.000000069
123	0.0000015	0.00000000015			0.0000033	0.00000000033		
126	0.0000050	0.00000050	0.0000036	0.00000036	0.000014	0.0000014	0.0000036	0.00000036
156	0.000015	0.0000000074	0.000060	0.000000030	0.000031	0.000000015	0.000060	0.000000030
157	0.0000028	0.0000000014	0.000014	0.0000000069	0.0000082	0.0000000041	0.000014	0.000000007
167	0.000010	0.00000000010			0.000022	0.00000000022		
169	0.0000033	0.000000033	0.00000050	0.0000000050	0.000009	0.000000093	0.00000050	0.0000000050
189	0.0000058	0.00000000058			0.000011	0.0000000011		
Dioxin-like PCB TEQ		*0.00000055*		*0.00000049*		*0.0000015*		*0.00000049*
Dioxin Congeners								
2,3,7,8-CDD	0	0	0.000000070	0.000000070	0	0	0.000000070	0.00000007
1,2,3,7,8-CDD	0	0	0.00000032	0.00000032	0	0	0.00000032	0.00000032
1,2,3,4,7,8-CDD	0	0	0.00000039	0.000000039	0	0	0.00000039	0.000000039
1,2,3,6,7,8-CDD	0	0	0.0000019	0.00000019	0	0	0.0000019	0.00000019
1,2,3,7,8,9-CDD	0	0	0.00000055	0.000000055	0	0	0.00000055	0.000000055
1,2,3,4,6,7,8-CDD	0	0	0.0000050	0.000000050	0	0	0.0000050	0.000000050
1,2,3,4,6,7,8,9-CDD	0	0	0.0000049	0.00000000049	0	0	0.0000049	0.00000000049
Dioxin TEQ		*0*		*0.00000072*		*0*		*0.00000072*
Furan Congeners								
2,3,7,8-CDF	0	0	0.000000080	0.0000000080	0	0	0.000000080	0.000000008
1,2,3,7,8-CDF	0	0	0.00000005[c]	0.0000000025	0	0	0.00000005[c]	0.0000000025
2,3,4,7,8-CDF	0	0	0.00000028	0.00000014	0	0	0.00000028	0.00000014
1,2,3,4,7,8-CDF	0	0	0.00000039	0.000000039	0	0	0.00000039	0.000000039
1,2,3,6,7,8-CDF	0	0	0.00000025	0.000000025	0	0	0.00000025	0.000000025
2,3,4,6,7,8-CDF	0	0	0.00000028	0.000000028	0	0	0.00000028	0.000000028
1,2,3,7,8,9-CDF	0	0	0.00000005[c]	0.0000000050	0	0	0.00000005[c]	0.0000000050
1,2,3,4,6,7,8-CDF	0	0	0.0000008	0.0000000083	0	0	0.00000083	0.0000000083
1,2,3,4,7,8,9-CDF	0	0	0.00000005[c]	0.00000000050	0	0	0.00000005[c]	0.00000000050
1,2,3,4,6,7,8,9-CDF	0	0	0.00000005[c]	0.0000000000050	0	0	0.00000005[c]	0.0000000000050
Furan TEQ		*0*		*0.00000026*		*0*		*0.000000256*
Total TEQ[d]		***0.00000055***		***0.0000015***		***0.0000015***		***0.0000015***

Notes:

NA = Not Applicable.

NM = Not Measured.

[a] The TEQ concentration is calculated using TEFs in: Van den Berg, et al. 1998. Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife. *Environmental Health Perspectives* 106(12):775-792.

[b]Lorber, M. et. al. 1998. A National Survey of Dioxin-Like Compounds in the United States Milk Supply. Short paper in Organohalogen Compounds, Volume 38: 125-129.

[c] This congener was not detected in the eight composite background samples.The mean concentration is calculated using half the detection limit for non-detects.

[d] The Total TEQ is the sum of the TEQ concentrations for all congeners. Note that background concentrations were not available for all PCB congeners for which milk fat TEQ concentrations were predicted.

Table 4-9b

Comparison of Predicted Milk Fat Concentrations for Cattle on Backyard Farms to Milk Fat Concentrations Measured in the U.S. Food Supply

Contaminant of Potential Concern (COPC)	0.5 mg/kg tPCB in Soil				2 mg/kg tPCB in Soil			
	Milk Fat Concentration (mg/kg fat)	Milk Fat TEQ Concentration[a] (mg TEQ/kg fat)	Background Milk Fat Mean Concentration[b] (mg/kg fat)	Background Milk Fat TEQ Concentration[a] (mg TEQ/kg fat)	Milk Fat Concentration (mg/kg fat)	Milk Fat TEQ Concentration[a] (mg TEQ/kg fat)	Background Milk Fat Mean Concentration[b] (mg/kg fat)	Background Milk Fat TEQ Concentration[a] (mg TEQ/kg fat)
tPCBs	0.056	NA	NM	NA	0.22	NA	NM	NA
Dioxin-like PCBs								
77	0.000092	0.0000000092	0.00001	0.0000000011	0.00028	0.000000028	0.000011	0.0000000011
81	0.00000018	0.000000000018			0.00000047	0.000000000047		
105	0.00056	0.000000056	0.00017	0.000000017	0.0011	0.00000011	0.00017	0.000000017
114	0.0000053	0.0000000027			0.000013	0.0000000065		
118	0.0028	0.00000028	0.00069	0.000000069	0.0058	0.00000058	0.00069	0.000000069
123	0.000077	0.0000000077			0.00017	0.000000017		
126	0.00017	0.000017	0.0000036	0.00000036	0.00047	0.000047	0.0000036	0.00000036
156	0.00072	0.00000036	0.000060	0.000000030	0.0015	0.00000074	0.000060	0.000000030
157	0.00014	0.000000071	0.000014	0.0000000069	0.00042	0.00000021	0.000014	0.0000000069
167	0.00048	0.0000000048			0.0010	0.000000010		
169	0.00011	0.0000011	0.00000050	0.0000000050	0.00030	0.0000030	0.00000050	0.0000000050
189	0.00027	0.000000027			0.00053	0.000000053		
Dioxin-like PCB TEQ		*0.000019*		*0.00000049*		*0.000051*		*0.00000049*
Dioxin Congeners								
2,3,7,8-CDD	0.000000025	0.000000025	0.000000070	0.000000070	0.000000047	0.000000047	0.000000070	0.000000070
1,2,3,7,8-CDD	0.000000045	0.000000045	0.00000032	0.000000320	0.000000091	0.000000091	0.00000032	0.00000032
1,2,3,4,7,8-CDD	0.000000029	0.0000000029	0.00000039	0.000000039	0.000000060	0.0000000060	0.00000039	0.000000039
1,2,3,6,7,8-CDD	0.000000074	0.0000000074	0.0000019	0.00000019	0.00000016	0.000000016	0.0000019	0.00000019
1,2,3,7,8,9-CDD	0.00000004	0.0000000038	0.00000055	0.000000055	0.000000075	0.0000000075	0.00000055	0.000000055
1,2,3,4,6,7,8-CDD	0.00000014	0.0000000014	0.0000050	0.000000050	0.00000034	0.0000000034	0.0000050	0.000000050
1,2,3,4,6,7,8,9-CDD	0.00000019	0.000000000019	0.0000049	0.00000000049	0.00000047	0.000000000047	0.0000049	0.00000000049
Dioxin TEQ		*0.000000086*		*0.00000072*		*0.00000017*		*0.00000072*
Furan Congeners								
2,3,7,8-CDF	0	0	0.000000080	0.0000000080	0	0	0.000000080	0.0000000080
1,2,3,7,8-CDF	0	0	0.00000005[c]	0.0000000025	0	0	0.00000005[c]	0.0000000025
2,3,4,7,8-CDF	0.00000026	0.00000013	0.00000028	0.00000014	0.00000070	0.00000035	0.00000028	0.00000014
1,2,3,4,7,8-CDF	0.00000015	0.000000015	0.00000039	0.000000039	0.00000041	0.000000041	0.00000039	0.000000039
1,2,3,6,7,8-CDF	0.000000079	0.0000000079	0.00000025	0.000000025	0.00000022	0.000000022	0.00000025	0.000000025
2,3,4,6,7,8-CDF	0.000000081	0.0000000081	0.00000028	0.000000028	0.00000020	0.000000020	0.00000028	0.000000028
1,2,3,7,8,9-CDF	0	0	0.00000005[c]	0.0000000050	0	0	0.00000005[c]	0.0000000050
1,2,3,4,6,7,8-CDF	0.00000017	0.0000000017	0.00000083	0.0000000083	0.00000046	0.0000000046	0.00000083	0.0000000083
1,2,3,4,7,8,9-CDF	0.000000022	0.00000000022	0.00000005[c]	0.00000000050	0.000000055	0.00000000055	0.00000005[c]	0.00000000050
1,2,3,4,6,7,8,9-CDF	0.000000029	0.0000000000029	0.00000005[c]	0.0000000000050	0.000000074	0.0000000000074	0.00000005[c]	0.0000000000050
Furan TEQ		*0.00000016*		*0.00000026*		*0.00000044*		*0.00000026*
Total TEQ [d]		***0.000019***		***0.0000015***		***0.000052***		***0.0000015***

Notes:

NA = Not Applicable.

NM = Not Measured.

[a] The TEQ concentration is calculated using TEFs in: Van den Berg, et al. 1998. Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife. *Environmental Health Perspectives* 106(12):775-792.

[b] Lorber, M. et. al. 1998. A National Survey of Dioxin-Like Compounds in the United States Milk Supply. Short paper in Organohalogen Compounds, Volume 38: 125-129.

[c] This congener was not detected in the eight composite background samples.The mean concentration is calculated using half the detection limit for non-detects.

[d] The Total TEQ is the sum of the TEQ concentrations for all congeners. Note that background concentrations were not available for all PCB congeners for which milk fat TEQ concentrations concentrations are presented in scientific notation.

Table 4-9c

Comparison of Predicted Beef Fat Concentrations for Cattle on Commercial Farms to Beef Fat Concentrations Measured in the U.S. Food Supply

Contaminant of Potential Concern (COPC)	0.5 mg/kg tPCB in Soil				2 mg/kg tPCB in Soil			
	Body Fat Concentration (mg/kg fat)	Body Fat TEQ Concentration[a] (mg TEQ/kg fat)	Background Body Fat Mean Concentration[b,c] (mg/kg fat)	Background Body Fat TEQ Concentration[a] (mg TEQ/kg fat)	Body Fat Concentration (mg/kg fat)	Body Fat TEQ Concentration[a] (mg TEQ/kg fat)	Background Body Fat Mean Concentration[b,c] (mg/kg fat)	Background Body Fat TEQ Concentration[a] (mg TEQ/kg fat)
tPCBs	0.065	NA	NM	NA	0.26	NA	NM	NA
Dioxin-like PCBs								
77	0.000080	0.0000000080	0.0000049	0.00000000049	0.00025	0.000000025	0.0000049	0.00000000049
81	0.00000035	0.000000000035			0.00000094	0.000000000094		
105	0.00062	0.000000062	0.000093	0.0000000093	0.0012	0.00000012	0.000093	0.0000000093
114	0.000011	0.0000000053			0.000026	0.000000013		
118	0.0029	0.00000029	0.00044	0.000000044	0.0061	0.00000061	0.00044	0.000000044
123	0.000093	0.0000000093			0.00020	0.000000020		
126	0.00015	0.000015	0.0000041	0.00000041	0.00040	0.000040	0.0000041	0.00000041
156	0.00085	0.00000043	0.000060	0.000000030	0.0018	0.00000088	0.000060	0.000000030
157	0.00018	0.000000088	0.000014	0.0000000069	0.00052	0.00000026	0.000014	0.0000000069
167	0.00054	0.0000000054			0.0011	0.000000011		
169	0.000084	0.00000084	0.00000070	0.0000000070	0.00024	0.0000024	0.00000070	0.0000000070
189	0.00030	0.000000030			0.00060	0.000000060		
Dioxin-like PCB TEQ		*0.000016*		*0.00000051*		*0.000044*		*0.00000051*
Dioxin Congeners								
2,3,7,8-CDD	0.000000050	0.000000050	0.000000050	0.000000050	0.000000095	0.000000095	0.000000050	0.000000050
1,2,3,7,8-CDD	0.000000090	0.000000090	0.00000035	0.00000035	0.00000018	0.00000018	0.00000035	0.00000035
1,2,3,4,7,8-CDD	0.000000057	0.0000000057	0.00000064	0.000000064	0.00000012	0.000000012	0.00000064	0.000000064
1,2,3,6,7,8-CDD	0.00000015	0.000000015	0.0000014	0.00000014	0.00000032	0.000000032	0.0000014	0.00000014
1,2,3,7,8,9-CDD	0.000000076	0.0000000076	0.00000053	0.000000053	0.00000015	0.000000015	0.00000053	0.000000053
1,2,3,4,6,7,8-CDD	0.00000028	0.0000000028	0.0000045	0.000000045	0.00000069	0.0000000069	0.0000045	0.000000045
1,2,3,4,6,7,8,9-CDD	0.00000038	0.000000000038	0.0000048	0.00000000048	0.00000094	0.000000000094	0.0000048	0.00000000048
Dioxin TEQ		*0.00000017*		*0.00000070*		*0.00000034*		*0.00000070*
Furan Congeners								
2,3,7,8-CDF	0	0	0.000000030	0.0000000030	0	0	0.000000030	0.0000000030
1,2,3,7,8-CDF	0	0	0.00000031	0.000000016	0	0	0.00000031	0.000000016
2,3,4,7,8-CDF	0.00000053	0.00000026	0.00000036	0.00000018	0.0000014	0.00000070	0.00000036	0.00000018
1,2,3,4,7,8-CDF	0.00000030	0.000000030	0.00000055	0.000000055	0.00000082	0.000000082	0.00000055	0.000000055
1,2,3,6,7,8-CDF	0.00000016	0.000000016	0.00000040	0.000000040	0.00000043	0.000000043	0.00000040	0.000000040
2,3,4,6,7,8-CDF	0.00000016	0.000000016	0.00000031	0.000000031	0.00000041	0.000000041	0.00000031	0.000000031
1,2,3,7,8,9-CDF	0	0	0.00000039	0.000000039	0	0	0.00000039	0.000000039
1,2,3,4,6,7,8-CDF	0.00000034	0.0000000034	0.0000010	0.000000010	0.00000092	0.0000000092	0.0000010	0.000000010
1,2,3,4,7,8,9-CDF	0.000000043	0.00000000043	0.00000031	0.0000000031	0.00000011	0.0000000011	0.00000031	0.0000000031
1,2,3,4,6,7,8,9-CDF	0.000000058	0.0000000000058	0.0000019	0.00000000019	0.00000015	0.000000000015	0.0000019	0.00000000019
Furan TEQ		*0.00000033*		0.00000038		*0.00000088*		0.00000038
Total TEQ [d]		***0.000017***		***0.0000016***		***0.000045***		***0.0000016***

Notes:

NA = Not Applicable.

NM = Not Measured.

[a] The TEQ concentration is calculated using TEFs in: Van den Berg, et al. 1998. Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife. *Environmental Health Perspectives* 106(12):775-792.

[b] Winters, D. et. al. 1996. Coplanar polychlorinated biphenyls (PCBs) in a national sample of beef in the United States: preliminary results. Presented at Dioxin '96, The 16th Symposium on Chlorinated Dioxins and Related Compounds, held Aug 12-16 at Amsterdam, the Netherlands. Short paper in, Organohalogen Compounds, Volume 27: 386-390.

[c] Winters, D. et al. 1996. A statistical survey of dioxin-like compounds in United States beef: a progress report. Chemosphere, 32(3): 469-478.

[d] The Total TEQ is the sum of the TEQ concentrations for all congeners. The mean concentration is calculated using half the detection limit for non-detects.

Table 4-9d

Comparison of Predicted Beef Fat Concentrations for Cattle on Backyard Farms to Beef Fat Concentrations Measured in the U.S. Food Supply

Contaminant of Potential Concern (COPC)	0.5 mg/kg tPCB in Soil				2 mg/kg tPCB in Soil			
	Body Fat Concentration (mg/kg fat)	Body Fat TEQ Concentration[a] (mg TEQ/kg fat)	Background Body Fat Mean Concentration[b,c] (mg/kg fat)	Background Body Fat TEQ Concentration[a] (mg TEQ/kg fat)	Body Fat Concentration (mg/kg fat)	Body Fat TEQ Concentration[a] (mg TEQ/kg fat)	Background Body Fat Mean Concentration[b,c] (mg/kg fat)	Background Body Fat TEQ Concentration[a] (mg TEQ/kg fat)
tPCBs	0.10	NA			0.40	NA		
Dioxin-like PCBs								
77	0.00016	0.000000016	0.0000049	0.00000000049	0.00048	0.000000048	0.0000049	0.00000000049
81	0.00000035	0.000000000035			0.00000094	0.000000000094		
105	0.00099	0.00000010	0.000093	0.0000000093	0.0020	0.00000020	0.000093	0.0000000093
114	0.000011	0.0000000053			0.000026	0.000000013		
118	0.0048	0.00000048	0.00044	0.000000044	0.010	0.0000010	0.00044	0.000000044
123	0.00014	0.000000014			0.00030	0.000000030		
126	0.00029	0.000029	0.0000041	0.00000041	0.00079	0.000079	0.0000041	0.00000041
156	0.0013	0.00000064	0.000060	0.000000030	0.0026	0.0000013	0.000060	0.000000030
157	0.00025	0.00000013	0.000014	0.0000000069	0.00075	0.00000038	0.000014	0.0000000069
167	0.00084	0.0000000084			0.0018	0.000000018		
169	0.00018	0.0000018	0.00000070	0.0000000070	0.00050	0.0000050	0.00000070	0.0000000070
189	0.00047	0.000000047			0.00093	0.000000093		
Dioxin-like PCB TEQ		*0.000032*		*0.00000051*		*0.000087*		*0.00000051*
Dioxin Congeners								
2,3,7,8-CDD	0.000000050	0.000000050	0.000000050	0.000000050	0.000000095	0.000000095	0.000000050	0.000000050
1,2,3,7,8-CDD	0.000000090	0.000000090	0.00000035	0.00000035	0.00000018	0.00000018	0.00000035	0.00000035
1,2,3,4,7,8-CDD	0.000000057	0.0000000057	0.00000064	0.000000064	0.00000012	0.000000012	0.00000064	0.000000064
1,2,3,6,7,8-CDD	0.00000015	0.000000015	0.0000014	0.00000014	0.00000032	0.000000032	0.0000014	0.00000014
1,2,3,7,8,9-CDD	0.000000076	0.0000000076	0.00000053	0.000000053	0.00000015	0.000000015	0.00000053	0.000000053
1,2,3,4,6,7,8-CDD	0.00000028	0.0000000028	0.0000045	0.000000045	0.00000069	0.0000000069	0.0000045	0.000000045
1,2,3,4,6,7,8,9-CDD	0.00000038	0.000000000038	0.0000048	0.00000000048	0.00000094	0.00000000009	0.0000048	0.00000000048
Dioxin TEQ		*0.00000017*		*0.00000070*		*0.00000034*		*0.00000070*
Furan Congeners								
2,3,7,8-CDF	0	0	0.000000030	0.0000000030	0	0	0.000000030	0.0000000030
1,2,3,7,8-CDF	0	0	0.00000031	0.000000016	0	0	0.00000031	0.000000016
2,3,4,7,8-CDF	0.00000053	0.00000026	0.00000036	0.00000018	0.0000014	0.00000070	0.00000036	0.00000018
1,2,3,4,7,8-CDF	0.00000030	0.000000030	0.00000055	0.000000055	0.00000082	0.000000082	0.00000055	0.000000055
1,2,3,6,7,8-CDF	0.00000016	0.000000016	0.00000040	0.000000040	0.00000043	0.000000043	0.00000040	0.000000040
2,3,4,6,7,8-CDF	0.00000016	0.000000016	0.00000031	0.000000031	0.00000041	0.000000041	0.00000031	0.000000031
1,2,3,7,8,9-CDF	0	0	0.00000039	0.000000039	0	0	0.00000039	0.000000039
1,2,3,4,6,7,8-CDF	0.00000034	0.0000000034	0.0000010	0.000000010	0.00000092	0.0000000092	0.0000010	0.000000010
1,2,3,4,7,8,9-CDF	0.000000043	0.00000000043	0.00000031	0.0000000031	0.00000011	0.0000000011	0.00000031	0.0000000031
1,2,3,4,6,7,8,9-CDF	0.000000058	0.0000000000058	0.0000019	0.00000000019	0.00000015	0.000000000015	0.0000019	0.00000000019
Furan TEQ		*0.00000033*		0.00000038		*0.00000088*		0.00000038
Total TEQ[d]		***0.000033***		***0.0000016***		***0.000088***		***0.0000016***

Notes:

NA = Not Applicable.

NM = Not Measured.

[a] The TEQ concentration is calculated using TEFs in: Van den Berg, et al. 1998. Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife. *Environmental Health Perspectives* 106(12):775-792.

[b] Winters, D. et. al. 1996. Coplanar polychlorinated biphenyls (PCBs) in a national sample of beef in the United States: preliminary results. Presented at Dioxin '96, The 16th Symposium on Chlorinated Dioxins and Related Compounds, held Aug 12-16 at Amsterdam, the Netherlands. Short paper in, Organohalogen Compounds, Volume 27: 386-390.

Table 4-9e

Comparison of Predicted Adipose Tissue Concentrations for Poultry on Commercial and Backyard Farms to Adipose Tissue Concentrations Measured in the U.S. Food Supply

Contaminant of Potential Concern (COPC)	0.5 mg/kg tPCB in soil		2 mg/kg tPCB in soil	
	Chicken Adipose Tissue Concentration (broilers) (mg/kg fat)	Chicken Adipose Tissue TEQ Concentration[a] (broilers) (mg TEQ/kg fat)	Chicken Adipose Tissue Concentration (broilers) (mg/kg fat)	Chicken Adipose Tissue TEQ Concentration[a] (broilers) (mg TEQ/kg fat)
tPCBs	0.13	NA	0.50	NA
Dioxin-like PCBs				
77	0.000028	0.0000000028	0.000087	0.0000000087
81	0.00000088	0.000000000088	0.0000024	0.00000000024
105	0.00063	0.000000063	0.0013	0.00000013
114	0.000019	0.0000000097	0.000047	0.000000024
118	0.0012	0.00000012	0.0025	0.00000025
123	0	0	0	0
126	0.000034	0.0000034	0.000091	0.0000091
156	0.00060	0.00000030	0.0012	0.00000062
157	0.00016	0.000000081	0.00048	0.00000024
167	0.00040	0.0000000040	0.00084	0.0000000084
169	0.0000046	0.000000046	0.000013	0.00000013
189	0.00021	0.000000021	0.00041	0.000000041
Dioxin-like PCB TEQ		*0.0000040*		*0.000011*
Dioxins				
2,3,7,8-CDD	0.00000011	0.00000011	0.00000022	0.00000022
1,2,3,7,8-CDD	0.00000020	0.00000020	0.00000040	0.00000040
1,2,3,4,7,8-CDD	0.00000014	0.000000014	0.00000030	0.000000030
1,2,3,6,7,8-CDD	0.00000063	0.000000063	0.0000014	0.00000014
1,2,3,7,8,9-CDD	0.00000018	0.000000018	0.00000035	0.000000035
1,2,3,4,6,7,8-CDD	0	0	0	0
1,2,3,4,6,7,8,9-CDD	0.000019	0.0000000019	0.000047	0.0000000047
Dioxin TEQ		*0.00000041*		*0.00000082*
Furans				
2,3,7,8-CDF	0.0000018	0.00000018	0.0000046	0.00000046
1,2,3,7,8-CDF	0.00000090	0.000000045	0.0000024	0.00000012
2,3,4,7,8-CDF	0.0000013	0.00000063	0.0000034	0.0000017
1,2,3,4,7,8-CDF	0.00000065	0.000000065	0.0000018	0.00000018
1,2,3,6,7,8-CDF	0.00000040	0.000000040	0.0000011	0.00000011
2,3,4,6,7,8-CDF	0.00000032	0.000000032	0.00000080	0.000000080
1,2,3,7,8,9-CDF	0	0	0	0
1,2,3,4,6,7,8-CDF	0.00000085	0.0000000085	0.0000023	0.000000023
1,2,3,4,7,8,9-CDF	0.000000079	0.00000000079	0.00000020	0.0000000020
1,2,3,4,6,7,8,9-CDF	0	0	0	0
Furan TEQ		*0.0000010*		*0.0000026*
Total TEQ		***0.0000054***		***0.000014***

Table 4-9e

Comparison of Predicted Adipose Tissue Concentrations for Poultry on Commercial and Backyard Farms to Adipose Tissue Concentrations Measured in the U.S. Food Supply

Contaminant of Potential Concern (COPC)	Background Concentrations									
	Two High Samples (Young chickens)[b,c] (mg/kg fat)	Two High Samples (Young chickens) TEQ[a] (mg TEQ/kg fat)	All Other Young Chickens[b,c] (n=39) (mg/kg fat)	All Other Young Chickens TEQ[a] (n=39) (mg TEQ/kg fat)	Light Fowl[b,c] (n=12) (mg/kg fat)	Light Fowl TEQ[a] (n=12) (mg TEQ/kg fat)	Heavy Fowl[b,c] (n=12) (mg/kg fat)	Heavy Fowl TEQ[a] (n=12) (mg TEQ/kg fat)	Young Turkeys[b,c] (n=15) (mg/kg fat)	Young Turkeys TEQ[a] (n=15) (mg TEQ/kg fat)
tPCBs	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Dioxin-like PCBs										
77	0.0000043, 0.000005	0.00000000043, 0.0000000005	0.0000093	0.00000000093	0.000012	0.0000000012	0.000011	0.000011	0.0000056	0.0000000011
81										
105	0.00007, 0.000085	0.000000007, 0.0000000085	0.00013	0.000000013	0.00017	0.000000017	0.00017	0.000000017	0.00031	0.0000000000017
114										
118	0.000214, 0.000296	0.0000000214, 0.0000000296	0.00052	0.000000052	0.00060	0.000000060	0.00066	0.000000066	0.0011	0.0000000000066
123										
126	0.0000011, 0.000002	0.00000011, 0.0000002	0.0000018	0.00000018	0.0000016	0.00000016	0.0000022	0.00000022	0.0000044	0.000000022
156	0.000021, 0.000031	0.0000000105, 0.0000000155	0.000041	0.000000021	0.000058	0.000000029	0.000054	0.000000027	0.00011	0.000000000014
157	0.0000064, 0.0000075	0.0000000032, 0.00000000375	0.000011	0.0000000053	0.000013	0.0000000063	0.000013	0.0000000067	0.000026	0.0000000000033
167										
169	0.00000005[d], 0.0000003	0.0000000005, 0.000000003	0.00000020	0.0000000020	0.00000020	0.0000000020	0.00000040	0.0000000040	0.00000060	0.000000000040
189										
Dioxin-like PCB TEQ		*0.000000153, 0.000000261*		*0.00000027*		*0.00000028*		*0.000011*		*0.000000023*
Dioxins										
2,3,7,8-CDD	0.0000168, 0.0000192	0.0000168, 0.0000192	0.00000016	0.00000016	0.000000050	0.000000050	0.00000043	0.00000043	0.00000024	0.00000043
1,2,3,7,8-CDD	0.00000694, 0.00000935	0.00000694, 0.00000935	0.00000024	0.00000024	0.00000015[d]	0.00000015	0.00000032	0.00000032	0.00000032	0.00000032
1,2,3,4,7,8-CDD	0.00000086, 0.00000162	0.000000086, 0.000000162	0.00000018	0.000000018	0.00000015[d]	0.000000015	0.00000024	0.000000024	0.00000016	0.0000000024
1,2,3,6,7,8-CDD	0.00000357, 0.00000568	0.000000357, 0.000000568	0.00000039	0.000000039	0.00000034	0.000000034	0.00000071	0.000000071	0.00000079	0.0000000071
1,2,3,7,8,9-CDD	0.0000105, 0.0000124	0.00000105, 0.00000124	0.00000039	0.000000039	0.00000015	0.000000015	0.00000060	0.000000060	0.00000017	0.0000000060
1,2,3,4,6,7,8-CDD	0.00000998, 0.0000207	0.0000000998, 0.000000207	0.0000015	0.000000015	0.00000093	0.0000000093	0.0000020	0.000000020	0.00000054	0.00000000020
1,2,3,4,6,7,8,9-CDD	0.0000478, 0.0000547	0.00000000478, 0.00000000547	0.0000053	0.00000000053	0.0000021	0.00000000021	0.0000077	0.00000000077	0.00000075	0.00000000000008
Dioxin TEQ		*0.0000253, 0.0000307*		*0.00000051*		*0.00000027*		*0.00000093*		*0.00000077*
Furans										
2,3,7,8-CDF	0.00000019, 0.00000024	0.000000019, 0.000000024	0.00000028	0.000000028	0.00000025	0.000000025	0.00000048	0.000000048	0.00000057	0.0000000048
1,2,3,7,8-CDF	0.00000016[d], 0.00000015[d]	0.000000008, 0.0000000075	0.00000021	0.000000011	0.00000018	0.0000000090	0.00000014	0.0000000070	0.00000036	0.00000000035
2,3,4,7,8-CDF	0.00000016[d], 0.00000015[d]	0.00000008, 0.000000075	0.00000025	0.00000013	0.00000022	0.00000011	0.00000018	0.000000090	0.00000053	0.000000045
1,2,3,4,7,8-CDF	0.00000016[d], 0.00000015[d]	0.000000016, 0.000000015	0.00000023	0.000000023	0.00000016	0.000000016	0.00000017	0.000000017	0.00000020	0.0000000017
1,2,3,6,7,8-CDF	0.00000016[d], 0.00000015[d]	0.000000016, 0.000000015	0.00000020	0.000000020	0.00000015	0.000000015	0.00000015	0.000000015	0.00000017	0.0000000015
2,3,4,6,7,8-CDF	0.00000016[d], 0.00000015[d]	0.000000016, 0.000000015	0.00000021	0.000000021	0.00000014	0.000000014	0.00000015	0.000000015	0.00000015	0.0000000015
1,2,3,7,8,9-CDF	0.00000016[d], 0.00000015[d]	0.000000016, 0.000000015	0.00000015[d]	0.000000015	0.00000015[d]	0.000000015	0.00000015[d]	0.000000015	0.00000015[d]	0.0000000015
1,2,3,4,6,7,8-CDF	0.00000016[d], 0.00000084	0.0000000016, 0.0000000084	0.00000027	0.0000000027	0.00000015	0.0000000015	0.00000020	0.0000000020	0.00000015	0.000000000020
1,2,3,4,7,8,9-CDF	0.00000016[d], 0.00000015[d]	0.0000000016, 0.0000000015	0.00000017	0.0000000017	0.00000015[d]	0.0000000015	0.00000015[d]	0.0000000015	0.00000015[d]	0.000000000015
1,2,3,4,6,7,8,9-CDF	0.00000016[d], 0.00000055	0.000000000031, 0.000000000055	0.00000034	0.000000000034	0.00000029[d]	0.000000000029	0.00000031	0.000000000031	0.00000029[d]	0.0000000000000031
Furan TEQ		*0.0000000672, 0.00000007*		*0.00000025*		*0.00000021*		*0.00000021*		*0.000000056*
Total TEQ		***0.0000256, 0.0000311***		***0.0000010***		***0.00000076***		***0.000012***		***0.00000085***

Notes:
NA = Not Applicable.
NM = Not Measured.
[a] The TEQ concentration is calculated using TEFs in: Van den Berg, et al. 1998. Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife. *Environmental Health Perspectives* 106(12):775-792.
[b] The mean concentration is calculated using half the detection limit for non-detects.
[c] Ferrario, J. et al. 1997. A Statistical Survey of Dioxin-like Compounds in United States Poulty Fat.Organohalogen Compounds. 32:245-251.
[d] This congener was never detected. The mean concentration is calculated using half the detection limit.

Table 4-9f

Predicted Whole Egg Concentrations for Poultry on Commercial and Backyard Farms

Contaminant of Potential Concern (COPC)	0.5 mg/kg tPCB in Soil: Whole Egg Concentration (mg/kg)	0.5 mg/kg tPCB in Soil: Whole Egg TEQ Concentration[a] (mg TEQ/kg)	2 mg/kg tPCB in Soil: Whole Egg Concentration (mg/kg)	2 mg/kg tPCB in Soil: Whole Egg TEQ Concentration[a] (mg TEQ/kg)
tPCBs	0.045	NA	0.18	NA
Dioxin-like PCBs				
77	0.000018	0.0000000018	0.000054	0.0000000054
81	0.00000044	0.000000000044	0.0000012	0.00000000012
105	0.00038	0.000000038	0.00076	0.000000076
114	0.000014	0.0000000068	0.000033	0.000000017
118	0.00078	0.000000078	0.0016	0.00000016
123	0	0	0	0
126	0.000016	0.0000016	0.000044	0.0000044
156	0.00037	0.00000018	0.00075	0.00000038
157	0.000090	0.000000045	0.00027	0.00000013
167	0.00024	0.0000000024	0.00050	0.0000000050
169	0.0000025	0.000000025	0.0000072	0.000000072
189	0.00015	0.000000015	0.00030	0.000000030
Dioxin-like PCB TEQ		*0.0000020*		*0.0000053*
Dioxins				
2,3,7,8-CDD	0.000000074	0.000000074	0.00000014	0.00000014
1,2,3,7,8-CDD	0.00000011	0.00000011	0.00000022	0.00000022
1,2,3,4,7,8-CDD	0.00000010	0.000000010	0.00000022	0.000000022
1,2,3,6,7,8-CDD	0.00000033	0.000000033	0.0000007	0.000000071
1,2,3,7,8,9-CDD	0.00000016	0.000000016	0.00000032	0.000000032
1,2,3,4,6,7,8-CDD	0.0000031	0.000000031	0.0000074	0.000000074
1,2,3,4,6,7,8,9-CDD	0.000015	0.0000000015	0.000038	0.0000000038
Dioxin TEQ		*0.00000028*		*0.00000057*
Furans				
2,3,7,8-CDF	0.00000038	0.000000038	0.00000095	0.000000095
1,2,3,7,8-CDF	0	0	0	0
2,3,4,7,8-CDF	0.0000011	0.00000057	0.0000030	0.0000015
1,2,3,4,7,8-CDF	0.00000088	0.000000088	0.0000024	0.00000024
1,2,3,6,7,8-CDF	0.00000048	0.000000048	0.0000013	0.00000013
2,3,4,6,7,8-CDF	0.00000032	0.000000032	0.00000080	0.000000080
1,2,3,7,8,9-CDF	0	0	0	0
1,2,3,4,6,7,8-CDF	0.0000026	0.000000026	0.0000069	0.000000069
1,2,3,4,7,8,9-CDF	0.00000022	0.0000000022	0.00000055	0.0000000055
1,2,3,4,6,7,8,9-CDF	0.0000012	0.00000000012	0.0000029	0.00000000029
Furan TEQ		*0.00000080*		*0.0000021*
Total TEQ		***0.0000031***		***0.0000080***

Notes:

NA = Not Applicable.

[a] The TEQ concentration is calculated using TEFs in: Van den Berg, et al. 1998. Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife. *Environmental Health Perspectives* 106(12):775-792.

Table 4-9g

Predicted Home Garden Produce Concentrations

Contaminant of Potential Concern (COPC)	0.5 mg/kg tPCB in Soil					
	Exposed Fruit Concentration (mg/kg, ww)	Exposed Fruit TEQ concentration (mg TEQ/kg, ww)	Exposed Vegetable Concentration (mg/kg, ww)	Exposed Vegetable TEQ concentration (mg TEQ/kg, ww)	Root Vegetable Concentration (mg/kg, ww)	Root Vegetable TEQ concentration (mg TEQ/kg, ww)
tPCBs	0.00090	NA	0.00090	NA	0.00015	NA
Dioxin-like PCBs						
77	0.0000011	0.00000000011	0.0000011	0.00000000011	0.00000019	0.000000000019
81	0	0	0	0	0	0
105	0.0000060	0.00000000060	0.0000060	0.00000000060	0.0000010	0.00000000010
114	0	0	0	0	0	0
118	0.000016	0.0000000016	0.000016	0.0000000016	0.0000027	0.00000000027
123	0.00000038	0.000000000038	0.00000038	0.000000000038	0.000000064	0.0000000000064
126	0.0000012	0.00000012	0.0000012	0.00000012	0.00000020	0.000000020
156	0.0000043	0.0000000022	0.0000043	0.0000000022	0.00000072	0.00000000036
157	0.00000085	0.00000000043	0.00000085	0.00000000043	0.00000014	0.000000000071
167	0.0000032	0.000000000032	0.0000032	0.000000000032	0.00000054	0.0000000000054
169	0.0000011	0.000000011	0.0000011	0.000000011	0.00000018	0.0000000018
189	0.0000021	0.00000000021	0.0000021	0.00000000021	0.00000036	0.000000000036
Dioxin-like PCB TEQ		*0.00000013*		*0.00000013*		*0.000000022*

Table 4-9g

Predicted Home Garden Produce Concentrations

Contaminant of Potential Concern (COPC)	2 mg/kg tPCB in Soil					
	Exposed Fruit Concentration (mg/kg, ww)	Exposed Fruit TEQ concentration (mg TEQ/kg, ww)	Exposed Vegetable Concentration (mg/kg, ww)	Exposed Vegetable TEQ concentration (mg TEQ/kg, ww)	Root Vegetable Concentration (mg/kg, ww)	Root Vegetable TEQ concentration (mg TEQ/kg, ww)
tPCBs	0.0036	NA	0.0036	NA	0.00060	NA
Dioxin-like PCBs						
77	0.0000034	0.00000000034	0.0000034	0.00000000034	0.00000057	0.000000000057
81	0	0	0	0	0	0
105	0.000012	0.0000000012	0.000012	0.0000000012	0.0000020	0.00000000020
114	0	0	0	0	0	0
118	0.000034	0.0000000034	0.000034	0.0000000034	0.0000057	0.00000000057
123	0.00000083	0.000000000083	0.00000083	0.000000000083	0.00000014	0.000000000014
126	0.0000032	0.00000032	0.0000032	0.00000032	0.00000054	0.000000054
156	0.0000089	0.0000000045	0.0000089	0.0000000045	0.0000015	0.00000000075
157	0.0000025	0.0000000013	0.0000025	0.0000000013	0.00000042	0.00000000021
167	0.0000069	0.000000000069	0.0000069	0.000000000069	0.0000011	0.000000000011
169	0.0000030	0.000000030	0.0000030	0.000000030	0.00000050	0.0000000050
189	0.0000042	0.00000000042	0.0000042	0.00000000042	0.00000070	0.000000000070
Dioxin-like PCB TEQ		*0.00000036*		*0.00000036*		*0.000000061*

Table 4-10

Exposure Assumptions(1)

Variable	CTE	RME	Units	Source	Description
General Info					
ED_{child}	6	6	yr	Assumed (1-7 year old)	
$ED_{adult\ farmer}$	29	64	yr	Assumed	Exposure duration on a farm (CTE: 35 yr; RME: 70 yr)
$ED_{adult\ resident}$	9	39	yr	MADPH 2001a	Exposure duration at a single residence in the Housatonic River area (CTE: 15 yr; RME: 45 yr)
EF	350	350	day/yr	Assumed	Exposure frequency
AT (cancer)	25,550	25,550	days	70 yr * 365 day/yr	Averaging time
AT $(noncancer)_{child\ farmer/residen}$	2,190	2,190	days	ED * 365 day/yr	Averaging time
AT $(noncancer)_{adult\ farmer}$	10,585	23,360	days	ED * 365 day/yr	Averaging time
AT $(noncancer)_{adult\ resident}$	3,285	14,235	days	ED * 365 day/yr	Averaging time
Conversion factor	0.001	0.001	kg/g	Units conversion	To convert consumption rate from g/kg-d to kg/kg-d
F_{GI}	1	1	unitless	Assumed	Fraction absorbed in GI tract
Ingestion of Dairy					
$CR_{dairy,\ child}$	44.1	70.3	g/kg-day	EPA, 1997; Table 13-28 & Table 11-2	Consumer-only intake of home-produced dairy (0.66 L/day CTE; 1.1 L/day RME)[1]
$CR_{dairy,\ adult\ farmer}$	12.4	15.1	g/kg-day	EPA, 1997; Table 13-28 & Table 11-2	Consumer-only intake of home-produced dairy (0.83 L/day CTE; 1.0 L/day RME)[1]
$CR_{dairy,\ adult\ resident}$	20.9	18.1	g/kg-day	EPA, 1997; Table 13-28 & Table 11-2	Consumer-only intake of home-produced dairy (0.86 L/day CTE; 0.74 L/day RME)[1]
Milk loss factor	0	0	unitless	Assumed	Mean net cooking loss and post-cooking loss
$F_{fat,\ Holstein}$	0.036	0.036	unitless	(2)	Fat content of Holstein cow milk (3.6%)[2]
$F_{fat,\ Jersey}$	0.046	0.046	unitless	(2)	Fat content of Jersey cow milk (4.6%)[2]
Ingestion of Beef					
$CR_{beef,\ child}$	3.72	4.86	g/kg-day	EPA, 1997; Table 13-36 & Table 11-3	Consumer-only intake of home-produced beef (0.12 lb/day CTE; 0.16 lb/day RME)[1]
$CR_{beef,\ adult\ farmer}$	2.26	2.65	g/kg-day	EPA, 1997; Table 13-36 & Table 11-3	Consumer-only intake of home-produced beef (0.33 lb/day CTE; 0.39 lb/day RME)[1]
$CR_{beef,\ adult\ resident}$	2.86	2.83	g/kg-day	EPA, 1997; Table 13-36 & Table 11-3	Consumer-only intake of home-produced beef (0.26 lb/day CTE and RME)[1]
Beef cooking loss	0.27	0.27	unitless	EPA, 1997; Table 13-5	Mean net cooking loss for beef (27%)
Beef post-cooking loss	0.24	0.24	unitless	EPA, 1997; Table 13-5	Mean post-cooking loss for beef (24%)
$F_{fat,\ beef}$	0.099	0.146	unitless	EPA, 1997, Tables 11-24 and 11-25; Schecter et al., 1998	Fat content of beef (CTE corresponds to lean and fat portions of beef; RME corresponds to cooked hamburger from Schecter et al., 1998)
Ingestion of Poultry					
$CR_{poultry,\ child}$	2.35	2.88	g/kg-day	EPA, 1997; Table 13-55 & Table 11-5	Consumer-only intake of home-produced poultry (0.08 lb/day CTE; 0.10 lb/day RME)[1]
$CR_{poultry,\ adult\ farmer}$	1.32	2.08	g/kg-day	EPA, 1997; Table 13-55 & Table 11-5	Consumer-only intake of home-produced poultry (0.19 lb/day CTE; 0.31 lb/day RME)[1]
$CR_{poultry,\ adult\ resident}$	1.62	1.73	g/kg-day	EPA, 1997; Table 13-55 & Table 11-5	Consumer-only intake of home-produced poultry (0.15 lb/day CTE; 0.16 lb/day RME)[1]
Poultry cooking loss	0.32	0.32	unitless	EPA, 1997; Table 13-5	Mean net cooking loss for chicken (32%)
Poultry post-cooking loss	0.31	0.31	unitless	EPA, 1997; Table 13-5	Mean post-cooking loss for chicken (31%)
$F_{fat,\ poultry}$	0.0741	0.136	unitless	EPA, 1997, Table 11-24 & 11-25	Fat content of poultry (CTE = meat only; RME = meat and skin)
Ingestion of Eggs					
$CR_{eggs,\ child}$	1.59	1.91	g/kg-day	EPA, 1997; Table 13-43 & Table 11-7	Consumer-only intake of home-produced eggs (< 1 peewee size (1.25 oz) egg/day CTE and RME)[1]
$CR_{eggs,\ adult\ farmer}$	0.672	0.846	g/kg-day	EPA, 1997; Table 13-43 & Table 11-7	Consumer-only intake of home-produced eggs (1 small (1.5 oz) egg/day CTE; 1 large (2 oz) egg/day RME)[1]
$CR_{eggs,\ adult\ resident}$	0.789	0.853	g/kg-day	EPA, 1997; Table 13-43 & Table 11-7	Consumer-only intake of home-produced eggs (1 peewee size (1.25 oz) egg/day CTE and RME)[1]
Egg loss factor	0	0	unitless	Assumed	Mean net cooking loss and post-cooking loss
$F_{fat,\ eggs}$	1	1	unitless	Assumed	No adjustment required for a whole egg concentration prediction

Table 4-10

Exposure Assumptions(1)

Variable	CTE	RME	Units	Source	Description
Ingestion of Exposed Fruit					
$CR_{exposed\ fruit,\ chilc}$	2.59	2.69	g/kg-day	EPA, 1997; Table 13-61	Consumer-only intake of home-produced exposed fruit (0.09 lb/day CTE and RME)[1]
$CR_{exposed\ fruit,\ adult\ farme}$	1.40	1.53	g/kg-day	EPA, 1997; Table 13-61	Consumer-only intake of home-produced exposed fruit (0.21 lb/day CTE; 0.23 lb/day RME)[1]
$CR_{exposed\ fruit,\ adult\ residen}$	1.99	1.60	g/kg-day	EPA, 1997; Table 13-61	Consumer-only intake of home-produced exposed fruit (0.18 lb/day CTE; 0.14 lb/day RME)[1]
AF_{fruit}	0.07	0.07	unitless	EPA, 1997; Tables 13-33, 13-61 and 13-62	Regional adjustment factor for home-produced fruit consumption
Produce loss factor	0.25	0	unitless	EPA, 1997; Table 13-6 and Assumed	Mean net preparation loss (mean of all data points listed in Table 13-6)
$F_{fat,\ produce}$	1	1	unitless	Assumed	No adjustment required for an exposed fruit concentration prediction
Ingestion of Exposed Vegetables					
$CR_{exposed\ vegetables,\ chilc}$	2.26	2.94	g/kg-day	EPA, 1997; Table 13-63	Consumer-only intake of home-produced exposed vegetables (0.07 lb/day CTE; 0.1 lb/day RME) [1]
$CR_{exposed\ vegetables,\ adult\ farme}$	1.11	1.64	g/kg-day	EPA, 1997; Table 13-63	Consumer-only intake of home-produced exposed vegetables (0.16 lb/day CTE; 0.24 lb/day RME) [1]
$CR_{exposed\ vegetables,\ adult\ residen}$	1.25	1.45	g/kg-day	EPA, 1997; Table 13-63	Consumer-only intake of home-produced exposed vegetables (0.11 lb/day CTE; 0.13 lb/day RME) [1]
$AF_{vegetables}$	0.3	0.3	unitless	EPA, 1997; Tables 13-33, 13-63, 13-64 and 13-65	Regional adjustment factor for home-produced vegetable consumption
Produce loss factor	0.16	0	unitless	EPA, 1997; Table 13-7 and Assumed	Mean net cooking loss (mean of data points for all exposed vegetables listed in Table 13-7)
$F_{fat,\ produce}$	1	1	unitless	Assumed	No adjustment required for an exposed vegetables concentration prediction
Ingestion of Root Vegetables					
$CR_{root\ vegetables,\ chilc}$	1.70	2.34	g/kg-day	EPA, 1997; Table 13-65	Consumer-only intake of home-produced root vegetables (0.06 lb/day CTE; 0.08 lb/day RME)[1]
$CR_{root\ vegetables,\ adult\ farme}$	0.968	1.31	g/kg-day	EPA, 1997; Table 13-65	Consumer-only intake of home-produced root vegetables (0.14 lb/day CTE; 0.19 lb/day RME)[1]
$CR_{root\ vegetables,\ adult\ residen}$	1.15	1.32	g/kg-day	EPA, 1997; Table 13-65	Consumer-only intake of home-produced root vegetables (0.10 lb/day CTE; 0.12 lb/day RME)[1]
$AF_{vegetables}$	0.3	0.3	unitless	EPA, 1997; Tables 13-33, 13-63, 13-64 and 13-65	Regional adjustment factor for home-produced vegetable consumption
Produce loss factor	0.17	0	unitless	EPA, 1997; Table 13-7 and Assumed	Mean net cooking loss (mean of cooking loss values for beets, carrots, and onions)
$F_{fat,\ produce}$	1	1	unitless	Assumed	No adjustment required for a root vegetable concentration prediction

[1] The mean value was used for the CTE and the 75th percentile value was used for the RME.

[2] The fat content of Jersey and Holstein milk was obtained from G.R. Wiggans, 2003. Summary of Herd Averages, DHI Report K-3 for 2003, Dairy Herd Improvement (DHI) reports published by AIPL. (http://www.aipl.arsusda.gov/publish/dhi/current/haall.html)

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Table 4-11

Model Inputs for Each Exposure Scenario: Total PCB Point Estimate Cancer Risk and Noncancer Hazard[1]

Inputs to Agricultural Exposure Pathways	Acronym	Units	COMMERCIAL FARMS									
			Dairy		Beef		Poultry Meat		Poultry Eggs		Produce	
			CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME
PARCEL-SPECIFIC INPUTS												
Soil EPCs for total PCBs (tPCBs)												
Pasture	$EPC_{pasture\ soil,PCB}$	mg/kg,dw	a	a	Assumed	(0.5, 2, 10, 25)	Assumed (0.5, 2, 10, 25)		Assumed (0.5, 2, 10, 25)		b	b
Cornfield	$EPC_{cornfield\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)		Assumed	(0.5, 2, 10, 25)	a	a	a	a	b	b
Hayfield	$EPC_{hayfield\ soil,PCB}$	mg/kg,dw	a	a	Assumed	(0.5, 2, 10, 25)	a	a	a	a	b	b
Garden	$EPC_{garden\ soil,PCB}$	mg/kg,dw	b	b	b	b	b	b	b	b	Assumed	(0.5, 2, 10, 25)
Fraction of farm area that is in the floodplain												
Pasture	$FS_{pasture}$	unitless	a	a	Assumed (0.25, 0.5, 0.75, 1)		Assumed (0.25, 0.5, 0.75, 1)		Assumed (0.25, 0.5, 0.75, 1)		b	b
Cornfield	$FS_{cornfield}$	unitless	Assumed (0.25, 0.5, 0.75, 1)		Assumed (0.25, 0.5, 0.75, 1)		a	a	a	a	b	b
Hayfield	$FS_{hayfield}$	unitless	a	a	Assumed (0.25, 0.5, 0.75, 1)		a	a	a	a	b	b
Garden	FS_{garden}	unitless	b	b	b	b	b	b	b	b	Assumed (0.25, 0.5, 0.75, 1)	
OTHER INPUTS												
Soil-to-Plant Modeling												
Soil-to-Corn Silage Transfer Factor (dw plant/dw soil)	$TF_{cornsilage,PCB}$	unitless	0.0012	0.0012	0.0012	0.0012	a	a	a	a	b	b
Soil-to-Grass Transfer Factor (dw plant/dw soil)	$TF_{grass,PCB}$	unitless	a	a	0.036	0.036	a	a	a	a	b	b
Soil-to-Hay Transfer Factor (dw plant/dw soil)	$TF_{hay,PCB}$	unitless	a	a	0.036	0.036	a	a	a	a	b	b
Soil-to-Exposed Vegetable Transfer Factor (ww plant/dw soil)	$TF_{expveg,PCB}$	unitless	b	b	b	b	b	b	b	b	0.0018	0.0018
Soil-to-Exposed Fruit Transfer Factor (ww plant/dw soil)	$TF_{fruit,PCB}$	unitless	b	b	b	b	b	b	b	b	0.0018	0.0018
Soil-to-Root Vegetable Transfer Factor (ww plant/dw soil)	$TF_{rtveg,PCB}$	unitless	b	b	b	b	b	b	b	b	0.0003	0.0003
Animal Intake												
Animal Diet Composition												
fraction of diet = soil	D_{soil}	unitless	a	a	0.02	0.02	0.1	0.1	0.1	0.1	b	b
fraction of diet = corn silage grown on farm	$D_{cornsilage}$	unitless	0.55	0.55	0.44	0.44	a	a	a	a	b	b
fraction of diet = hay or other grass-based feed grown on farm	D_{hay}	unitless	a	a	0.44	0.44	a	a	a	a	b	b
fraction of diet = pasture grass on farm	D_{grass}	unitless	a	a			a	a	a	a	b	b
fraction of diet = concentrate (e.g., grain/supplements) from outside the floodplain	$D_{concentrate}$	unitless	0.45	0.45	0.1	0.1	0.9	0.9	0.9	0.9	b	b
Soil Bioavailability	$BA_{soil,PCB}$	unitless	a	a	1	1	1	1	1	1	b	b
Animal Bioaccumulation												
Mammalian BCFs (fat basis)	$BCF_{mammal,PCB}$	unitless	3.6	3.6	3.6	3.6	b	b	b	b	b	b
Avian BCFs (fat basis)	$BCF_{poultry\ meat,PCB}$	unitless	b	b	b	b	2.5	2.5	b	b	b	b
Avian BCFs (whole food basis)	$BCF_{poultry\ egg,PCB}$	unitless	b	b	b	b	b	b	0.9	0.9	b	b

Table 4-11

Model Inputs for Each Exposure Scenario:
Total PCB Point Estimate Cancer Risk and Noncancer Hazard[1]

Inputs to Agricultural Exposure Pathways	**Acronym**	**Units**	**COMMERCIAL FARMS**									
			Dairy		**Beef**		**Poultry Meat**		**Poultry Eggs**		**Produce**	
			CTE	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**
Food Concentration												
Animal product fat content (in "as consumed" food)												
dairy-milk: jersey cows	$F_{dairy-jersey}$	mg fat/ mg whole food	0.046	0.046	b	b	b	b	b	b	b	b
beef	F_{beef}	mg fat/ mg whole food	b	b	0.099	0.146	b	b	b	b	b	b
poultry meat	$F_{poultry,meat}$	mg fat/ mg whole food	b	b	b	b	0.0741	0.136	b	b	b	b
Cooking loss												
dairy	CL_{dairy}	unitless	0	0	b	b	b	b	b	b	b	b
beef	CL_{beef}	unitless	b	b	0.27	0.27	b	b	b	b	b	b
poultry meat	$CL_{poultry,meat}$	unitless	b	b	b	b	0.32	0.32	b	b	b	b
poultry eggs	$CL_{poultry,egg}$	unitless	b	b	b	b	b	b	0	0	b	b
exposed vegetables	CL_{expveg}	unitless	b	b	b	b	b	b	b	b	0.16	0
exposed fruit	CL_{fruit}	unitless	b	b	b	b	b	b	b	b	0.25	0
root vegetables	CL_{rtveg}	unitless	b	b	b	b	b	b	b	b	0.17	0
Post-cooking loss												
dairy	PCL_{dairy}	unitless	0	0	b	b	b	b	b	b	b	b
beef	PCL_{beef}	unitless	b	b	0.24	0.24	b	b	b	b	b	b
poultry meat	$PCL_{poultry,meat}$	unitless	b	b	b	b	0.31	0.31	b	b	b	b
poultry eggs	$PCL_{poultry,egg}$	unitless	b	b	b	b	b	b	0	0	b	b
exposed vegetables	PCL_{expveg}	unitless	b	b	b	b	b	b	b	b	0	0
exposed fruit	PCL_{fruit}	unitless	b	b	b	b	b	b	b	b	0	0
root vegetables	PCL_{rtveg}	unitless	b	b	b	b	b	b	b	b	0	0
Human Exposure												
Fraction absorbed in GI tract	ABS_{food}	unitless	1	1	1	1	1	1	1	1	1	1
Food consumption rates (body weight-normalized)												
unit correction factor	UCF	kg whole food/ g whole food	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
dairy-milk												
child	$CR_{child,dairy}$	g/kg-day	44.1	70.3	b	b	b	b	b	b	b	b
adult resident	$CR_{adult,resident,dairy}$	g/kg-day	b	b	b	b	b	b	b	b	b	b
adult farmer	$CR_{adult,farmer, dairy}$	g/kg-day	12.4	15.1	b	b	b	b	b	b	b	b
beef												
child	$CR_{child,beef}$	g/kg-day	b	b	3.72	4.86	b	b	b	b	b	b
adult resident	$CR_{adult,resident,beef}$	g/kg-day	b	b	b	b	b	b	b	b	b	b
adult farmer	$CR_{adult,farmer,beef}$	g/kg-day	b	b	2.26	2.65	b	b	b	b	b	b

Table 4-11

Model Inputs for Each Exposure Scenario:
Total PCB Point Estimate Cancer Risk and Noncancer Hazard[1]

Inputs to Agricultural Exposure Pathways	**Acronym**	**Units**	**COMMERCIAL FARMS**									
			Dairy		**Beef**		**Poultry Meat**		**Poultry Eggs**		**Produce**	
			CTE	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**
poultry meat												
child	$CR_{child,poultry,meat}$	g/kg-day	b	b	b	b	2.35	2.88	b	b	b	b
adult resident	$CR_{adult,resident,poultry,meat}$	g/kg-day	b	b	b	b	b	b	b	b	b	b
adult farmer	$CR_{adult,farmer, poultry,meat}$	g/kg-day	b	b	b	b	1.32	2.08	b	b	b	b
poultry eggs												
child	$CR_{child,poultry,eggs}$	g/kg-day	b	b	b	b	b	b	1.59	1.91	b	b
adult resident	$CR_{adult,resident,poultry,eggs}$	g/kg-day	b	b	b	b	b	b	b	b	b	b
adult farmer	$CR_{adult,farmer, poultry,eggs}$	g/kg-day	b	b	b	b	b	b	0.672	0.846	b	b
regional adjustment factor for garden produce consumption												
exposed fruit	AF_{fruit}	unitless	b	b	b	b	b	b	b	b	0.07	0.07
vegetables (exposed & root)	$AF_{vegetables}$	unitless	b	b	b	b	b	b	b	b	0.3	0.3
exposed vegetables												
child	$CR_{child,expveg}$	g/kg-day	b	b	b	b	b	b	b	b	2.26	2.94
adult resident	$CR_{adult,resident,expveg}$	g/kg-day	b	b	b	b	b	b	b	b	b	b
adult farmer	$CR_{adult,farmer, expveg}$	g/kg-day	b	b	b	b	b	b	b	b	1.11	1.64
exposed fruit												
child	$CR_{child,fruit}$	g/kg-day	b	b	b	b	b	b	b	b	2.59	2.69
adult resident	$CR_{adult,resident,fruit}$	g/kg-day	b	b	b	b	b	b	b	b	b	b
adult farmer	$CR_{adult,farmer, fruit}$	g/kg-day	b	b	b	b	b	b	b	b	1.4	1.53
root vegetables												
child	$CR_{child,rtveg}$	g/kg-day	b	b	b	b	b	b	b	b	1.7	2.34
adult resident	$CR_{adult,resident,rtveg}$	g/kg-day	b	b	b	b	b	b	b	b	b	b
adult farmer	$CR_{adult,farmer, rtveg}$	g/kg-day	b	b	b	b	b	b	b	b	0.968	1.31
Exposure Frequency												
child	EF_{child}	day/year	350	350	350	350	350	350	350	350	350	350
adult resident	$EF_{adult,resident}$	day/year	b	b	b	b	b	b	b	b	b	b
adult farmer	$EF_{adult,farmer}$	day/year	350	350	350	350	350	350	350	350	350	350
Exposure Duration												
child	ED_{child}	year	6	6	6	6	6	6	6	6	6	6
adult resident	$ED_{adult,resident}$	year	b	b	b	b	b	b	b	b	b	b
adult farmer	$ED_{adult,farmer}$	year	29	64	29	64	29	64	29	64	29	64
Averaging Time, Noncancer												
child	$AT_{nc,child}$	day	2,190	2,190	2,190	2,190	2,190	2,190	2,190	2,190	2,190	2,190
adult resident	$AT_{nc,adult,resident}$	day	b	b	b	b	b	b	b	b	b	b
adult farmer	$AT_{nc,adult,farmer}$	day	10,585	23,360	10,585	23,360	10,585	23,360	10,585	23,360	10,585	23,360
Averaging Time, Cancer	AT_{cancer}	day	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550
Toxicity Information												
tPCB CSF	CSF_{PCB}	$(mg/kg-day)^{-1}$	1	2	1	2	1	2	1	2	1	2
tPCB RfD	RfD_{PCB}	mg/kg-day	2E-05	2E-05	2E-05	2E-05	2E-05	2E-05	2E-05	2E-05	2E-05	2E-05

Notes:

[1] This table summarizes input values for each scenario that are presented in greater detail in previous tables in this section. The rationale for selection of each input value is discussed in Section 4.

a - Not relevant to scenario based on local farming practices

b - Not relevant to scenario

Table 4-11

Model Inputs for Each Exposure Scenario: Total PCB Point Estimate Cancer Risk and Noncancer Hazard[1]

Inputs to Agricultural Exposure Pathways	Acronym	Units	BACKYARD FARMS									
			Dairy		Beef		Poultry Meat		Poultry Eggs		Produce	
			CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME
PARCEL-SPECIFIC INPUTS												
Soil EPCs for total PCBs (tPCBs)												
Pasture	$EPC_{pasture\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)		Assumed (0.5, 2, 10, 25)		Assumed (0.5, 2, 10, 25)		Assumed (0.5, 2, 10, 25)		b	b
Cornfield	$EPC_{cornfield\ soil,PCB}$	mg/kg,dw	a	a	a	a	a	a	a	a	b	b
Hayfield	$EPC_{hayfield\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)		Assumed (0.5, 2, 10, 25)		a	a	a	a	b	b
Garden	$EPC_{garden\ soil,PCB}$	mg/kg,dw	b	b	b	b	b	b	b	b	Assumed (0.5, 2, 10, 25)	
Fraction of farm area that is in the floodplain												
Pasture	$FS_{pasture}$	unitless	Assumed (0.25, 0.5, 0.75, 1)		Assumed (0.25, 0.5, 0.75, 1)		Assumed (0.25, 0.5, 0.75, 1)		Assumed (0.25, 0.5, 0.75, 1)		b	
Cornfield	$FS_{cornfield}$	unitless	a	a	a	a	a	a	a	a	b	
Hayfield	$FS_{hayfield}$	unitless	Assumed (0.25, 0.5, 0.75, 1)		Assumed (0.25, 0.5, 0.75, 1)		a	a	a	a	b	
Garden	FS_{garden}	unitless	b	b	b	b	b	b	b	b	Assumed (0.25, 0.5, 0.75, 1)	
OTHER INPUTS												
Soil-to-Plant Modeling												
Soil-to-Corn Silage Transfer Factor (dw plant/dw soil)	$TF_{cornsilage,PCB}$	unitless	a	a	a	a	a	a	a	a	b	b
Soil-to-Grass Transfer Factor (dw plant/dw soil)	$TF_{grass,PCB}$	unitless	0.036	0.036	0.036	0.036	a	a	a	a	b	b
Soil-to-Hay Transfer Factor (dw plant/dw soil)	$TF_{hay,PCB}$	unitless	0.036	0.036	0.036	0.036	a	a	a	a	b	b
Soil-to-Exposed Vegetable Transfer Factor (ww plant/dw soil)	$TF_{expveg,PCB}$	unitless	b	b	b	b	b	b	b	b	0.0018	0.0018
Soil-to-Exposed Fruit Transfer Factor (ww plant/dw soil)	$TF_{fruit,PCB}$	unitless	b	b	b	b	b	b	b	b	0.0018	0.0018
Soil-to-Root Vegetable Transfer Factor (ww plant/dw soil)	$TF_{rtveg,PCB}$	unitless	b	b	b	b	b	b	b	b	0.0003	0.0003
Animal Intake												
Animal Diet Composition												
fraction of diet = soil	D_{soil}	unitless	0.01	0.01	0.02	0.02	0.1	0.1	0.1	0.1	b	b
fraction of diet = corn silage grown on farm	$D_{cornsilage}$	unitless	a	a	a	a	a	a	a	a	b	b
fraction of diet = hay or other grass-based feed grown on farm	D_{hay}	unitless	0.59	0.59	0.98	0.98	a	a	a	a	b	b
fraction of diet = pasture grass on farm	D_{grass}	unitless					a	a	a	a	b	b
fraction of diet = concentrate (e.g., grain/supplements) from outside the floodplain	$D_{concentrate}$	unitless	0.4	0.4	a	a	0.9	0.9	0.9	0.9	b	b
Soil Bioavailability	$BA_{soil,PCB}$	unitless	1	1	1	1	1	1	1	1	b	b
Animal Bioaccumulation												
Mammalian BCFs (fat basis)	$BCF_{mammal,PCB}$	unitless	3.6	3.6	3.6	3.6	b	b	b	b	b	b
Avian BCFs (fat basis)	$BCF_{poultry\ meat,PCB}$	unitless	b	b	b	b	2.5	2.5	b	b	b	b
Avian BCFs (whole food basis)	$BCF_{poultry\ egg,PCB}$	unitless	b	b	b	b	b	b	0.9	0.9	b	b

Table 4-11

Model Inputs for Each Exposure Scenario:
Total PCB Point Estimate Cancer Risk and Noncancer Hazard[1]

Inputs to Agricultural Exposure Pathways	**Acronym**	**Units**	**BACKYARD FARMS**									
			Dairy		**Beef**		**Poultry Meat**		**Poultry Eggs**		**Produce**	
			CTE	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**
Food Concentration												
Animal product fat content (in "as consumed" food)												
dairy-milk: jersey cows	$F_{dairy\text{-}jersey}$	mg fat/ mg whole food	0.046	0.046	b	b	b	b	b	b	b	b
beef	F_{beef}	mg fat/ mg whole food	b	b	0.099	0.146	b	b	b	b	b	b
poultry meat	$F_{poultry,meat}$	mg fat/ mg whole food	b	b	b	b	0.0741	0.136	b	b	b	b
Cooking loss												
dairy	CL_{dairy}	unitless	0	0	b	b	b	b	b	b	b	b
beef	CL_{beef}	unitless	b	b	0.27	0.27	b	b	b	b	b	b
poultry meat	$CL_{poultry,meat}$	unitless	b	b	b	b	0.32	0.32	b	b	b	b
poultry eggs	$CL_{poultry,egg}$	unitless	b	b	b	b	b	b	0	0	b	b
exposed vegetables	CL_{expveg}	unitless	b	b	b	b	b	b	b	b	0.16	0
exposed fruit	CL_{fruit}	unitless	b	b	b	b	b	b	b	b	0.25	0
root vegetables	CL_{rtveg}	unitless	b	b	b	b	b	b	b	b	0.17	0
Post-cooking loss												
dairy	PCL_{dairy}	unitless	0	0	b	b	b	b	b	b	b	b
beef	PCL_{beef}	unitless	b	b	0.24	0.24	b	b	b	b	b	b
poultry meat	$PCL_{poultry,meat}$	unitless	b	b	b	b	0.31	0.31	b	b	b	b
poultry eggs	$PCL_{poultry,egg}$	unitless	b	b	b	b	b	b	0	0	b	b
exposed vegetables	PCL_{expveg}	unitless	b	b	b	b	b	b	b	b	0	0
exposed fruit	PCL_{fruit}	unitless	b	b	b	b	b	b	b	b	0	0
root vegetables	PCL_{rtveg}	unitless	b	b	b	b	b	b	b	b	0	0
Human Exposure												
Fraction absorbed in GI tract	ABS_{food}	unitless	1	1	1	1	1	1	1	1	1	1
Food consumption rates (body weight-normalized)												
unit correction factor	UCF	kg whole food/ g whole food	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
dairy-milk												
child	$CR_{child,dairy}$	g/kg-day	44.1	70.3	b	b	b	b	b	b	b	b
adult resident	$CR_{adult,resident,dairy}$	g/kg-day	20.9	18.1	b	b	b	b	b	b	b	b
adult farmer	$CR_{adult,farmer,\ dairy}$	g/kg-day	b	b	b	b	b	b	b	b	b	b
beef												
child	$CR_{child,beef}$	g/kg-day	b	b	3.72	4.86	b	b	b	b	b	b
adult resident	$CR_{adult,resident,beef}$	g/kg-day	b	b	2.86	2.83	b	b	b	b	b	b
adult farmer	$CR_{adult,farmer,beef}$	g/kg-day	b	b	b	b	b	b	b	b	b	b

Table 4-11

Model Inputs for Each Exposure Scenario:
Total PCB Point Estimate Cancer Risk and Noncancer Hazard[1]

Inputs to Agricultural Exposure Pathways	**Acronym**	**Units**	**BACKYARD FARMS**									
			Dairy		**Beef**		**Poultry Meat**		**Poultry Eggs**		**Produce**	
			CTE	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**	**CTE**	**RME**
poultry meat												
child	$CR_{child,poultry,meat}$	g/kg-day	b	b	b	b	2.35	2.88	b	b	b	b
adult resident	$CR_{adult,resident,poultry,meat}$	g/kg-day	b	b	b	b	1.62	1.73	b	b	b	b
adult farmer	$CR_{adult,farmer, poultry,meat}$	g/kg-day	b	b	b	b	b	b	b	b	b	b
poultry eggs												
child	$CR_{child,poultry,eggs}$	g/kg-day	b	b	b	b	b	b	1.59	1.91	b	b
adult resident	$CR_{adult,resident,poultry,eggs}$	g/kg-day	b	b	b	b	b	b	0.789	0.853	b	b
adult farmer	$CR_{adult,farmer, poultry,eggs}$	g/kg-day	b	b	b	b	b	b	b	b	b	b
regional adjustment factor for garden produce consumption												
exposed fruit	AF_{fruit}	unitless	b	b	b	b	b	b	b	b	0.07	0.07
vegetables (exposed & root)	$AF_{vegetables}$	unitless	b	b	b	b	b	b	b	b	0.3	0.3
exposed vegetables												
child	$CR_{child,expveg}$	g/kg-day	b	b	b	b	b	b	b	b	2.26	2.94
adult resident	$CR_{adult,resident,expveg}$	g/kg-day	b	b	b	b	b	b	b	b	1.25	1.45
adult farmer	$CR_{adult,farmer, expveg}$	g/kg-day	b	b	b	b	b	b	b	b	b	b
exposed fruit												
child	$CR_{child,fruit}$	g/kg-day	b	b	b	b	b	b	b	b	2.59	2.69
adult resident	$CR_{adult,resident,fruit}$	g/kg-day	b	b	b	b	b	b	b	b	1.99	1.6
adult farmer	$CR_{adult,farmer, fruit}$	g/kg-day	b	b	b	b	b	b	b	b	b	b
root vegetables												
child	$CR_{child,rtveg}$	g/kg-day	b	b	b	b	b	b	b	b	1.7	2.34
adult resident	$CR_{adult,resident,rtveg}$	g/kg-day	b	b	b	b	b	b	b	b	1.15	1.32
adult farmer	$CR_{adult,farmer, rtveg}$	g/kg-day	b	b	b	b	b	b	b	b	b	b
Exposure Frequency												
child	EF_{child}	day/year	350	350	350	350	350	350	350	350	350	350
adult resident	$EF_{adult,resident}$	day/year	350	350	350	350	350	350	350	350	350	350
adult farmer	$EF_{adult,farmer}$	day/year	b	b	b	b	b	b	b	b	b	b
Exposure Duration												
child	ED_{child}	year	6	6	6	6	6	6	6	6	6	6
adult resident	$ED_{adult,resident}$	year	9	39	9	39	9	39	9	39	9	39
adult farmer	$ED_{adult,farmer}$	year	b	b	b	b	b	b	b	b	b	b
Averaging Time, Noncancer												
child	$AT_{nc,child}$	day	2,190	2,190	2,190	2,190	2,190	2,190	2,190	2,190	2,190	2,190
adult resident	$AT_{nc,adult,resident}$	day	3,285	14,235	3,285	14,235	3,285	14,235	3,285	14,235	3,285	14,235
adult farmer	$AT_{nc,adult,farmer}$	day	b	b	b	b	b	b	b	b	b	b
Averaging Time, Cancer	AT_{cancer}	day	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550
Toxicity Information												
tPCB CSF	CSF_{PCB}	$(mg/kg\text{-}day)^{-1}$	1	2	1	2	1	2	1	2	1	2
tPCB RfD	RfD_{PCB}	mg/kg-day	2E-05	2E-05	2E-05	2E-05	2E-05	2E-05	2E-05	2E-05	2E-05	2E-05

Notes:

[1] This table summarizes input values for each scenario that are presented in greater detail in previous tables in this section. The rationale for selection of each input value is discussed in Section 4.

a - Not relevant to scenario based on local farming practices

b - Not relevant to scenario

Table 4-12

Estimating Total PCB ADDs and LADDs:
Selection of Input Parameter Values from Range of Possible Values

Input Parameters	Selected Values
Total PCB Soil Concentrations	**Assumed** (0.5, 2, 10, or 20 mg/kg)
Fraction of Cultivation Field or Pasture in the Floodplain	**Assumed** (0.25, 0.5, 0.75 or 1)
Soil-to-Grass Transfer Factors	**Mean**
Soil-to-Corn Transfer Factors	**Mean**
Soil-to-Garden Produce Transfer Factors	**Maximum site-specific** (to account for limited data and to balance the fact that some transfer factors were derived from studies where edible produce was washed and/or peeled prior to analysis)
Animal Intake Rates	**Mean**
BCFs	
Cattle	**Upper-bound**
Poultry	**Mean**
Animal Product Fat Content	
Dairy	CTE = **mean**; RME = **mean** (for Jersey cow, which is present in floodplain and has a relatively high fat content of 4.6% in whole milk)
Beef	CTE = **mid-range estimate**; RME = **upper-bound estimate**
Cooking Loss	
Dairy	**None**
Beef and poultry	CTE = **mean**; RME = **mean** (accounts for weight loss associated with inedible portions as well as cooking, trimming, and other losses)
Food Consumption Rates	CTE = **mean**; RME = **75th percentile**
Regional Consumption Rate Adjustment Factor for Produce	CTE = **mean**; RME = **mean**
Exposure Frequency	Assumed food consumption rates were applicable 50 weeks per year
Exposure Duration	
Residential/backyard scenarios	CTE = **mean** length of residence in the HRA; RME = **95th percentile** length of residence in the HRA
Farm scenarios	CTE = **1/2 RME**; RME = **70-year lifetime** (some local farms are multigenerational)
Body Weight	Food consumption rate are normalized to consumer body weight
Averaging Time	Noncancer assessment = exposure duration; cancer assessment = 70 year lifetime

CTE = Central tendency exposure.
RME = Reasonable maximum exposure.
NA = Not applicable
HRA = Housatonic River area.

SECTION 4

FIGURES

Exposed vegetable

$$C_{expveg} = EPC_{garden\ soil} * TF_{expveg} * FS_{garden}$$

(mg/kg) (mg/kg, dw) (ww plant/dw soil) (unitless)

Root vegetable

$$C_{rtveg} = EPC_{garden\ soil} * TF_{rtveg} * FS_{garden}$$

(mg/kg) (mg/kg, dw) (ww plant/dw soil) (unitless)

Fruit

$$C_{fruit} = EPC_{garden\ soil} * TF_{fruit} * FS_{garden}$$

(mg/kg) (mg/kg, dw) (ww plant/dw soil) (unitless)

Where:

C_{expveg}, C_{rtveg}, C_{fruit} = concentration of tPCBs in three produce categories

$EPC_{garden\ soil}$ = exposure point concentration for tPCBs in garden soil

TF_{expveg}, TF_{rtveg}, TF_{fruit} = soil-to-plant transfer factors for three produce categories

FS_{garden} = fraction of garden within the floodplain

Figure 4-1 Model Used to Predict Agricultural Produce Concentrations

Soil intake from pasture	Grass-based feed intake	Corn silage intake	Concentration (i.e. food supplement) intake

$$C_{food} = BCF * F * (BA_{soil} * D_{soil} * EPC_{pasture\ soil} * FS_{pasture}) + (D_{grass} * EPC_{hayfield\ soil,\ pasture\ soil} * TF_{grass} * FS_{hayfield,\ pasture}) + (D_{corn\ silage} * EPC_{cornfield\ soil} * TF_{corn\ silage} * FS_{cornfield}) + (D_{concentrate} * EPC_{grainfield\ soil} * TF_{concentrate} * FS_{grainfield})$$

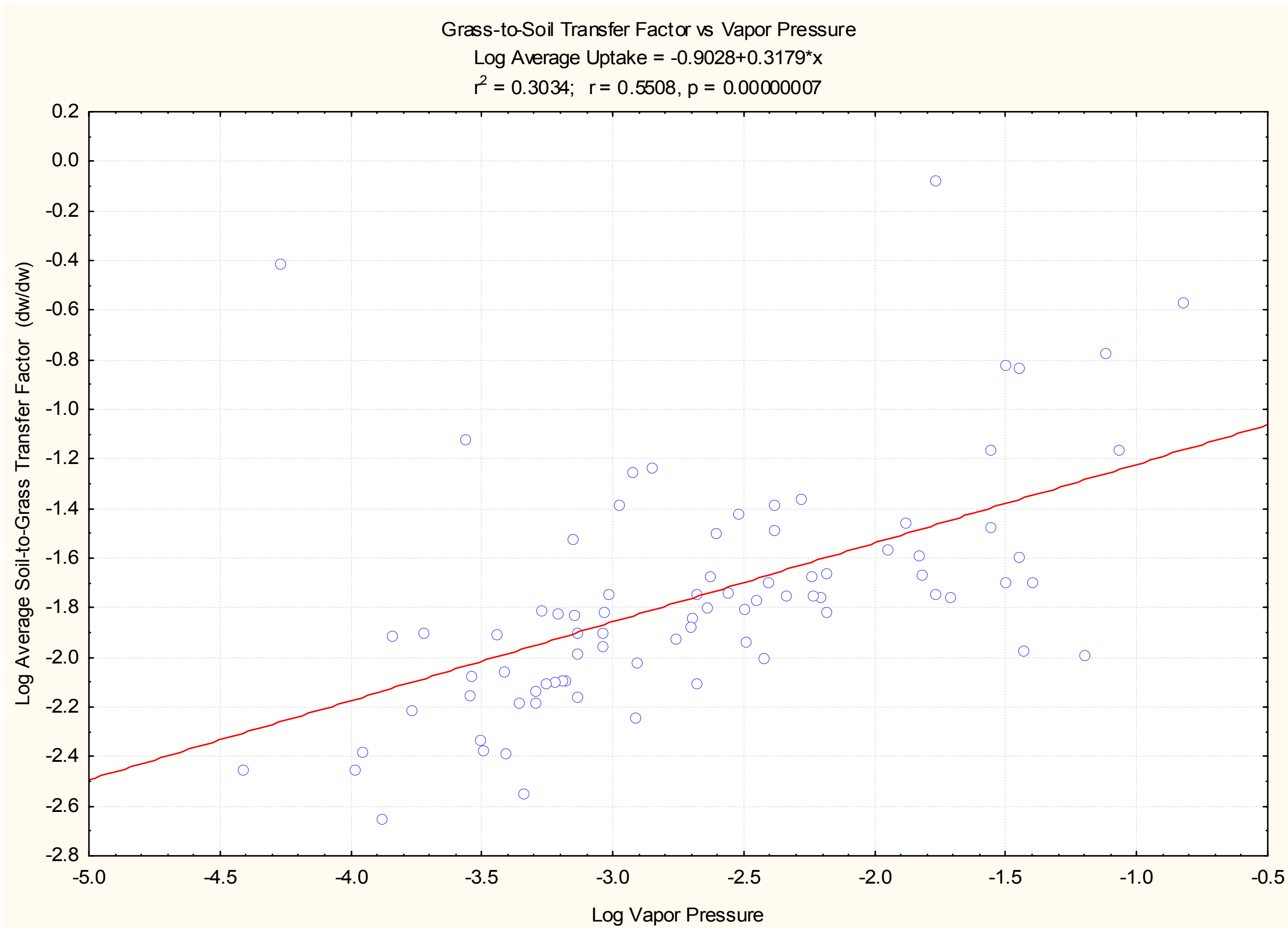
C_{food}	BCF	F	BA_{soil}	D_{soil}	$EPC_{pasture\ soil}$	$FS_{pasture}$	D_{grass}	$EPC_{hayfield\ soil}$ pasture soil	TF_{grass}	$FS_{hayfield}$ pasture	$D_{corn\ silage}$	$EPC_{cornfield\ soil}$	$TF_{corn\ silage}$	$FS_{cornfield}$	$D_{concentrate}$	$EPC_{grainfield\ soil}$	$TF_{concentrate}$	$FS_{grainfield}$
(mg/kg)	(unitless)	(mg fat/mg whole food)	(unitless)	(unitless)	(mg/kg, dw)	(unitless)	(unitless)	(mg/kg, dw)	(dw plant/dw soil)	(unitless)	(unitless)	(mg/kg,dw)	(dw plant/dw soil)	(unitless)	(unitless)	(mg/kg,dw)	(dw plant/ dw soil)	(unitless)

	BCF	F	Soil intake from pasture	Grass-based feed intake	Corn silage intake	Concentration (i.e. food supplement) intake
Commercial						
Dairy	X	X	-	-	X	X
Beef	X	X	X	X	X	X
Poultry - Meat	X	X	X	-	-	X
Poultry - Egg	X	-	X	-	-	X
Backyard						
Dairy	X	X	X	X	-	X
Beef	X	X	X	X	-	-
Poultry - Meat	X	X	X	-	-	X
Poultry - Egg	X	-	X	-	-	X

Note:
X = used to evaluate exposure scenarios

BCF = concentration in the fat divided by concentration in diet (dry matter) for dairy, beef and poultry except for egg which is calculated by dividing the concentration in the whole egg by the concentration in diet.
F = fat content of food as it is consumed by people
BAsoil = bioavailability of tPCBs from soil
D_{soil} = fraction of diet that is soil, reflects time on pasture given regional climate and farming practices
D_{grass} = fraction of diet that is grass-based feed (i.e. pasture grass and hay); reflects time on pasture given regional climate and farming practices
$D_{cornsilage}$ = fraction of the diet that is corn silage grown on the farm, assumed to occur year-round
$D_{concentrate}$ = fraction of diet that is concentrate (e.g., grain/supplements) from outside the floodplain
EPCpasture soil, EPChayfield soil, EPCcornfield soil, EPCgrainfield soil = exposure point concentration of tPCBs in agricultural areas
$FS_{pasture}$, $FS_{hayfield}$, $FS_{cornfield}$, $FS_{grainfield}$ = fraction of agricultural area that is in the floodplain
TFgrass = Total PCB soil-to-grass transfer factor
TFcorn silage = Total PCB soil-to-corn transfer factor
TFconcentrate = Total PCB soil-to-concentrate factor. This value was not quantified for this assessment, because animal feeds from outside the floodplain were assumed to have tPCB concentrations of zero.

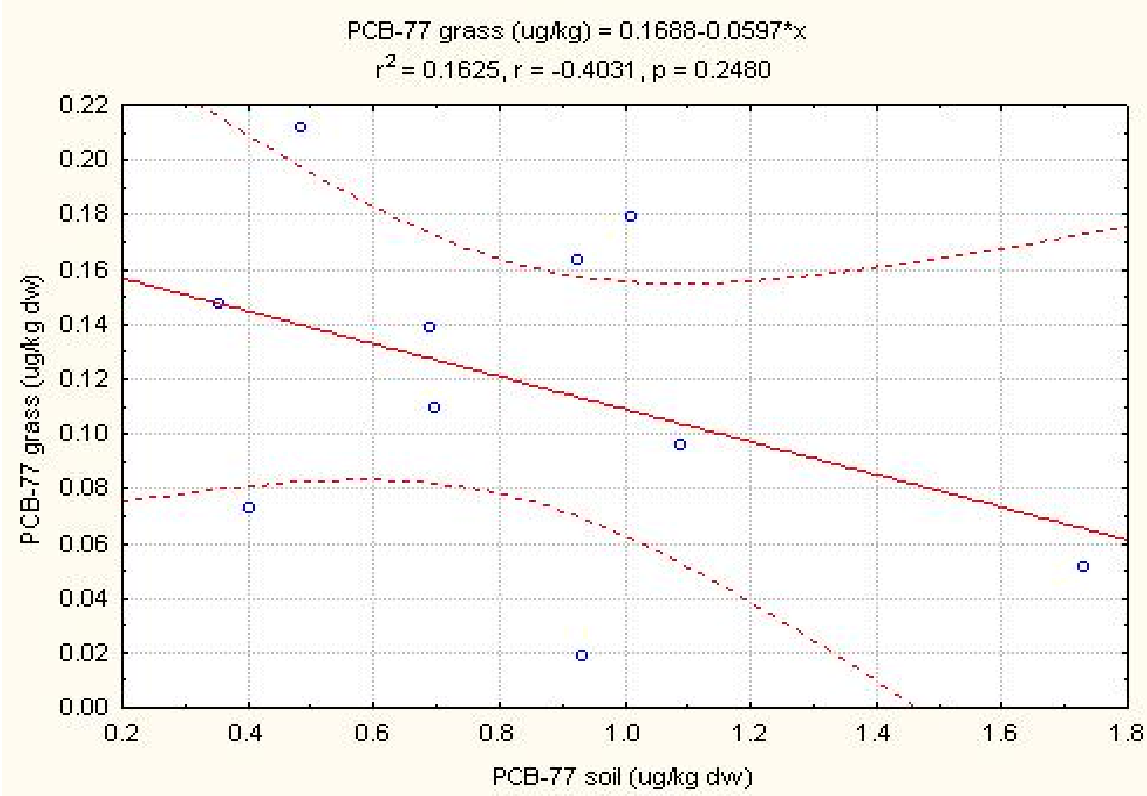
Figure 4-2 Model Used to Predict Agricultural Animal Product Food Concentrations

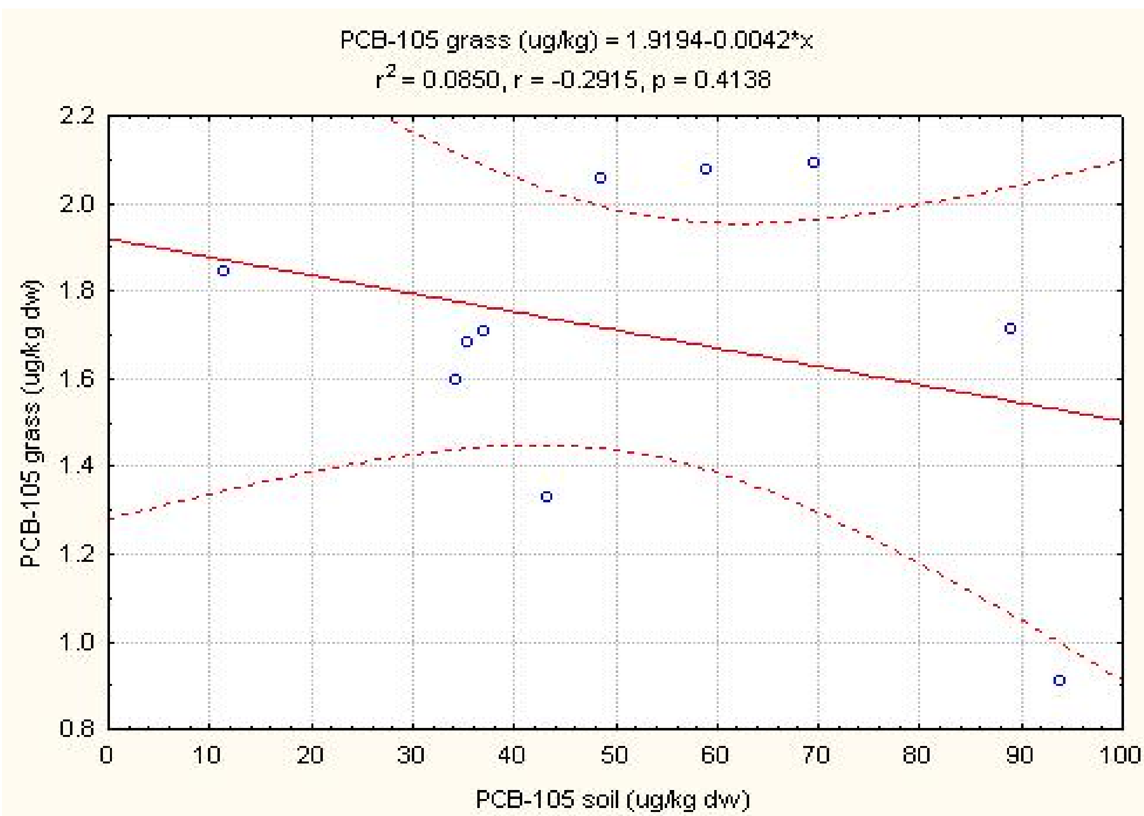


(subcooled liquid vapor pressures (25° C) from Burkhard et al. (1985))

Figure 4-3

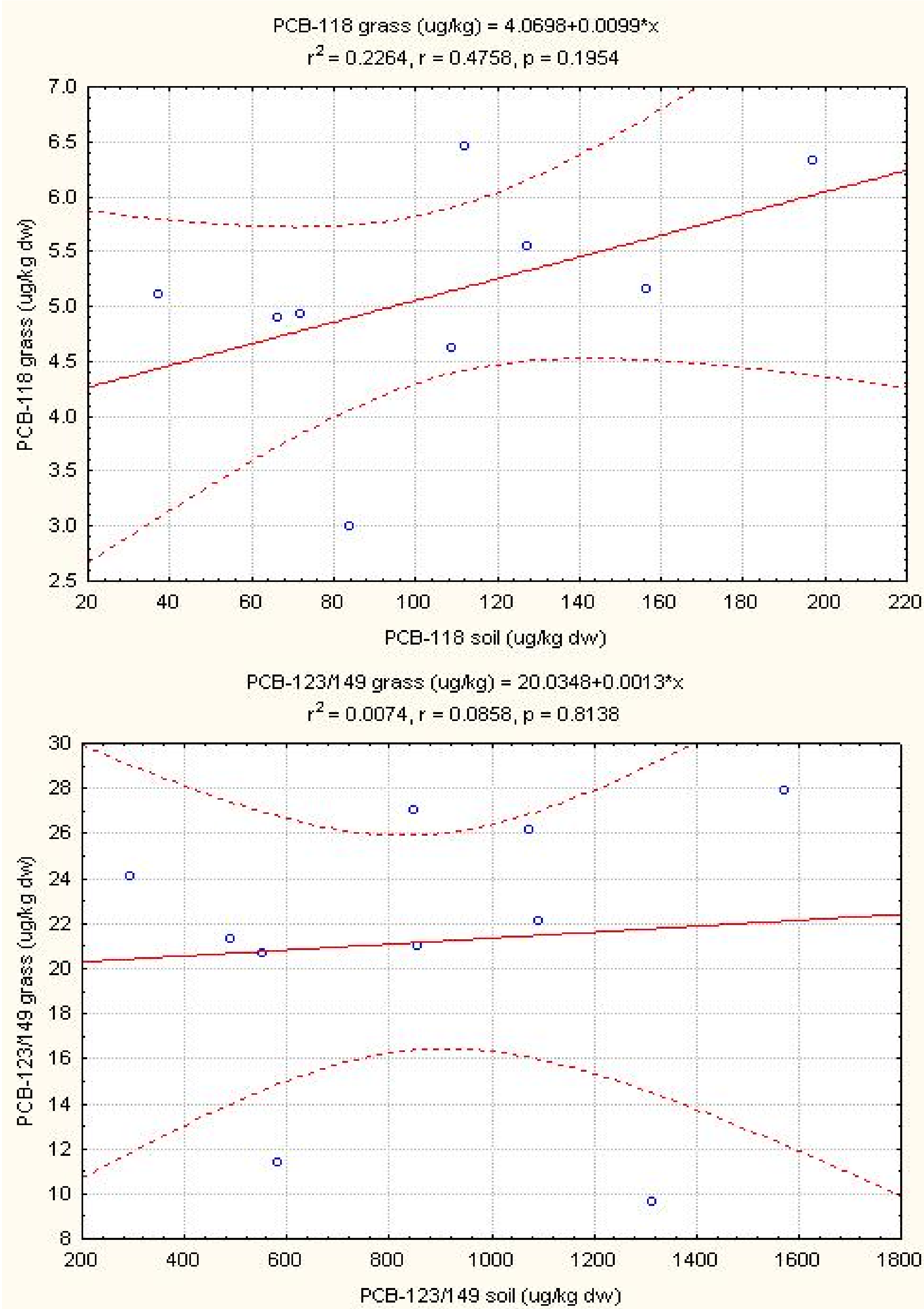
Relationship Between Grass-To-Soil Transfer Factors (dw/dw) and PCB Congener Vapor Pressure





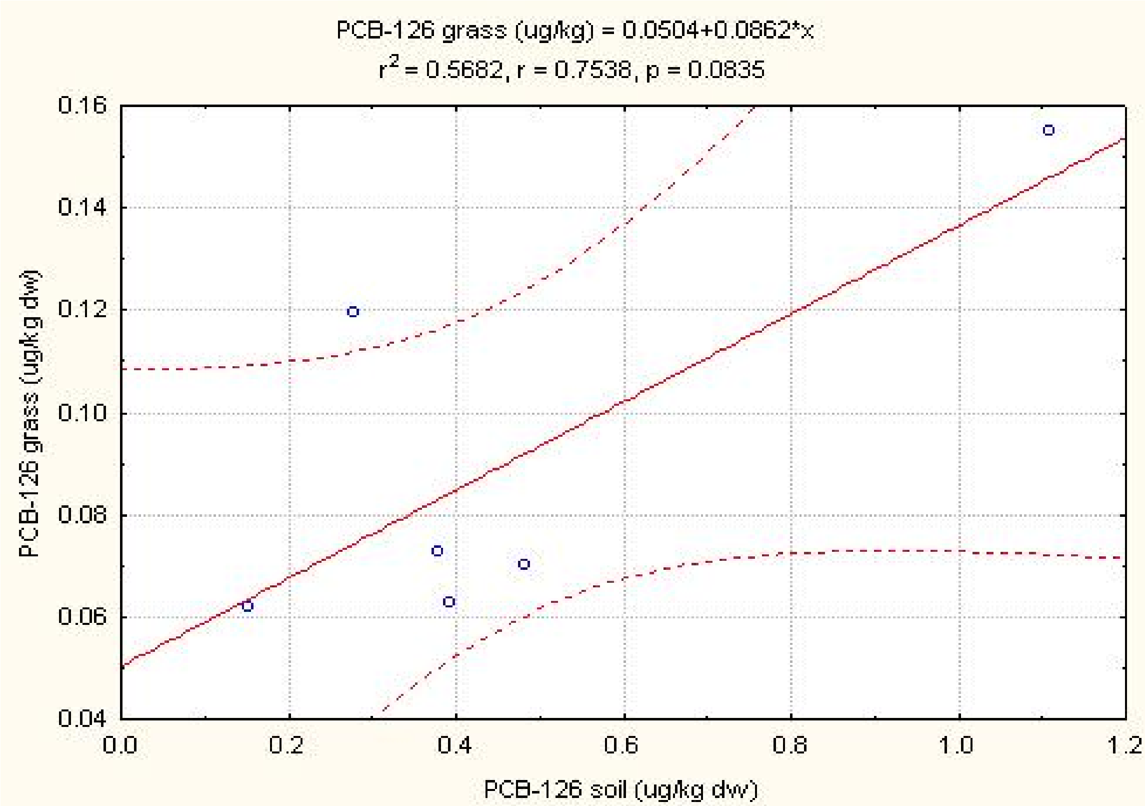
[1]Regressions were performed with data sets composed of only detected concentrations of co-located floodplain soil and grass samples.

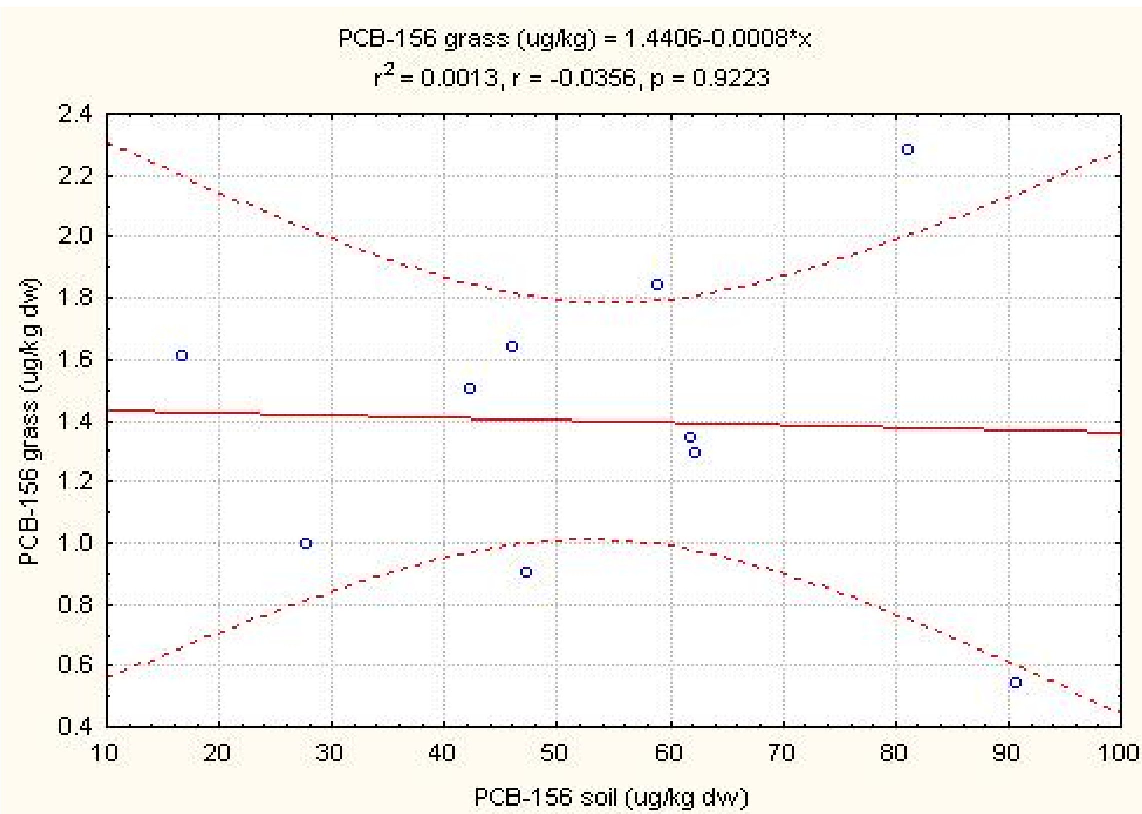
Figure 4-4a[1]
Relationship Between PCB Concentrations in Soil (dw) and Grass (dw)



[1]Regressions were performed with data sets composed of only detected concentrations of co-located floodplain soil and grass samples.

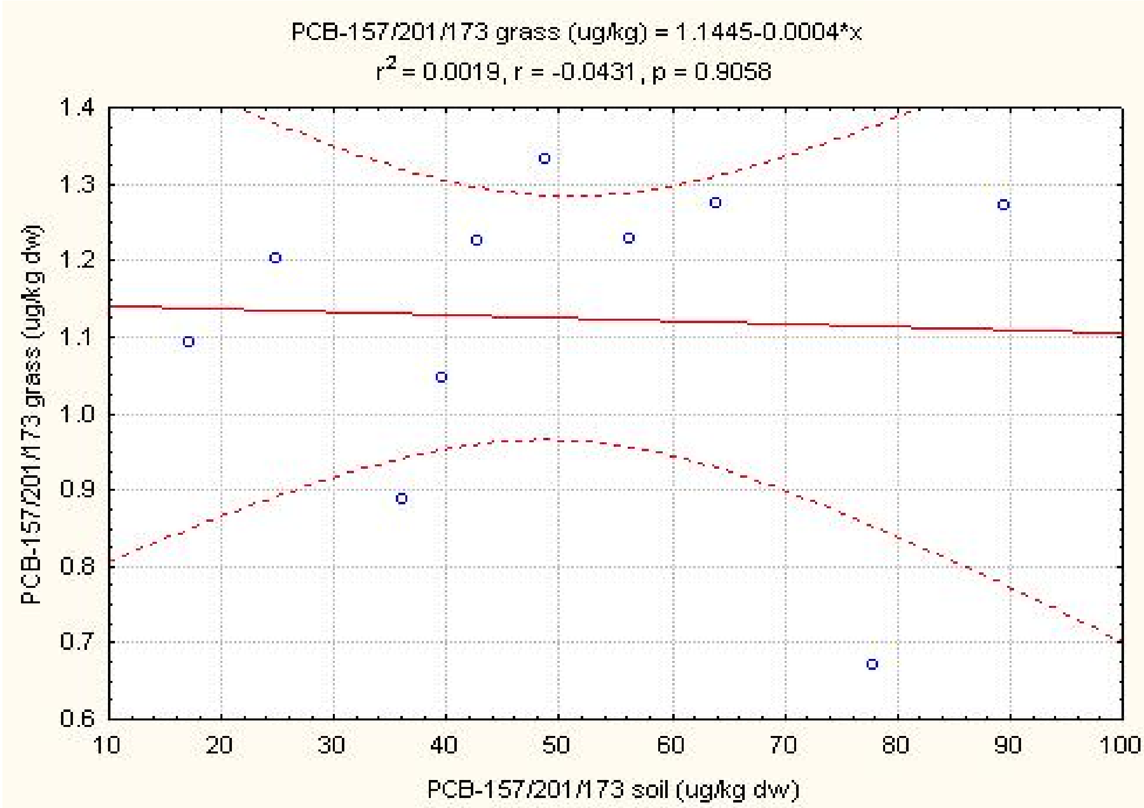
Figure 4-4a[1]
Relationship Between PCB Concentrations in Soil (dw) and Grass (dw) (Continued)

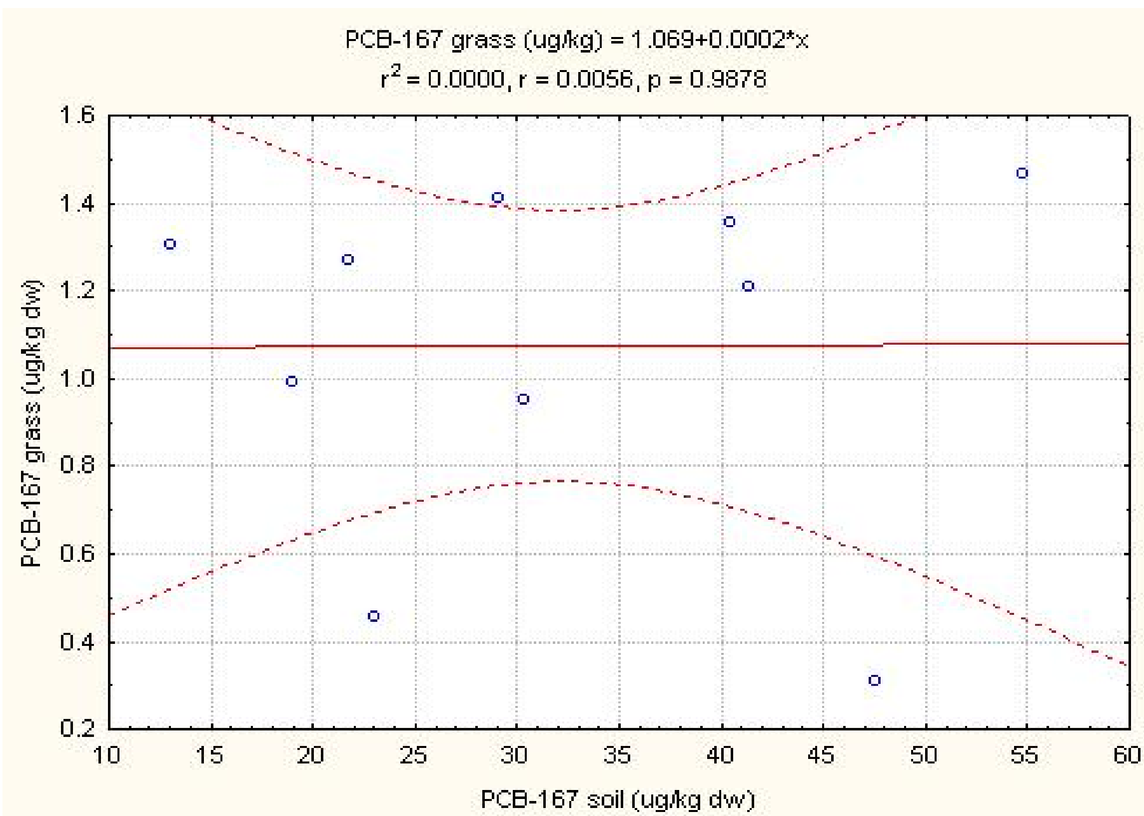




[1]Regressions were performed with data sets composed of only detected concentrations of co-located floodplain soil and grass samples.

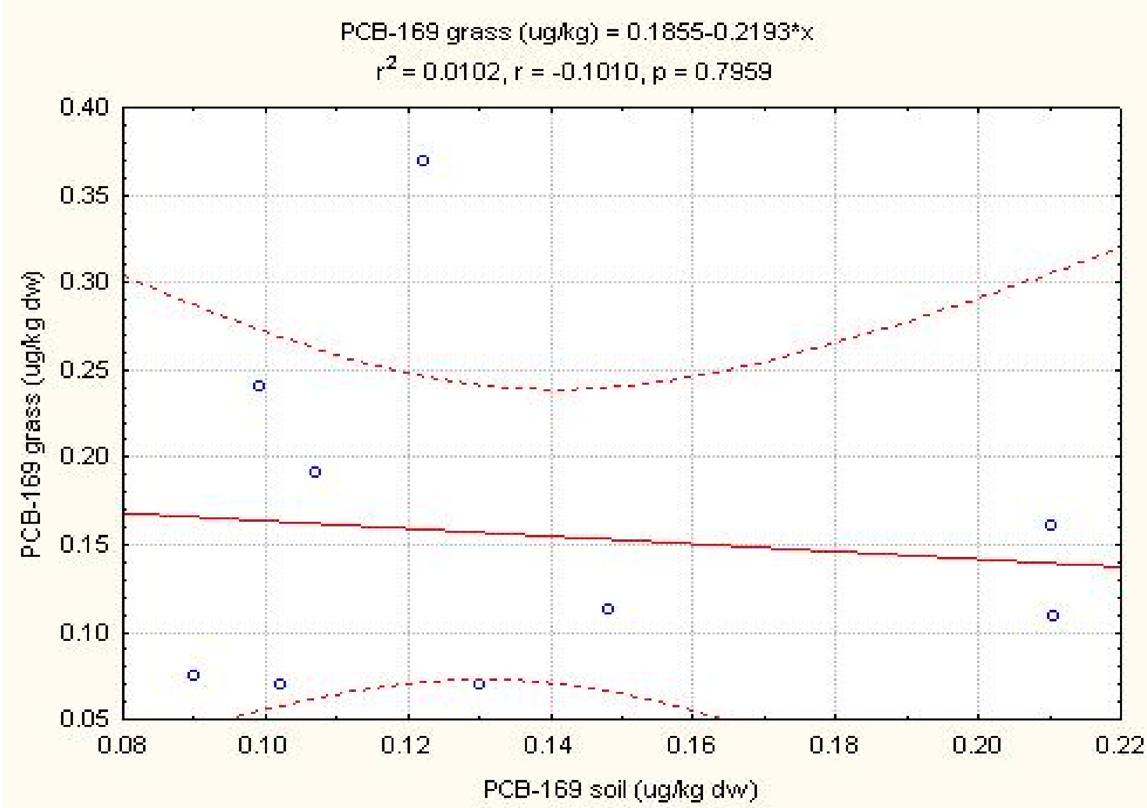
Figure 4-4a[1]
Relationship Between PCB Concentrations in Soil (dw) and Grass (dw)
(Continued)

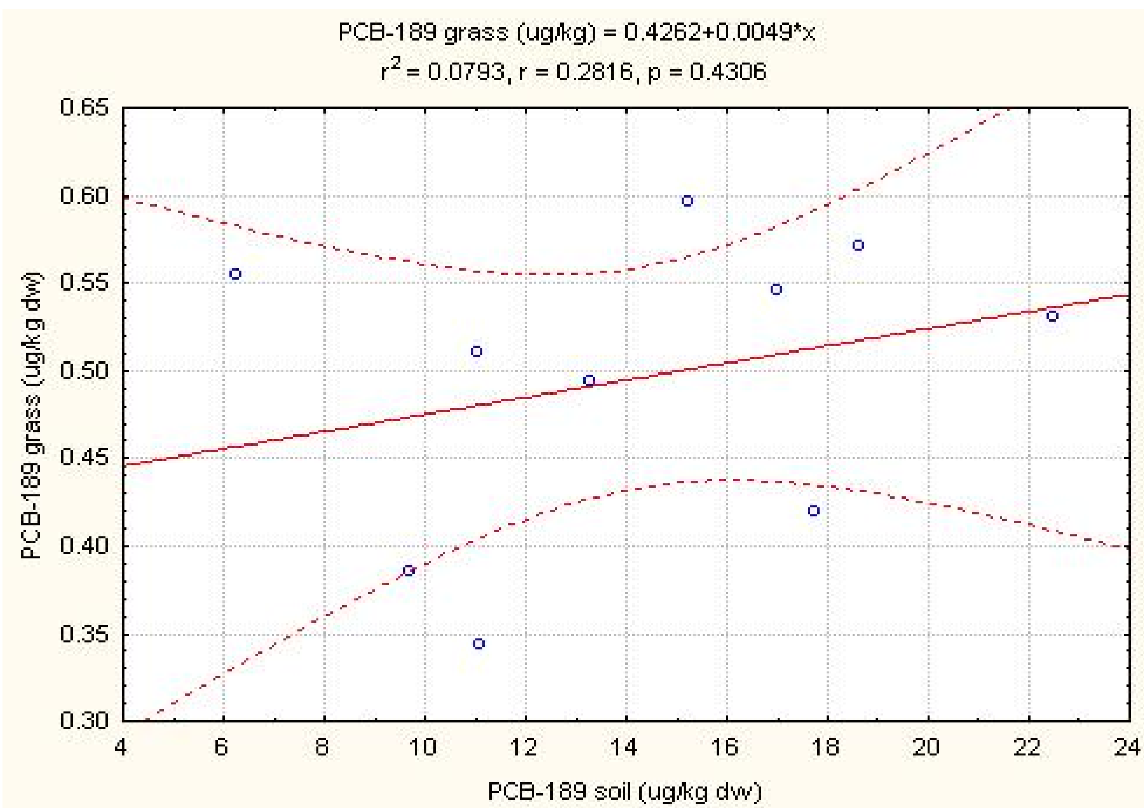




[1]Regressions were performed with data sets composed of only detected concentrations of co-located floodplain soil and grass samples.

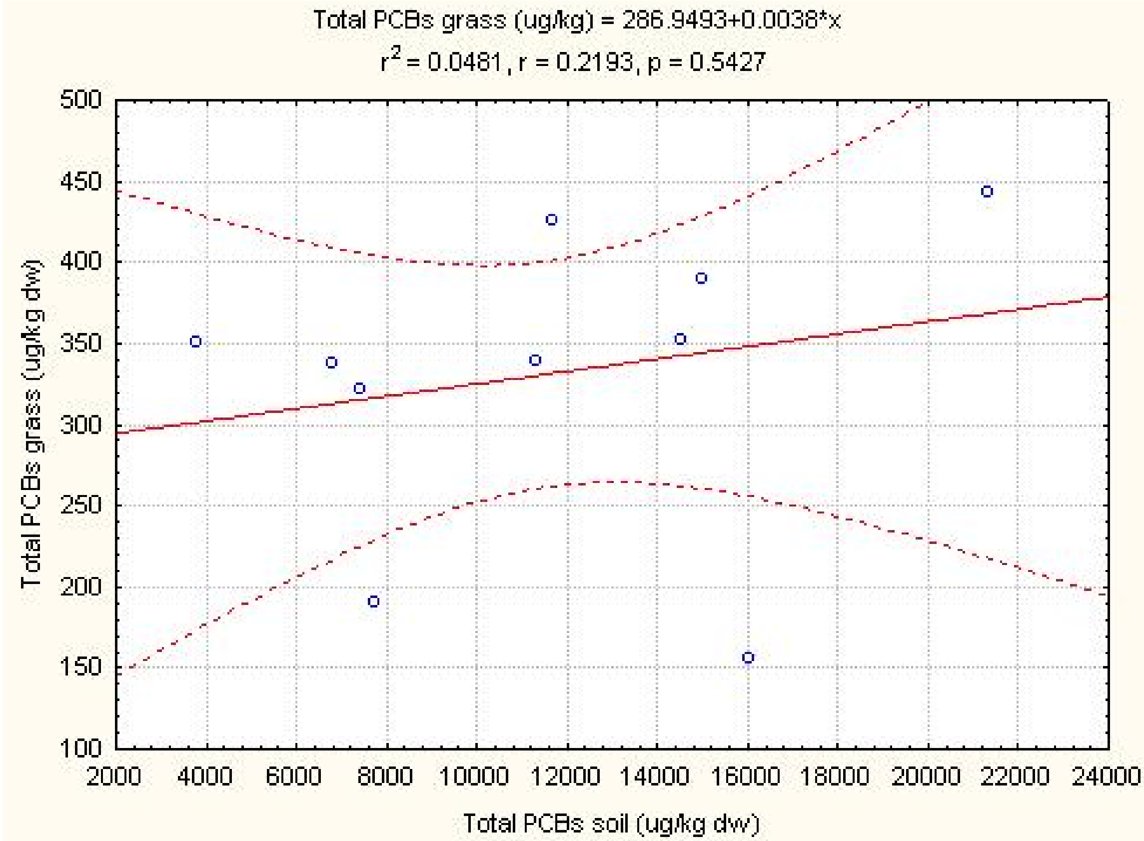
Figure 4-4a[1]
Relationship Between PCB Concentrations in Soil (dw) and Grass (dw)
(Continued)





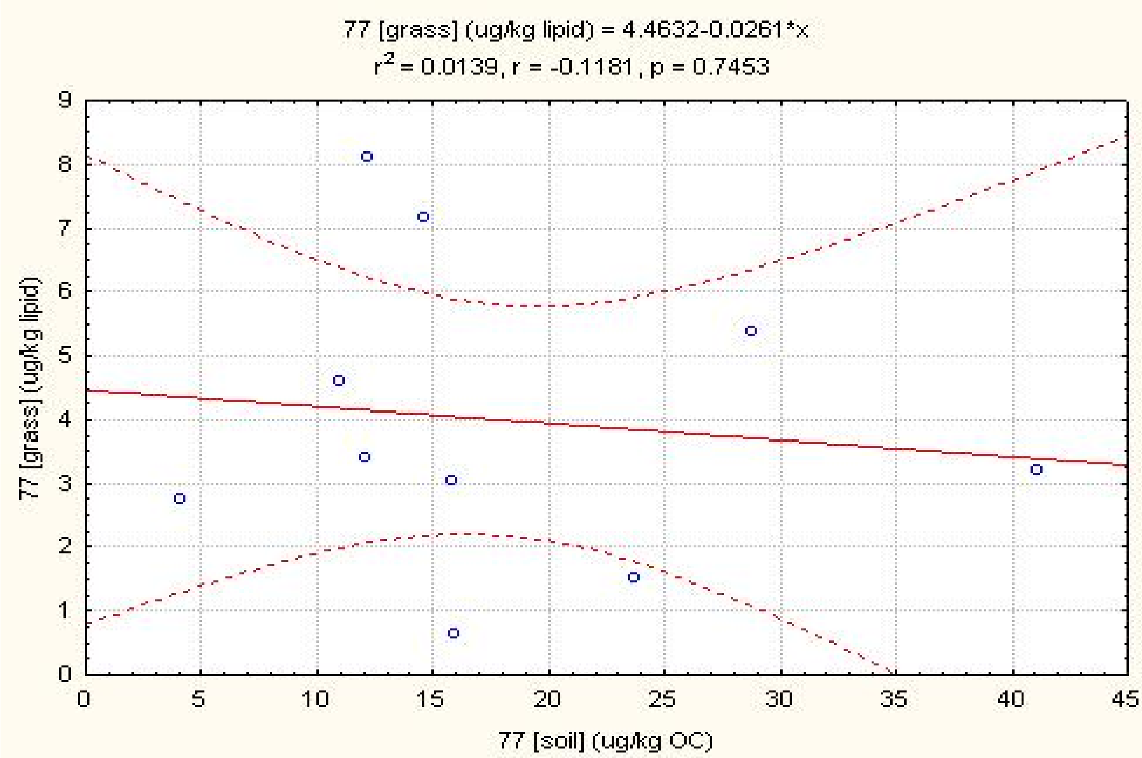
[1]Regressions were performed with data sets composed of only detected concentrations of co-located floodplain soil and grass samples.

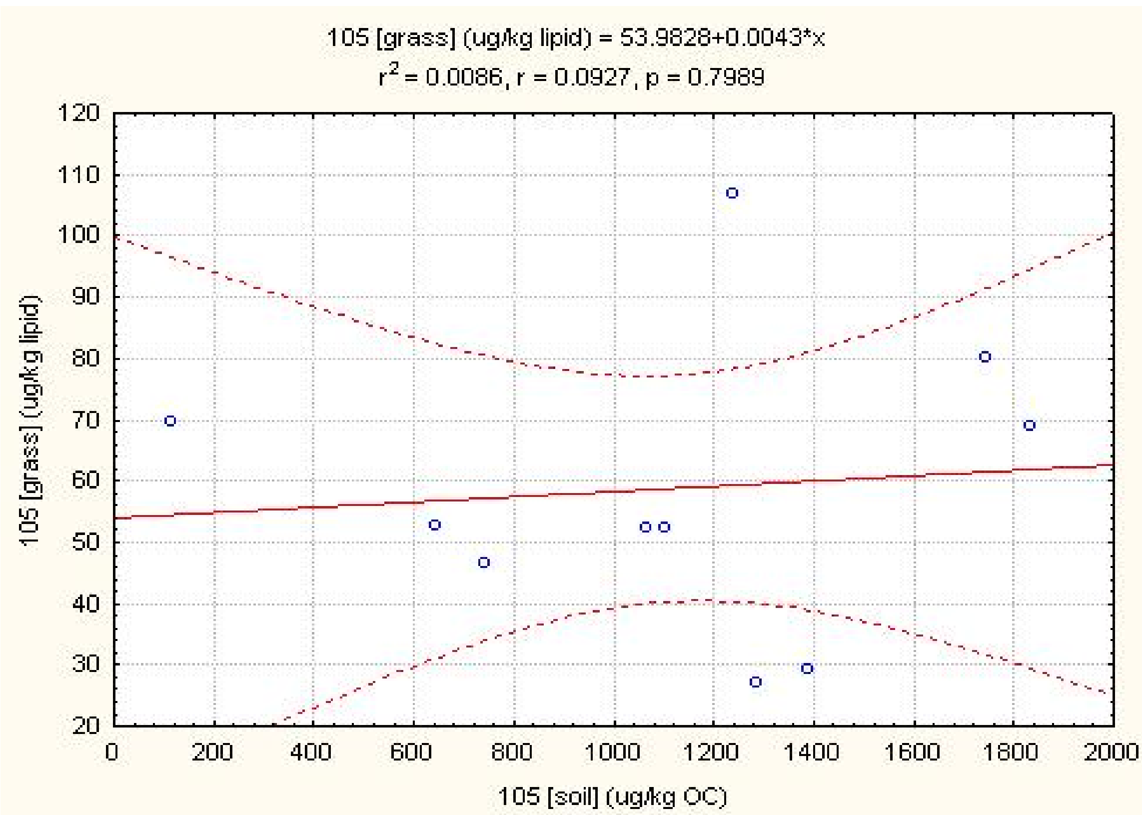
Figure 4-4a[1]
Relationship Between PCB Concentrations in Soil (dw) and Grass (dw) (Continued)



[1]Regressions were performed with data sets composed of only detected concentrations of co-located floodplain soil and grass samples.

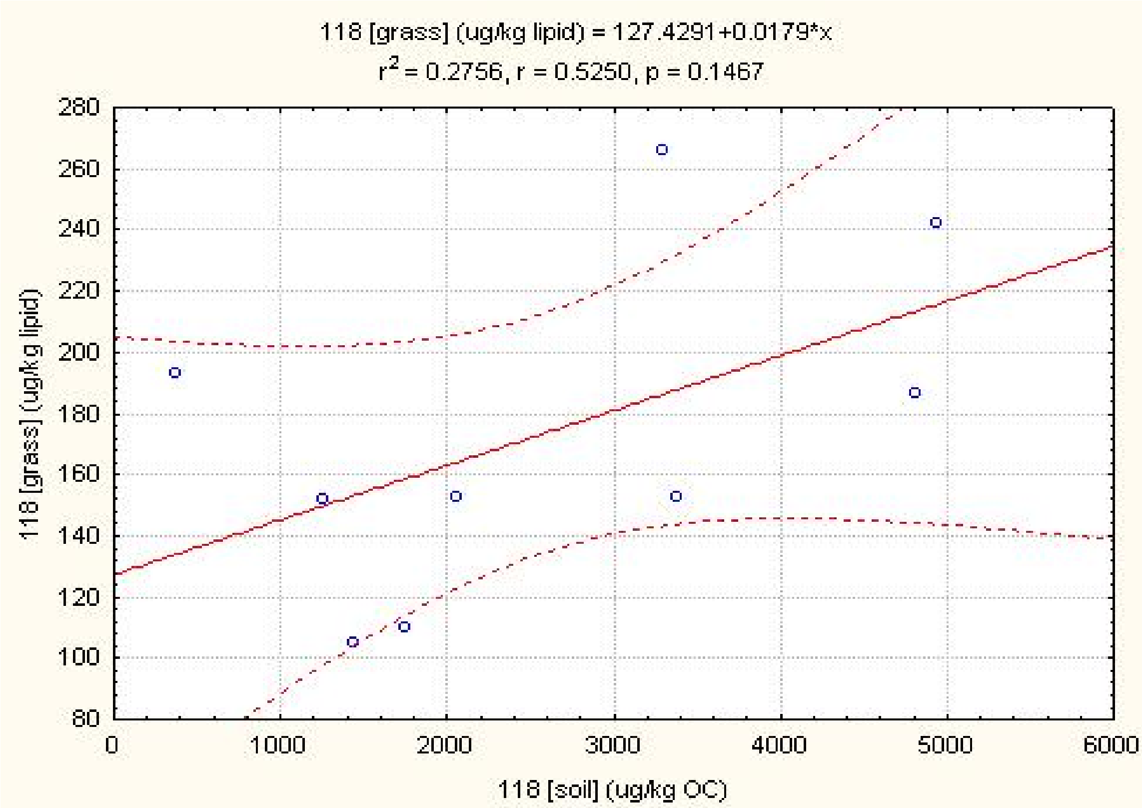
Figure 4-4a[1]
Relationship Between PCB Concentrations in Soil (dw) and Grass (dw)
(Continued)

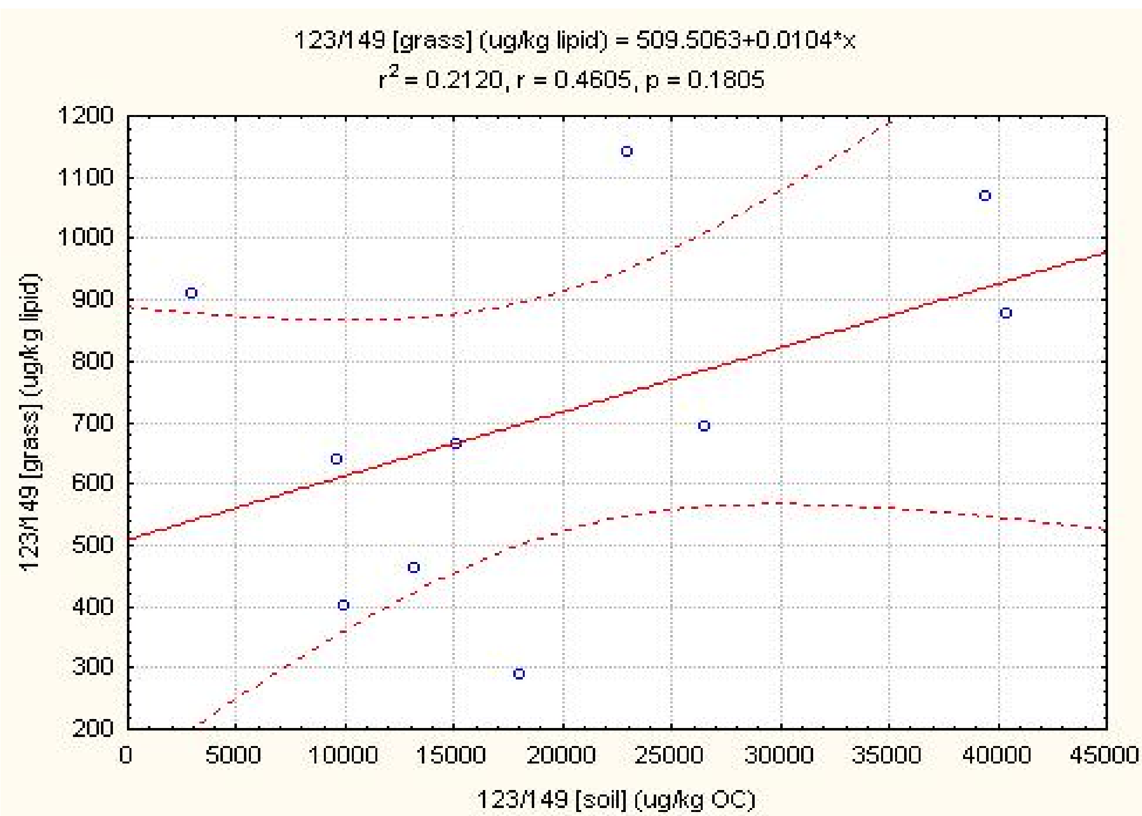




[1]Regressions were performed with data sets composed of only detected concentrations of co-located floodplain soil and grass samples.

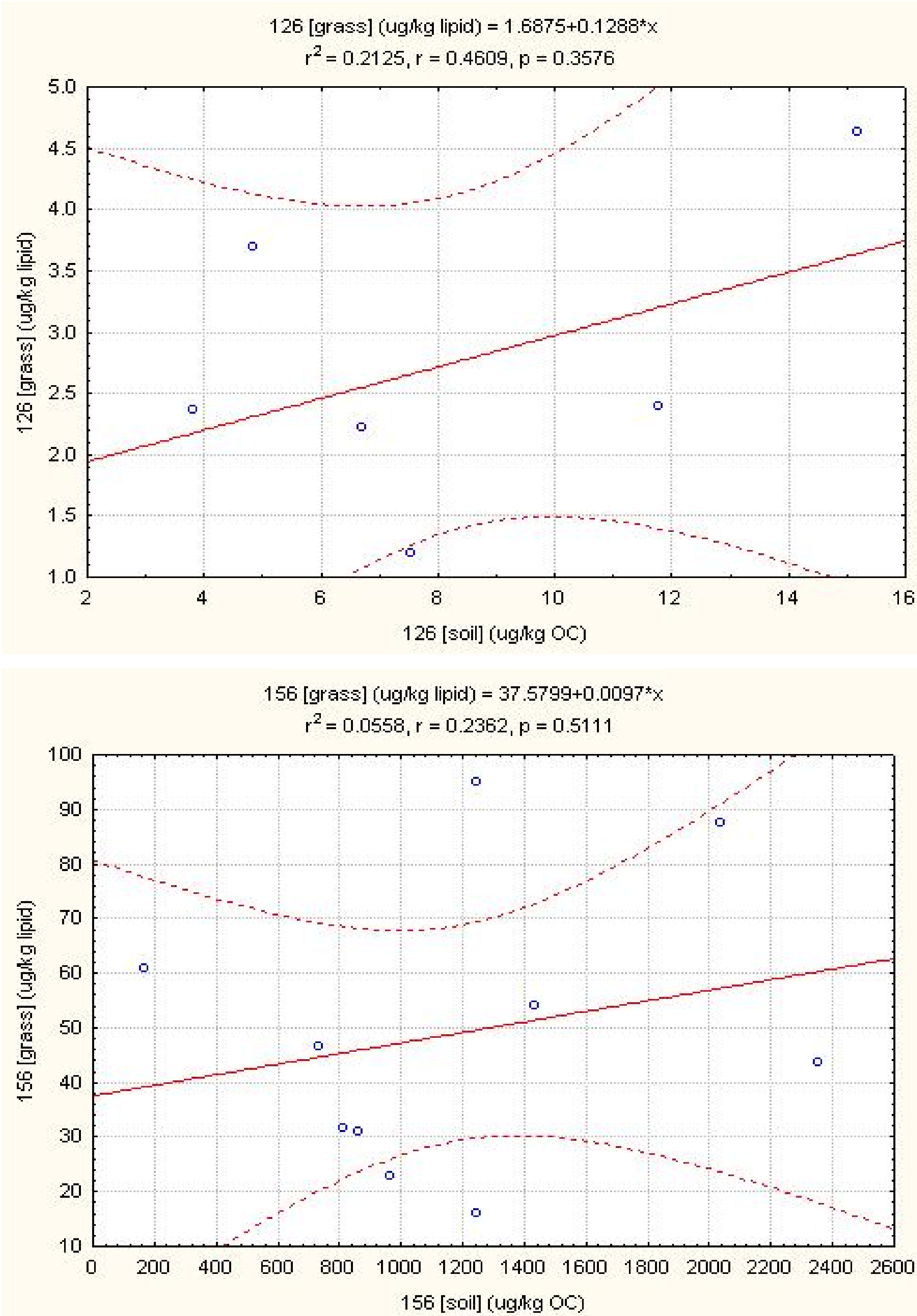
Figure 4-4b[1]
Relationship Between PCB Concentrations in
Soil (Organic Carbon Normalized) and Grass (Lipid Normalized)





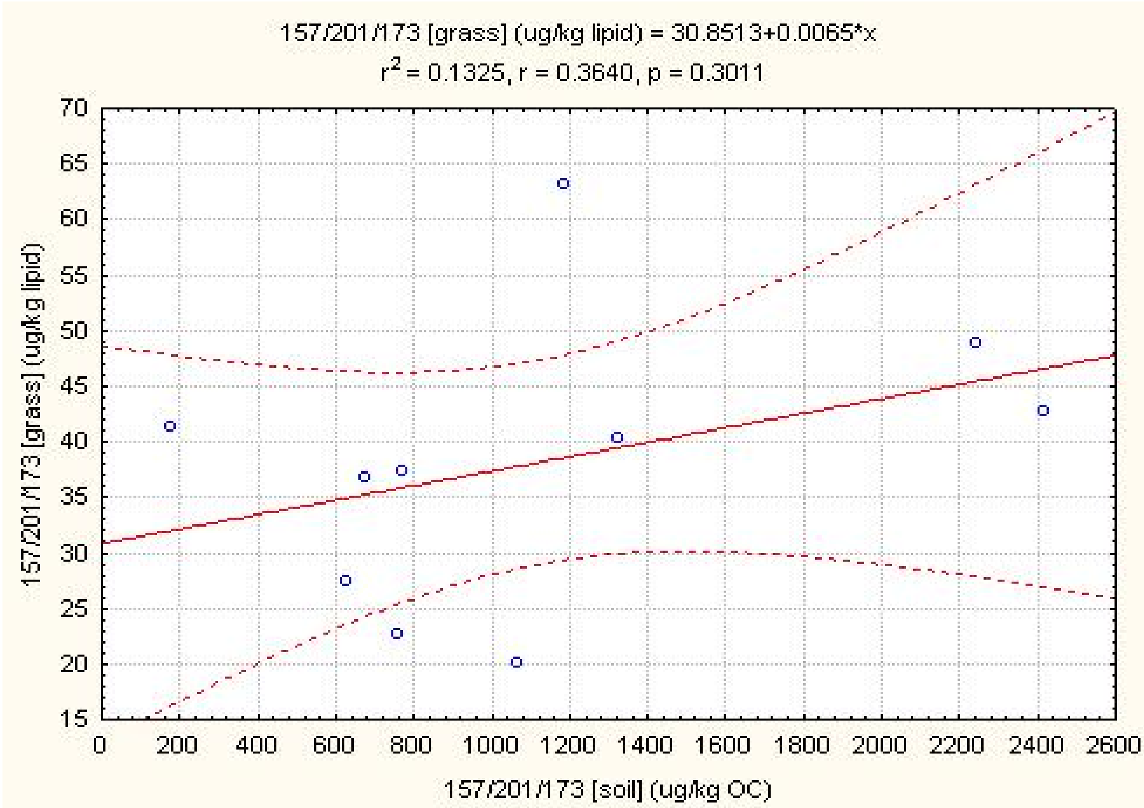
[1]Regressions were performed with data sets composed of only detected concentrations of co-located floodplain soil and grass samples.

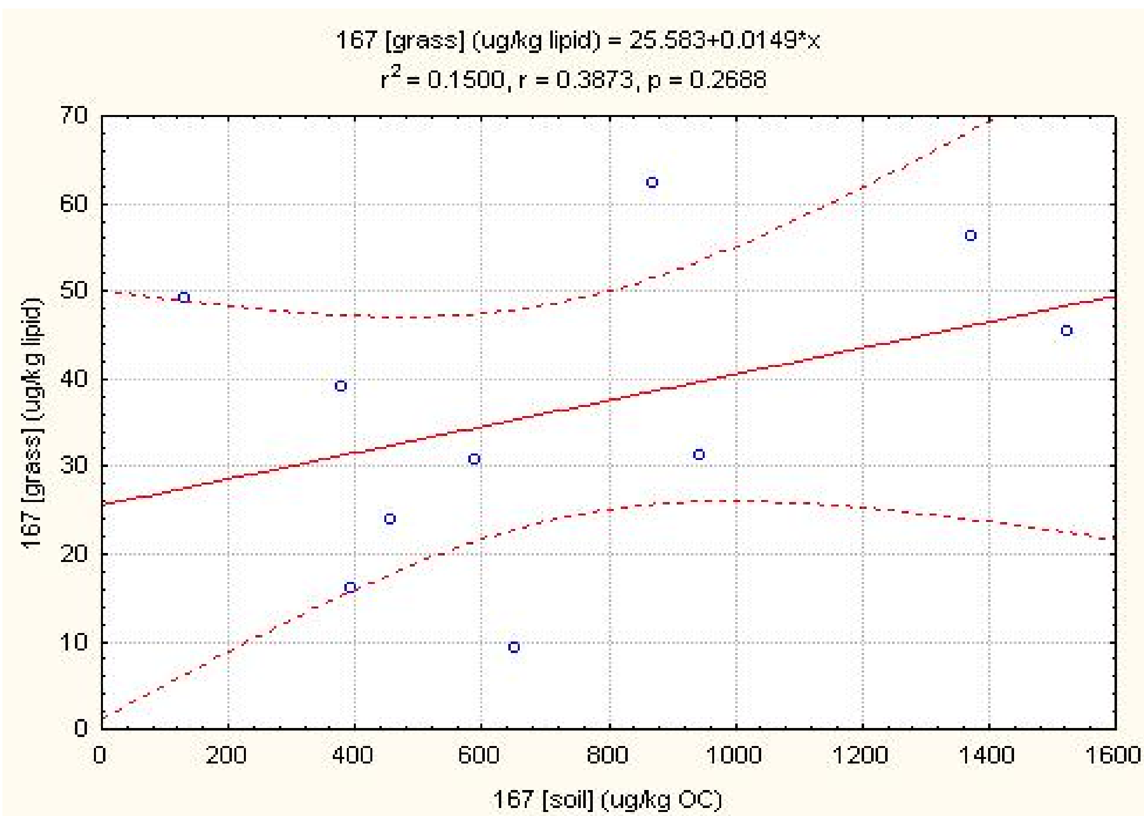
Figure 4-4b[1]
Relationship Between PCB Concentrations in
Soil (Organic Carbon Normalized) and Grass (Lipid Normalized)
(Continued)



[1]Regressions were performed with data sets composed of only detected concentrations of co-located floodplain soil and grass samples.

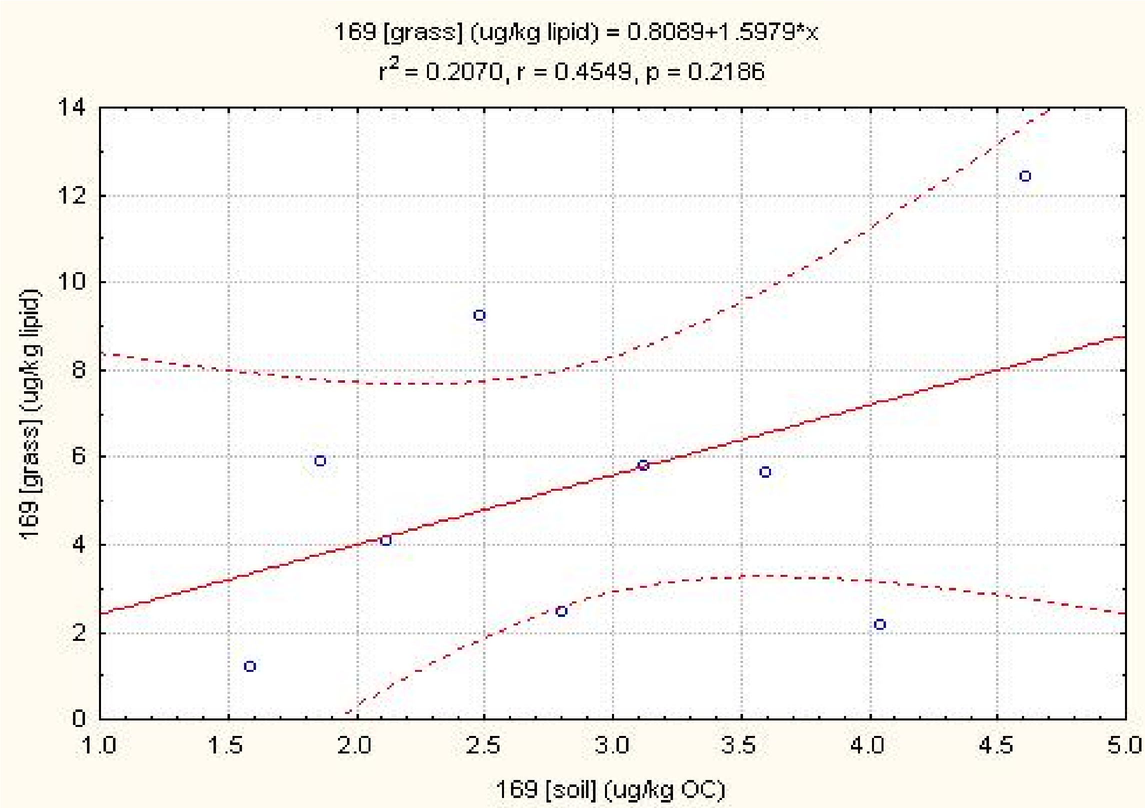
Figure 4-4b[1]
Relationship Between PCB Concentrations in
Soil (Organic Carbon Normalized) and Grass (Lipid Normalized)
(Continued)

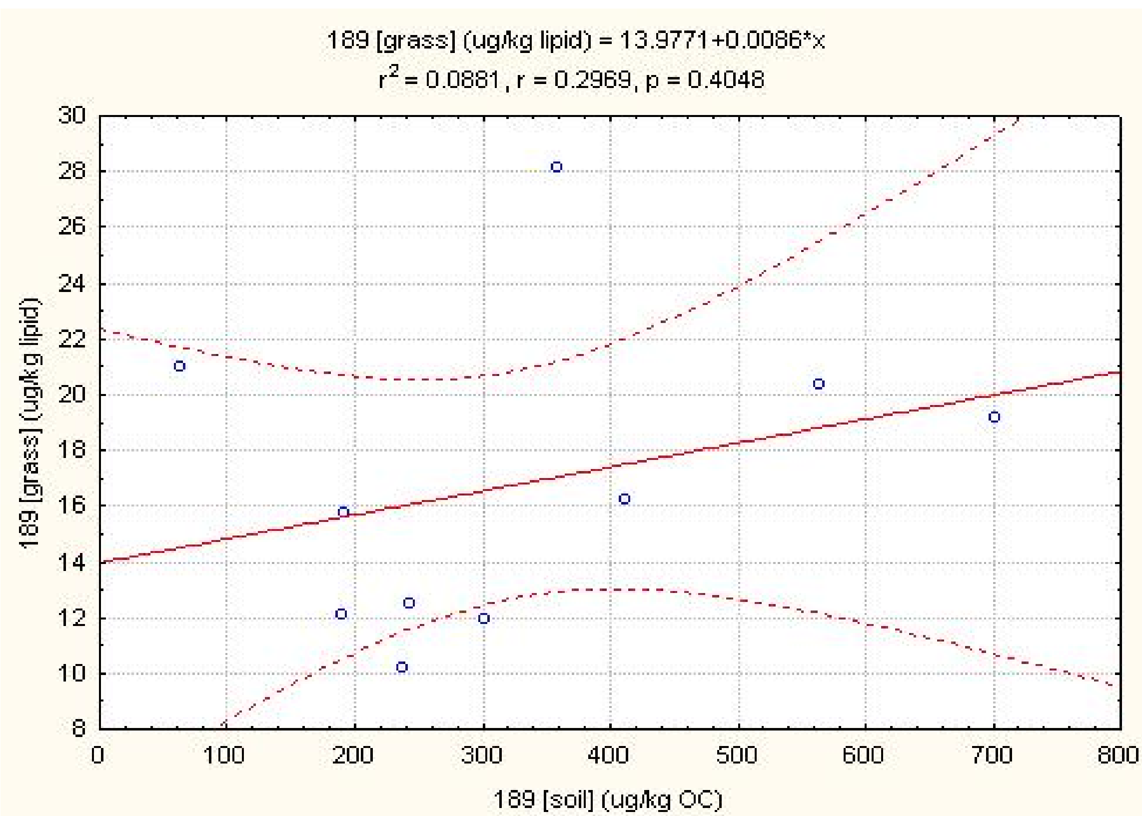




[1]Regressions were performed with data sets composed of only detected concentrations of co-located floodplain soil and grass samples.

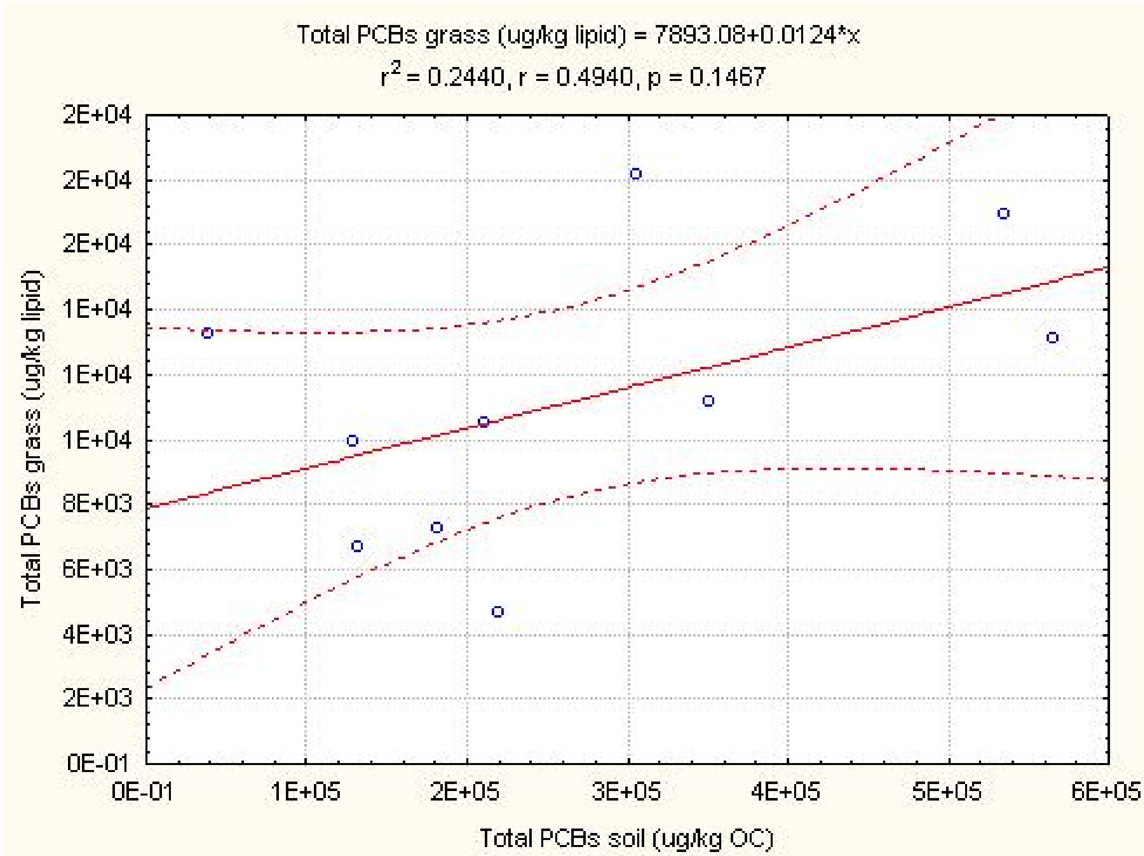
Figure 4-4b[1]
Relationship Between PCB Concentrations in
Soil (Organic Carbon Normalized) and Grass (Lipid Normalized)
(Continued)





[1]Regressions were performed with data sets composed of only detected concentrations of co-located floodplain soil and grass samples.

Figure 4-4b[1]
Relationship Between PCB Concentrations in
Soil (Organic Carbon Normalized) and Grass (Lipid Normalized)
(Continued)



[1]Regressions were performed with data sets composed of only detected concentrations of co-located floodplain soil and grass samples.

Figure 4-4b[1]
Relationship Between PCB Concentrations in Soil (Organic Carbon Normalized) and Grass (Lipid Normalized) (Continued)

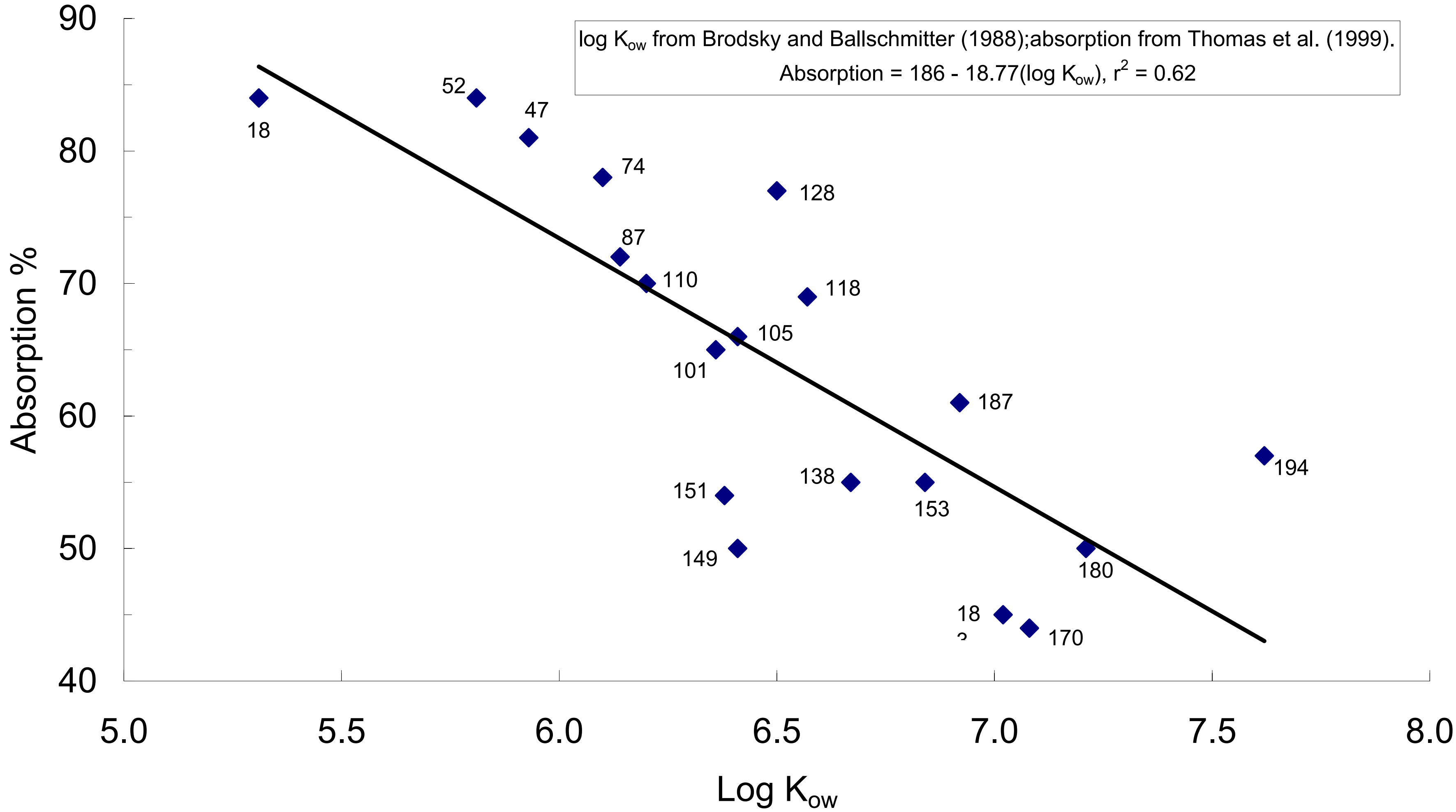


Figure 4-5
Relationship Between PCB Congener Absorption and Log K_{ow}

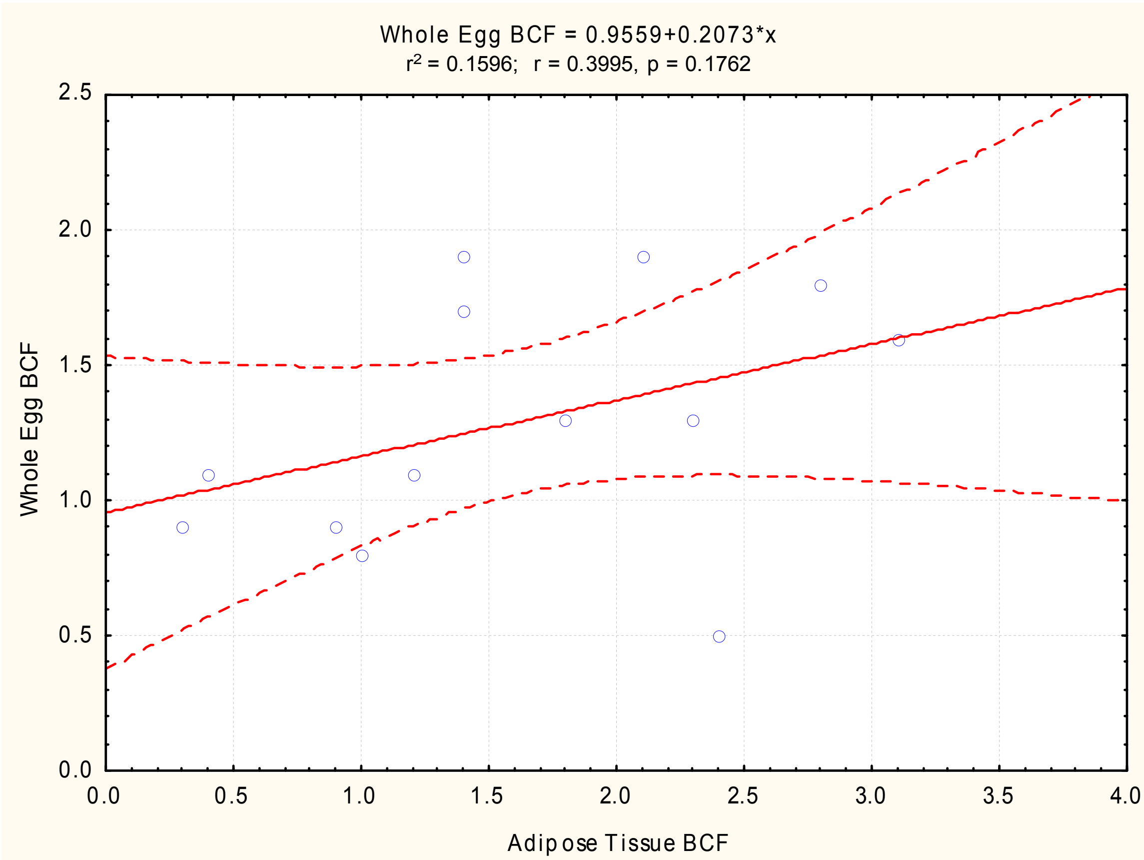


Figure 4-6 Relationship Between PCDD/PCDF BCFS in Poultry Tissue and Whole Eggs

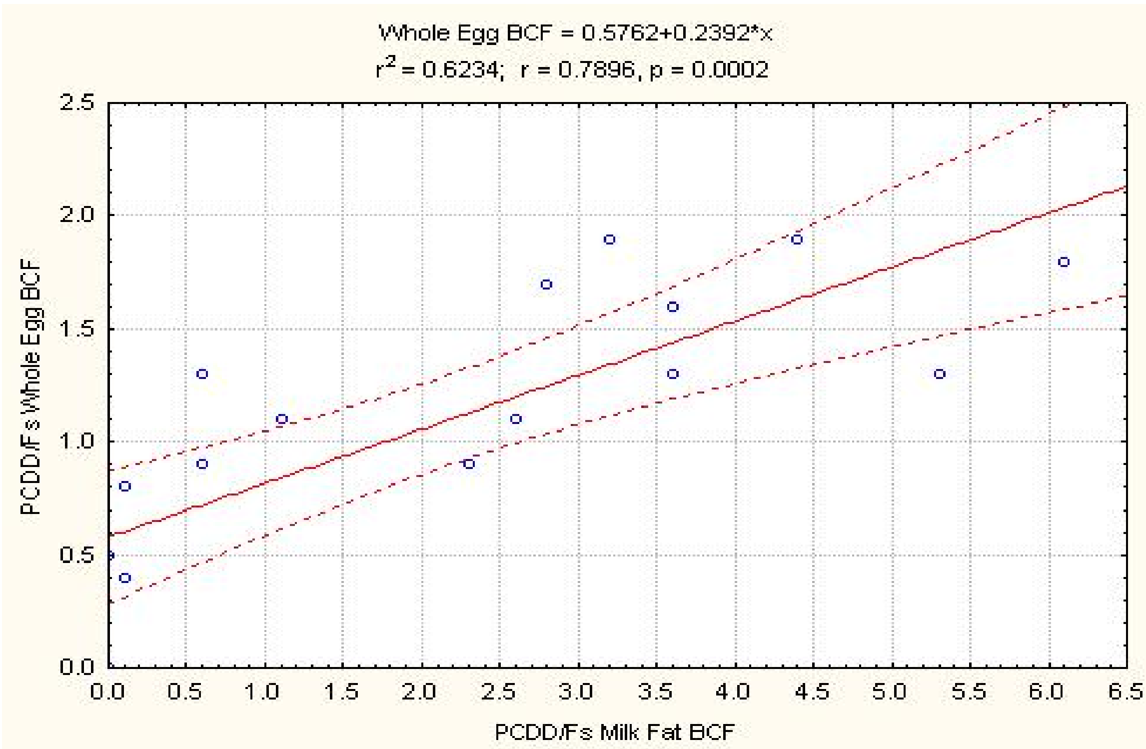


Figure 4-7 Relationship Between Milk Fat BCFs and Poultry Whole Egg BCFs

5. POINT ESTIMATE RISK CHARACTERIZATION

The objective 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 associated with consumption of foods from the floodplain. Cancer risks and noncancer health hazards from tPCBs were evaluated for both the RME and CTE scenarios, and results are presented in this section. Cancer risks associated with 2,3,7,8-TCDD TEQ are presented in the uncertainty analysis (Section 7) due to uncertainties associated with predicting congener concentrations in floodplain soil, and the limited bioconcentration factor (BCF) data for dioxin-like PCB congeners. Some dioxin-like congener risk estimates are sufficiently certain to remain in this section (e.g., risk from dioxin congeners in soil for the dairy and poultry exposure scenarios). However, to avoid the confusion of having some aspects of the TEQ pathway for a given exposure scenario divided between the risk characterization and uncertainty analysis sections, all congener-specific TEQ cancer risk estimates are presented in Section 7.

Potential cancer risk was calculated using the equation:

$$\text{Risk} = \text{LADD} * \text{CSF}$$

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 (assumed) lifetime.

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

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

The EPA cancer risk range identified in the National Contingency Plan (NCP) (EPA, 1990) is approximately 1 in 1,000,000 (expressed as 1E-06, equivalent to 1×10^{-6}) to 1 in 10,000 (expressed as 1E-04, equivalent to 1×10^{-4}) over a 70-year lifetime. Where the cumulative site risk to an individual based on the RME exceeds the 1E-04 lifetime excess cancer risk end of the risk range, 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 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) across COPCs and exposure pathways. In the assessment of agricultural and other terrestrial food exposure pathways, there is only one COPC (tPCBs) being evaluated for noncancer effects because RfDs are not available for PCB congeners, and there is only one exposure pathway (food ingestion). Therefore, the HQs are equal to HIs for each receptor.

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 noncancer health effects, EPA considers action when the hazard index (HI) exceeds 1. HIs of less than 1 indicate that adverse health effects associated with the exposure scenario are unlikely to occur.

Cancer risk and noncancer hazard estimates are presented in a matrix format presenting risks for different combinations of two agricultural model inputs: (1) tPCB EPC in floodplain soil on current or possible future agricultural parcels, and (2) fraction of cultivated land or pasture that is in the floodplain. A separate matrix is provided for each agricultural scenario. Using these matrices, risk can be estimated for each agricultural scenario for the range of potential mean tPCB soil EPC and fraction of farmland in the floodplain. In each matrix, cancer risk and noncancer hazard estimates are reported for four tPCB soil EPCs (0.5, 2, 10, and 25 mg/kg) and four fractions of cultivation fields and pastures in the floodplain (0.25, 0.5, 0.75, and 1.0), for a total of 16 combinations of the two factors. Note that an underlying assumption of this approach is that the tPCB concentration in farm soil outside the floodplain is zero. This assumption is likely to underestimate risk slightly, depending upon site-specific background concentrations of tPCBs.

As shown in Table 2-2 and discussed in Section 4.1, the tPCB EPCs shown in the matrices span the range of actual EPCs that apply to current and potential future agricultural lands. In all matrices, the term "cornfield" is used to indicate an area used to grow corn for corn silage production, and "pasture" is used to indicate an area used for grass-based feed, which animals consume on pasture during warmer months or in the form of hay or other grass-based feed during colder months.

The cancer risk and noncancer hazard estimates summarized in this section apply to the non-parcel-specific exposure scenarios described in Section 4, including child and adult RME and CTE scenarios. Cancer risk estimates are listed in Table 5-1, and noncancer hazard estimates are listed in Table 5-2. Attachment D.2 includes cancer risk and noncancer hazard worksheets for each scenario. These sheets include the estimated tPCB concentrations in food and the ADDs, LADDs, cancer risks, and noncancer HIs associated with these concentrations. Worksheets are provided for only one of the 16 combinations of tPCB concentration and fraction in the floodplain to avoid redundancy, given the linear nature of the risk model. (Note that worksheets in Attachment D.2 also include food concentrations, LADDs, and cancer risks from TEQ, which are discussed in Section 7).

The risk estimates presented in this section are the result of a conservative, point estimate assessment. Section 6 of this volume provides a quantitative assessment of uncertainty in these estimates. Section 10 of HHRA Volume I discusses cumulative risk from the agricultural product consumption exposure pathways and direct soil contact exposure pathways.

5.1 COMMERCIAL DAIRY

Currently, lactating dairy cattle are confined outside the floodplain and fed concentrates and corn silage, with little to no grass-based feed. Therefore, it was assumed that dairy cattle were exposed only through consumption of contaminated corn silage grown in the floodplain. The risk estimates for consumption of dairy products are ultimately attributable to ingestion of contaminated corn silage by the herd. All RME and CTE cancer risks were below or within EPA's risk range (Table 5-1). Nearly all adult RME and CTE HIs were less than 1. Child RME and CTE HIs were less than 1 at assumed tPCB EPC of 0.5 mg/kg and 2 mg/kg, but most exceeded 1 at assumed tPCB EPCs of 10 mg/kg and 25 mg/kg (Table 5-2).

Farm 2 in Reach 5, where dairy cattle are reportedly fed an appreciable amount of grass-based feed in addition to corn silage, appears to be an exception to the typical farm management practices in the area, although the exact amount of grass-based feed used is not known and could vary over time (Williams, 2002). Therefore, an additional commercial dairy scenario was evaluated to illustrate the effect of changing the dairy cattle diet assumption from 100% corn silage to 50% corn silage and 50% grass-based feed. Cancer risk and noncancer hazard estimates are shown in Tables 5-3 and 5-4, respectively. RME cancer risk estimates exceeded 1E-04 at assumed tPCB EPCs of 10 mg/kg and 25 mg/kg and all assumed fractions. CTE cancer risk estimates exceeded 1E-04 at an assumed tPCB EPC of 25 mg/kg and a fraction of agricultural land in the floodplain of at least 0.5. RME and CTE child HIs exceeded 1 at all assumed tPCB EPCs greater than 0.5 mg/kg.

5.2 COMMERCIAL BEEF

Currently, no commercial beef cattle farm operations have been identified in the floodplain. If current dairy farms or other land suitable for agriculture is converted to use for commercial beef cattle in the future, a typical scenario would include a cattle roughage diet consisting of a 50:50 mixture of corn silage and grass-based feed and soil ingested while grazing at a rate of 2% of the diet. RME risks for this scenario exceeded 1E-04 at an assumed tPCB EPC of 10 mg/kg and fractions in the floodplain of at least 0.5 and at an assumed tPCB EPC of 25 mg/kg and the full range of assumed fractions in the floodplain. CTE cancer risks exceeded 1E-04 only at an assumed tPCB EPC of 25 mg/kg and fractions in the floodplain of at least 0.75 (Table 5-1). RME and CTE child and adult HIs exceeded 1 at assumed tPCB EPCs of 10 mg/kg and 25 mg/kg and all fractions of floodplain, and they exceeded 1 at an assumed tPCB EPC of 2 mg/kg at most assumed fractions (Table 5-2). Cancer risk and noncancer hazard from tPCBs in beef resulted primarily from the animals' soil consumption (55%), followed by grass consumption (44%), and corn silage consumption (1%).

As discussed in Section 2.1.2.2.2, one local organization, the New England Livestock Alliance, promotes grass-based agriculture in the New England area with the goal of raising beef cattle and sheep on pastures, rather than in pens. If this practice is adopted by any future beef cattle farms operating in the floodplain, risks for this grass-fed beef cattle scenario would be similar to risks associated with the backyard beef cattle scenario described in Section 5.3.

5.3 BACKYARD DAIRY AND BEEF

Risk and hazard estimates for backyard beef and dairy operations, where one or a few cattle are kept, were generally higher than for commercial farms. Backyard cattle were assumed to consume more grass-based feeds because of the impracticality of growing corn on residential parcels and the expense associated with purchasing commercial feeds. This approach is conservative because soil-to-grass transfer factors exceed soil-to-corn transfer factors. Also, unlike commercial dairy cattle, backyard dairy cattle would be more likely to graze in the floodplain, with consequent ingestion of soil.

In this scenario, it was assumed that cattle were exposed to contamination in grass and soil while grazing. RME cancer risks for consumption of home-produced dairy products exceeded 1E-04 at all assumed tPCB EPCs except 0.5 mg/kg. RME cancer risks for consumption of home-produced beef exceeded 1E-04 at only the assumed tPCB EPCs of 10 mg/kg and 25 mg/kg (Table 5-1). CTE cancer risks for backyard dairy and beef were generally lower than corresponding RME cancer risks, with dairy risks nearly always exceeding 1E-04 at assumed tPCB EPCs of 10 mg/kg and 25 mg/kg and beef risks exceeding 1E-04 only at an assumed tPCB EPC of 25 mg/kg with a fraction in the floodplain of 1 (Table 5-2).

Adult and child RME HIs for consumption of backyard dairy and beef products exceeded 1 under nearly all assumed tPCB EPC and fraction combinations, except for 0.5 mg/kg tPCBs in the backyard beef scenario (Table 5-2).

For backyard dairy animals, about 68% of the animals' intake of total PCBs (tPCBs) came from grass consumption and 32% from soil consumption. For backyard beef animals, about 64% of the animals' intake of tPCBs came from grass consumption and 36% from soil consumption.

5.4 COMMERCIAL AND BACKYARD FREE-RANGE POULTRY

In this scenario, soil ingestion is the major exposure pathway for poultry because they are fed grains that are unlikely to be contaminated with PCBs or PCDD/PCDFs, but they might have access to floodplain soil. Therefore, the risk estimates for consumption of poultry products are attributable to ingestion of contaminated soil by poultry. The only difference between the commercial and backyard scenarios is the higher RME and CTE exposure duration assumed for farm families than for other residents, which resulted in different age-weighted poultry meat and egg consumption rates.

RME cancer risks for commercial farm families consuming poultry meat exceeded 1E-04 at the assumed tPCB EPCs of 10 mg/kg and 25 mg/kg (Table 5-1). Corresponding CTE cancer risks exceeded 1E-04 only at an assumed tPCB EPC of 25 mg/kg with a fraction in the floodplain of 1.

RME cancer risks for consumption of backyard poultry meat are somewhat less due to the shorter exposure duration and lower RME consumption rate, with RME risks greater than 1E-04 only at assumed tPCB EPCs of 10 mg/kg and 25 mg/kg, and CTE risks all within EPA's risk range (Table 5-1).

RME cancer risks for commercial farm families consuming poultry eggs exceeded 1E-04 at the assumed tPCB EPCs of 2 mg/kg, 10 mg/kg, and 25 mg/kg, except for the combination of 2 mg/kg with a fraction in the floodplain of 0.25 (Table 5-1). CTE cancer risks for these commercial farm families exceeded 1E-04 at fewer tPCB EPC and fraction combinations, with exceedances limited to assumed tPCB EPCs of 10 mg/kg and 25 mg/kg. Similar, but slightly lower, CTE and RME cancer risks were estimated for consumption of backyard poultry eggs (Table 5-1).

RME and CTE HIs for commercial and backyard farm families consuming poultry meat and eggs were similar between these two scenarios, with most or all RME HIs exceeding 1 at assumed tPCB EPCs of 2 mg/kg, 10 mg/kg, and 25 mg/kg (Table 5-2). Adult RME HIs at an assumed tPCB EPC of 0.5 mg/kg were nearly always less than 1, and child RME HIs at this concentration were sometimes less than 1 (Table 5-2).

5.5 HOME GARDENS

Risks from ingestion of homegrown garden produce were estimated for both a farm family and a resident with a small garden in the Housatonic River area. Cancer risks and noncancer HIs were estimated for exposed fruit, exposed vegetables, and root vegetables. Cancer risks and HIs were summed across these three produce categories to yield the total cancer risk and HI.

All RME and CTE cancer risks for the farm family and home gardening family were below or within EPA's risk range. Nearly all HIs for the farm family and home gardening family were below 1, except the child RME HIs at an assumed tPCB EPC of 25 mg/kg and fractions of 0.75 and 1, and the child CTE HIs at an assumed tPCB EPC of 25 mg/kg and a fraction of 1.

The home garden risk estimates might not account for risks associated with consumption of squash, which were estimated separately using a site-specific mean tPCB concentration of 0.049 mg/kg (ww). A cancer risk of 5E-06 would be associated with consumption of one ½-cup squash meal per week, 12 weeks per year for 45 years (6 as a 15-kg child and 39 as a 70-kg adult). A noncancer HI of 0.6 would be associated with a young child's consumption of one ½-cup squash meal per week, 12 weeks per year, assuming a body weight of 15 kg. If a very young child (1 to 2 years old with a body weight of about 11 kg) consumed this much squash, the noncancer HI would be 0.8. These risk and hazard estimates do not include a cooking loss factor.

5.6 SHEEP

The sheep scenario described in Section 4.4 represents a reasonable upper bound estimate of the accumulation of contaminants in the body fat of this species under the local climatic conditions, which prevent grazing during periods of snow cover and grass dormancy. Sheep meat consumed in the United States is primarily lamb. Although contaminant accumulation in lamb was not assessed directly in Section 4.4, it was noted that lambs being finished for slaughter are usually fed concentrates. It is also likely that lambs being finished for slaughter would be confined in a small area out of the floodplain. These factors should reduce the predicted concentration of contaminants in the body fat of lambs compared to the adult sheep maintained on pasture or an all-roughage diet as described in Section 4.4.

A second factor that could mitigate the risk from consumption of sheep meat is the low likelihood that consumers of lamb would use lamb as the sole source of red meat. That is, it is likely that lamb consumption by a consumer is less than beef consumption by a frequent consumer of beef. Home-produced lamb consumption rate data were not available to verify this assumption. However, if this assumption were accurate, risk associated with home-produced lamb consumption would be less than that associated with home-produced beef consumption.

Unlike Europe and some other areas, sheep have not seen significant use for dairy purposes in the United States. However, some interest in using sheep milk for production of specialty cheese has arisen in recent years (http://www.sare.org/highlights/2001/sheep_milk.htm). An analysis of potential exposure to contaminants in sheep milk was not conducted. However, the management and feeding of dairy sheep would be similar to that of dairy goats, and it is expected that milk concentrations of the two species would be similar when management conditions are similar.

5.7 GOATS

Dairy goats are small animals compared to dairy cows. Thus, the area required to confine them is much smaller than that required for dairy cattle. Also, if pasture is used, the area required will be small. Milking, housing, and feed storage facilities will not be located in the floodplain. It is likely that pastures and confinement areas will be located close to the milking facilities to eliminate the inconvenience of moving animals long distances twice per day for milking. Thus, the likelihood of dairy goats having access to the floodplain soil is low.

Home-produced goat milk consumption rate data were not available, but these rates are not expected to exceed rates for home-produced cow milk. Mean goat milk fat content of 3.8% (American Dairy Goat Association, 2002) is similar to the fat content of cow milk. Therefore, risk associated with home-produced goat milk consumption would likely be similar to, or less than, that associated with home-produced dairy consumption.

Although not discussed in Section 4.4, the same factors that were cited for lamb in Section 5.6 would mitigate the significance of contaminants in goat meat.

5.8 DEER HUNTING

Clancy and Nelson (1991) and Hiller (1996) summarized the feeding habits of deer. Deer remain in a small area if the habitat provides food, water, and vegetative shelter. At any given time the range of a female will encompass approximately 200 to 300 acres. This range might change modestly from time to time so that over a lifetime a single deer might roam over about 1,000 acres. Generally the range of males is larger than that of females, and the range will be configured to overlap the ranges of several females.

It is possible that some deer spend their entire lifetime within the floodplain or in areas that are inclusive of the floodplain. The presence of deer stands in the PSA indicates that some hunting activity is occurring, and that deer living in the floodplain may be harvested. It is also probable that most of the deer harvested in the Housatonic Valley overall will have spent their entire life out of the floodplain, based upon the abundance of suitable deer habitat outside the PSA. Therefore, it is unlikely that a large proportion of hunters, during each year that they hunt, would take only deer that graze exclusively in the floodplain. This contrasts with backyard animals that could graze exclusively within the floodplain year after year.

Deer are opportunistic in their dietary habits and may consume many different plant species. Because of the wide variety of plant materials consumed by deer, diets can be described by categories such as browse (leaves and shoots of woody plants), forbs (broad-leafed weeds and flowering plants), grasses, and mast (fruits and nuts). Generally, deer will not consume grass if forbs or browse are available. When grasses are consumed, deer prefer the tender growing shoots and will consume the coarser mature grass only as a last resort. Fruits and nuts will be consumed when available, and acorn consumption can be quite high as the deer store fat for the winter. These dietary habits explain the low levels of soil consumption by deer. Based on the nature of the diet, it is likely that the use of the soil-to-grass transfer factor would overestimate the potential contaminant level in the diets of deer.

Deer meat is lean compared with beef, with reported fat contents ranging from 2.7 to 3.3% (Macrea et al., 1993). Except for the bounding estimate based on the annual bag limit, estimated deer consumption rates were less than home-produced beef consumption rates (see Section 4.6.2.2.2). Given these factors, along with the foraging habits of deer, risk associated with consumption of deer meat is likely to be substantially less than consumption of home-produced beef.

5.9 WILD EDIBLE PLANTS

Screening-level risks associated with consumption of fiddlehead ferns were estimated using a site-specific maximum tPCB concentration in fiddlehead ferns of 0.0083 mg/kg (ww). A cancer risk of 7E-06 would be associated with 45 years (6 as a 15-kg child and 39 as a 70-kg adult) of consuming 104 ½-cup meals per year. A noncancer HI of 0.9 would be associated with a young child's consumption of 104 ½-cup fern meals per year for 6 years. The 104 meal/year rate is the 95th percentile fiddlehead fern consumption rate reported by MDPH (2001). These cancer risk and noncancer hazard estimates are upper-bound estimates of risk for fiddlehead fern consumption. MDPH (2001) reports a much lower mean consumption rate of 18 fiddlehead fern meals per year, which is more consistent with the brief availability of these plants during spring.

5.10 REFERENCES

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SECTION 5

TABLES

Table 5-1
Cancer Risk Summary for Agricultural Scenarios[1]

Commercial Farm Family: Dairy Consumption

RME				
Fraction of Cornfield in the Floodplain (unitless)	Total PCB Concentration in Cornfield (mg/kg dw) 0.5	2	10	25
0.25	5E-07	2E-06	1E-05	3E-05
0.5	1E-06	4E-06	2E-05	5E-05
0.75	2E-06	6E-06	3E-05	8E-05
1	2E-06	8E-06	4E-05	1E-04

Commercial Farm Family: Dairy Consumption

CTE				
Fraction of Cornfield in the Floodplain (unitless)	Total PCB Concentration in Cornfield (mg/kg dw) 0.5	2	10	25
0.25	1E-07	5E-07	2E-06	6E-06
0.5	2E-07	9E-07	5E-06	1E-05
0.75	4E-07	1E-06	7E-06	2E-05
1	5E-07	2E-06	9E-06	2E-05

Backyard Farm Family: Dairy Consumption

RME				
Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
0.25	2E-05	8E-05	4E-04	1E-03
0.5	4E-05	2E-04	8E-04	2E-03
0.75	6E-05	2E-04	1E-03	3E-03
1	8E-05	3E-04	2E-03	4E-03

Backyard Farm Family: Dairy Consumption

CTE				
Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
0.25	4E-06	2E-05	8E-05	2E-04
0.5	8E-06	3E-05	2E-04	4E-04
0.75	1E-05	5E-05	2E-04	6E-04
1	2E-05	6E-05	3E-04	8E-04

Commercial Farm Family: Beef Consumption

RME				
Fraction of Pasture & Cornfield in the Floodplain (unitless)	Total PCB Concentration in Pasture & Cornfield (mg/kg dw) 0.5	2	10	25
0.25	7E-06	3E-05	1E-04	4E-04
0.5	1E-05	6E-05	3E-04	7E-04
0.75	2E-05	9E-05	4E-04	1E-03
1	3E-05	1E-04	6E-04	1E-03

Commercial Farm Family: Beef Consumption

CTE				
Fraction of Pasture & Cornfield in the Floodplain (unitless)	Total PCB Concentration in Pasture & Cornfield (mg/kg dw) 0.5	2	10	25
0.25	1E-06	4E-06	2E-05	5E-05
0.5	2E-06	9E-06	4E-05	1E-04
0.75	3E-06	1E-05	6E-05	2E-04
1	4E-06	2E-05	9E-05	2E-04

Backyard Farm Family: Beef Consumption

RME				
Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
0.25	8E-06	3E-05	2E-04	4E-04
0.5	2E-05	6E-05	3E-04	8E-04
0.75	2E-05	9E-05	5E-04	1E-03
1	3E-05	1E-04	6E-04	2E-03

Backyard Farm Family: Beef Consumption

CTE				
Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
0.25	9E-07	4E-06	2E-05	4E-05
0.5	2E-06	7E-06	4E-05	9E-05
0.75	3E-06	1E-05	5E-05	1E-04
1	4E-06	1E-05	7E-05	2E-04

Commercial Farm Family: Poultry Meat Consumption

RME				
Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
0.25	8E-06	3E-05	2E-04	4E-04
0.5	2E-05	7E-05	3E-04	8E-04
0.75	2E-05	1E-04	5E-04	1E-03
1	3E-05	1E-04	7E-04	2E-03

Commercial Farm Family: Poultry Meat Consumption

CTE				
Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
0.25	8E-07	3E-06	2E-05	4E-05
0.5	2E-06	6E-06	3E-05	8E-05
0.75	2E-06	9E-06	5E-05	1E-04
1	3E-06	1E-05	6E-05	2E-04

Table 5-1
Cancer Risk Summary for Agricultural Scenarios[1]

Backyard Farm Family: Poultry Meat Consumption

RME

Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
0.25	5E-06	2E-05	9E-05	2E-04
0.5	9E-06	4E-05	2E-04	5E-04
0.75	1E-05	6E-05	3E-04	7E-04
1	2E-05	7E-05	4E-04	9E-04

CTE

Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
0.25	4E-07	2E-06	9E-06	2E-05
0.5	9E-07	3E-06	2E-05	4E-05
0.75	1E-06	5E-06	3E-05	6E-05
1	2E-06	7E-06	3E-05	9E-05

Commercial Farm Family: Poultry Egg Consumption

RME

Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
0.25	2E-05	8E-05	4E-04	1E-03
0.5	4E-05	2E-04	8E-04	2E-03
0.75	6E-05	2E-04	1E-03	3E-03
1	8E-05	3E-04	2E-03	4E-03

CTE

Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
0.25	4E-06	2E-05	9E-05	2E-04
0.5	9E-06	4E-05	2E-04	4E-04
0.75	1E-05	5E-05	3E-04	7E-04
1	2E-05	7E-05	4E-04	9E-04

Backyard Farm Family: Poultry Egg Consumption

RME

Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
0.25	1E-05	6E-05	3E-04	7E-04
0.5	3E-05	1E-04	6E-04	1E-03
0.75	4E-05	2E-04	8E-04	2E-03
1	6E-05	2E-04	1E-03	3E-03

CTE

Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
0.25	3E-06	1E-05	5E-05	1E-04
0.5	5E-06	2E-05	1E-04	3E-04
0.75	8E-06	3E-05	2E-04	4E-04
1	1E-05	4E-05	2E-04	5E-04

Commercial Farm Family: Produce Consumption

RME

Fraction of Home Garden in the Floodplain (unitless)	Total PCB Concentration in Home Garden (mg/kg dw) 0.5	2	10	25
0.25	3E-07	1E-06	6E-06	2E-05
0.5	6E-07	2E-06	1E-05	3E-05
0.75	9E-07	4E-06	2E-05	5E-05
1	1E-06	5E-06	2E-05	6E-05

CTE

Fraction of Home Garden in the Floodplain (unitless)	Total PCB Concentration in Home Garden (mg/kg dw) 0.5	2	10	25
0.25	5E-08	2E-07	1E-06	2E-06
0.5	1E-07	4E-07	2E-06	5E-06
0.75	1E-07	6E-07	3E-06	7E-06
1	2E-07	8E-07	4E-06	1E-05

Backyard Farm Family: Produce Consumption

RME

Fraction of Home Garden in the Floodplain (unitless)	Total PCB Concentration in Home Garden (mg/kg dw) 0.5	2	10	25
0.25	2E-07	8E-07	4E-06	1E-05
0.5	4E-07	2E-06	8E-06	2E-05
0.75	6E-07	2E-06	1E-05	3E-05
1	8E-07	3E-06	2E-05	4E-05

CTE

Fraction of Home Garden in the Floodplain (unitless)	Total PCB Concentration in Home Garden (mg/kg dw) 0.5	2	10	25
0.25	3E-08	1E-07	5E-07	1E-06
0.5	5E-08	2E-07	1E-06	3E-06
0.75	8E-08	3E-07	2E-06	4E-06
1	1E-07	4E-07	2E-06	5E-06

[1] These point estimates of cancer risk are subject to uncertainties that are addressed in Sections 5, 6, and 7 of Appendix D. Estimates that exceed EPA's cancer risk range are shaded.

Table 5-2
Noncancer Hazard Summary for Agricultural Scenarios[1]

Commercial Farm Family: Dairy Consumption

RME					
Receptor	Fraction of Cornfield in the Floodplain (unitless)	Total PCB Concentration in Cornfield (mg/kg dw) 0.5	2	10	25
Adult	0.25	0.01	0.04	0.2	0.5
	0.5	0.02	0.08	0.4	1
	0.75	0.03	0.1	0.6	1
	1	0.04	0.2	0.8	2
Child	0.25	0.05	0.2	0.9	2
	0.5	0.09	0.4	2	5
	0.75	0.1	0.6	3	7
	1	0.2	0.7	4	9

Commercial Farm Family: Dairy Consumption

CTE					
Receptor	Fraction of Cornfield in the Floodplain (unitless)	Total PCB Concentration in Cornfield (mg/kg dw) 0.5	2	10	25
Adult	0.25	0.008	0.03	0.2	0.4
	0.5	0.02	0.06	0.3	0.8
	0.75	0.02	0.1	0.5	1
	1	0.03	0.1	0.6	2
Child	0.25	0.03	0.1	0.6	1
	0.5	0.06	0.2	1	3
	0.75	0.09	0.3	2	4
	1	0.1	0.5	2	6

Backyard Farm Family: Dairy Consumption

RME					
Receptor	Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
Adult	0.25	0.6	2	11	28
	0.5	1	4	22	56
	0.75	2	7	34	84
	1	2	9	45	110
Child	0.25	2	9	44	110
	0.5	4	17	87	220
	0.75	7	26	130	330
	1	9	35	170	440

Backyard Farm Family: Dairy Consumption

CTE					
Receptor	Fraction of Pasture in the Floodplain (unitless)	Total PCB Concentration in Pasture (mg/kg dw) 0.5	2	10	25
Adult	0.25	0.6	3	13	32
	0.5	1	5	26	65
	0.75	2	8	39	97
	1	3	10	52	130
Child	0.25	1	5	27	68
	0.5	3	11	55	140
	0.75	4	16	82	210
	1	5	22	110	270

Table 5-2

Noncancer Hazard Summary for Agricultural Scenarios[1]

Commercial Farm Family: Beef Consumption

RME					
Receptor	**Fraction of Pasture & Cornfield in the Floodplain (unitless)**	**Total PCB Concentration in Pasture & Cornfield (mg/kg dw)**			
		0.5	2	10	25
Adult	0.25	0.2	0.7	3	8
	0.5	0.3	1	7	17
	0.75	0.5	2	10	25
	1	0.7	3	13	34
Child	0.25	0.3	1	6	15
	0.5	0.6	2	12	31
	0.75	0.9	4	19	46
	1	1	5	25	62

Commercial Farm Family: Beef Consumption

CTE					
Receptor	**Fraction of Pasture & Cornfield in the Floodplain (unitless)**	**Total PCB Concentration in Pasture & Cornfield (mg/kg dw)**			
		0.5	2	10	25
Adult	0.25	0.1	0.4	2	5
	0.5	0.2	0.8	4	10
	0.75	0.3	1	6	15
	1	0.4	2	8	19
Child	0.25	0.2	1	3	8
	0.5	0.3	1	6	16
	0.75	0.5	2	10	24
	1	0.6	3	13	32

Backyard Farm Family: Beef Consumption

RME					
Receptor	**Fraction of Pasture in the Floodplain (unitless)**	**Total PCB Concentration in Pasture (mg/kg dw)**			
		0.5	2	10	25
Adult	0.25	0.3	1	5	14
	0.5	0.5	2	11	27
	0.75	0.8	3	16	41
	1	1	4	22	55
Child	0.25	0.5	2	9	23
	0.5	0.9	4	19	47
	0.75	1	6	28	70
	1	2	8	38	94

Backyard Farm Family: Beef Consumption

CTE					
Receptor	**Fraction of Pasture in the Floodplain (unitless)**	**Total PCB Concentration in Pasture (mg/kg dw)**			
		0.5	2	10	25
Adult	0.25	0.2	0.7	4	9
	0.5	0.4	1	7	19
	0.75	0.6	2	11	28
	1	0.7	3	15	37
Child	0.25	0.2	1	5	12
	0.5	0.5	2	10	24
	0.75	0.7	3	15	37
	1	1	4	19	49

Table 5-2

Noncancer Hazard Summary for Agricultural Scenarios[1]

Commercial Farm Family: Poultry Meat Consumption

RME					
Receptor	**Fraction of Pasture in the Floodplain (unitless)**	**Total PCB Concentration in Pasture (mg/kg dw)** 0.5	2	10	25
Adult	0.25	0.2	0.8	4	10
	0.5	0.4	2	8	20
	0.75	0.6	2	12	30
	1	0.8	3	16	40
Child	0.25	0.3	1	6	14
	0.5	0.6	2	11	28
	0.75	0.8	3	17	41
	1	1	4	22	55

Commercial Farm Family: Poultry Meat Consumption

CTE					
Receptor	**Fraction of Pasture in the Floodplain (unitless)**	**Total PCB Concentration in Pasture (mg/kg dw)** 0.5	2	10	25
Adult	0.25	0.07	0.3	1	3
	0.5	0.1	0.6	3	7
	0.75	0.2	0.8	4	10
	1	0.3	1	6	14
Child	0.25	0.1	0.5	2	6
	0.5	0.2	1	5	12
	0.75	0.4	1	7	18
	1	0.5	2	10	24

Backyard Farm Family: Poultry Meat Consumption

RME					
Receptor	**Fraction of Pasture in the Floodplain (unitless)**	**Total PCB Concentration in Pasture (mg/kg dw)** 0.5	2	10	25
Adult	0.25	0.2	0.7	3	8
	0.5	0.3	1	7	17
	0.75	0.5	2	10	25
	1	0.7	3	13	33
Child	0.25	0.3	1	6	14
	0.5	0.6	2	11	28
	0.75	0.8	3	17	41
	1	1	4	22	55

Backyard Farm Family: Poultry Meat Consumption

CTE					
Receptor	**Fraction of Pasture in the Floodplain (unitless)**	**Total PCB Concentration in Pasture (mg/kg dw)** 0.5	2	10	25
Adult	0.25	0.08	0.3	2	4
	0.5	0.2	0.7	3	8
	0.75	0.3	1	5	13
	1	0.3	1	7	17
Child	0.25	0.1	0.5	2	6
	0.5	0.2	1	5	12
	0.75	0.4	1	7	18
	1	0.5	2	10	24

Table 5-2
Noncancer Hazard Summary for Agricultural Scenarios[1]

Commercial Farm Family: Poultry Egg Consumption

RME					
		Total PCB Concentration in Pasture (mg/kg dw)			
Receptor	Fraction of Pasture in the Floodplain (unitless)	0.5	2	10	25
Adult	0.25	0.5	2	9	23
	0.5	0.9	4	18	46
	0.75	1	5	27	68
	1	2	7	37	91
Child	0.25	1	4	21	52
	0.5	2	8	41	100
	0.75	3	12	62	150
	1	4	16	82	210

Commercial Farm Family: Poultry Egg Consumption

CTE					
		Total PCB Concentration in Pasture (mg/kg dw)			
Receptor	Fraction of Pasture in the Floodplain (unitless)	0.5	2	10	25
Adult	0.25	0.4	1	7	18
	0.5	0.7	3	14	36
	0.75	1	4	22	54
	1	1	6	29	72
Child	0.25	0.9	3	17	43
	0.5	2	7	34	86
	0.75	3	10	51	130
	1	3	14	69	170

Backyard Farm Family: Poultry Egg Consumption

RME					
		Total PCB Concentration in Pasture (mg/kg dw)			
Receptor	Fraction of Pasture in the Floodplain (unitless)	0.5	2	10	25
Adult	0.25	0.5	2	9	23
	0.5	0.9	4	18	46
	0.75	1	6	28	69
	1	2	7	37	92
Child	0.25	1	4	21	52
	0.5	2	8	41	100
	0.75	3	12	62	150
	1	4	16	82	210

Backyard Farm Family: Poultry Egg Consumption

CTE					
		Total PCB Concentration in Pasture (mg/kg dw)			
Receptor	Fraction of Pasture in the Floodplain (unitless)	0.5	2	10	25
Adult	0.25	0.4	2	9	21
	0.5	0.9	3	17	43
	0.75	1	5	26	64
	1	2	7	34	85
Child	0.25	0.9	3	17	43
	0.5	2	7	34	86
	0.75	3	10	51	130
	1	3	14	69	170

Table 5-2
Noncancer Hazard Summary for Agricultural Scenarios[1]

Commercial Farm Family: Produce Consumption

RME					
Receptor	Fraction of Home Garden in the Floodplain (unitless)	Total PCB Concentration in Home Garden (mg/kg dw) 0.5	2	10	25
Adult	0.25	0.01	0.03	0.1	0.4
	0.5	0.01	0.06	0.3	1
	0.75	0.02	0.1	0.4	1
	1	0.03	0.1	0.6	1
Child	0.25	0.01	0.05	0.3	1
	0.5	0.03	0.1	0.5	1
	0.75	0.04	0.2	1	2
	1	0.05	0.2	1	3

Commercial Farm Family: Produce Consumption

CTE					
Receptor	Fraction of Home Garden in the Floodplain (unitless)	Total PCB Concentration in Home Garden (mg/kg dw) 0.5	2	10	25
Adult	0.25	0.004	0.02	0.1	0.2
	0.5	0.01	0.03	0.2	0.4
	0.75	0.01	0.05	0.3	1
	1	0.02	0.1	0.3	1
Child	0.25	0.01	0.03	0.2	0.4
	0.5	0.02	0.1	0.3	1
	0.75	0.03	0.1	0.5	1
	1	0.03	0.1	1	2

Backyard Farm Family: Produce Consumption

RME					
Receptor	Fraction of Home Garden in the Floodplain (unitless)	Total PCB Concentration in Home Garden (mg/kg dw) 0.5	2	10	25
Adult	0.25	0.01	0.03	0.1	0.3
	0.5	0.01	0.05	0.3	1
	0.75	0.02	0.1	0.4	1
	1	0.03	0.1	0.5	1
Child	0.25	0.01	0.05	0.3	1
	0.5	0.03	0.1	0.5	1
	0.75	0.04	0.2	1	2
	1	0.05	0.2	1	3

Backyard Farm Family: Produce Consumption

CTE					
Receptor	Fraction of Home Garden in the Floodplain (unitless)	Total PCB Concentration in Home Garden (mg/kg dw) 0.5	2	10	25
Adult	0.25	0.005	0.02	0.1	0.3
	0.5	0.01	0.04	0.2	0.5
	0.75	0.02	0.1	0.3	1
	1	0.02	0.1	0.4	1
Child	0.25	0.01	0.03	0.2	0.4
	0.5	0.02	0.1	0.3	1
	0.75	0.03	0.1	0.5	1
	1	0.03	0.1	1	2

[1] These point estimates of cancer risk are subject to uncertainties that are addressed in Sections 5, 6, and 7 of Appendix D. Estimates that exceed a hazard index of one are shaded.

Table 5-3

Cancer Risk Summary for Commercial Dairy Scenario Assuming Roughage Intake of Half Corn and Half Grass-Based Feed [1]

Commercial Farm Family: Dairy Consumption

RME				
Fraction of Pasture & Cornfield in the Floodplain (unitless)	**Total PCB Concentration in Pasture & Cornfield (mg/kg dw)**			
	0.5	2	10	25
0.25	8E-06	3E-05	2E-04	4E-04
0.5	2E-05	6E-05	3E-04	8E-04
0.75	2E-05	1E-04	5E-04	1E-03
1	3E-05	1E-04	6E-04	2E-03

Commercial Farm Family: Dairy Consumption

CTE				
Fraction of Pasture & Cornfield in the Floodplain (unitless)	**Total PCB Concentration in Pasture & Cornfield (mg/kg dw)**			
	0.5	2	10	25
0.25	2E-06	7E-06	4E-05	9E-05
0.5	4E-06	1E-05	7E-05	2E-04
0.75	5E-06	2E-05	1E-04	3E-04
1	7E-06	3E-05	1E-04	4E-04

[1] These point estimates of cancer risk are subject to uncertainties that are addressed in Sections 5, 6, and 7 of Appendix D. Estimates that exceed EPA's cancer risk range are shaded.

Table 5-4

Noncancer Hazard Summary for Commercial Dairy Scenario Assuming Roughage Intake of Half Corn and Half Grass-Based Feed[1]

Commercial Farm Family: Dairy Consumption

RME					
Receptor	**Fraction of Pasture & Cornfield in the Floodplain (unitless)**	**Total PCB Concentration in Pasture & Cornfield (mg/kg dw)**			
		0.5	2	10	25
Adult	0.25	0.2	0.6	3	8
	0.5	0.3	1	6	15
	0.75	0.5	2	9	23
	1	0.6	2	12	31
Child	0.25	0.7	3	14	36
	0.5	1	6	29	71
	0.75	2	9	43	110
	1	3	11	57	140

Commercial Farm Family: Dairy Consumption

CTE					
Receptor	**Fraction of Pasture & Cornfield in the Floodplain (unitless)**	**Total PCB Concentration in Pasture & Cornfield (mg/kg dw)**			
		0.5	2	10	25
Adult	0.25	0.1	0.5	3	6
	0.5	0.3	1	5	13
	0.75	0.4	2	8	19
	1	0.5	2	10	25
Child	0.25	0.4	2	9	22
	0.5	0.9	4	18	45
	0.75	1	5	27	67
	1	2	7	36	90

[1] These point estimates of cancer risk are subject to uncertainties that are addressed in Sections 5, 6, and 7 of Appendix D. Estimates that exceed a hazard index of one are shaded.

6. PROBABILISTIC RISK CHARACTERIZATION

Probabilistic risk assessments (PRAs) were performed to assess risks due to total PCB (tPCB) exposure associated with agricultural product consumption exposure pathways. The probabilistic approaches used for these analyses consisted of probability bounds analysis (PBA) and a semi-analytical method (i.e., analytical solution with discretization error) analogous to one-dimensional Monte Carlo analysis (MCA analog) performed using PBA. The latter approach is referred to in this section 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 HHRA Volume I, Attachment 5).

The agricultural product consumption PRA was conducted using 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 incorporate variability in the development of best estimates for probabilities of the risks of various magnitudes and to graphically illustrate these risks with probability distributions. The PBA was used to assess the reliability of the estimated probabilities by also accounting for sources of uncertainty such as the selection and parameterization of probability distributions, and relationships between input variables. In combination, these approaches permit the graphical illustration of the variability and uncertainty in risk estimates, and provide a convenient and comprehensive form of sensitivity analysis. Extensive guidance is available on the methodology and use of probabilistic analyses in human health risk assessments (EPA, 2001). Attachment 5 of the HHRA Volume I provides 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, significant uncertainty is expected 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 in most human health risk assessments (EPA, 2001, 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 for the agricultural 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 PBA.
- 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 discusses sources of uncertainty.

6.1 TIERED APPROACH TO PROBABILISTIC RISK ASSESSMENT

EPA guidance (EPA, 2001) 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. According to 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 agricultural product consumption 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 consumption of agricultural products was calculated using a one-dimensional MCA analog and PBA. The term "one-dimensional" refers to a probabilistic modeling approach that characterizes either variability or uncertainty, but not both. 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 both the variability and 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 uncertainty bounds on the risk distribution, for agricultural exposure scenarios. These uncertainty bounds account for uncertainty regarding the magnitudes and distributions of input variables, and for uncertainty regarding dependencies between input variables. EPA (2001, Volume 3, Part A, Chapter 3, Section 3.4) discusses the application of 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 agricultural product consumption exposure pathways are farm families and other residents who consume animal products and plants from the Housatonic River floodplain. Models were used to assess cancer risk and noncancer health hazard for adults and young children.

Each agricultural product consumption exposure pathway was evaluated under a commercial operation scenario and a backyard operation scenario in the point estimate risk assessment (see Section 5). The sources of uncertainty are virtually the same between these two types of operations. Also, at some combination of assumed tPCB soil exposure point concentrations (EPCs) and fraction of grazing and cultivation areas in the floodplain, all scenarios are associated with hazard indices greater than one or cancer risks greater than 10E-4. The tPCB soil EPCs reflect the range of concentrations measured in current and potential future agricultural areas and a range of fractions of agricultural area within the floodplain, with the exception of some residential properties (see Table 2-2). Total PCB concentrations outside this range also have been measured on some recreational properties, but no plans to convert these areas to agricultural uses in the future were identified. Agricultural areas typically do not fall entirely within the floodplain, but have a wide range of extent of floodplain use. For example, in Reach 9 one corn cultivation area is almost entirely outside of the floodplain, with a fraction of cultivated acreage in the floodplain of 0.004, while another corn cultivation area is entirely within the floodplain with a fraction of 1 (see Table 2-2).

For these reasons, probabilistic analyses were conducted only for the type of operations currently in the floodplain. These are commercial dairy, commercial poultry meat, commercial poultry eggs, commercial produce, and backyard beef. The commercial poultry scenario involves poultry with access to floodplain soil. For convenience, such poultry are referred to as “free-range” throughout this assessment.

6.2 EXPOSURE MODELS

For the second-tier analysis, exposure to tPCBs due to consumption of agricultural products was calculated using the same models for dose calculations applied in the point estimate assessment. This means that the MCA analog and PBA models were 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) were used in place of many of the point estimate inputs. The equations for calculating concentrations in agricultural products are shown in Figure 4-1 for garden produce and Figure 4-2 for animal products, and the general dose equation that incorporates agricultural product concentration estimates is provided in Section 4.6.1. Cancer risk and noncancer hazard equations are described in Section 5.

In both tiers, exposures were calculated using a noncancer and a cancer 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.

One-dimensional Monte Carlo analog analyses for cancer and noncancer calculations were performed using Risk Calc® (Ferson, 2002). All variables were assumed mutually independent because there was no quantitative information that could be used to parameterize any correlations. 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 PBAs.

6.3 RELAXING INDEPENDENCE ASSUMPTIONS

The MCA analog analysis assumed strict independence between all variables, not because this is likely, but because relevant data required to parameterize a more realistic model were not available. DBA (Ferson and Long, 1995) was used to relax the assumptions of independence made in the MCA analog analysis and explore risks under other dependency assumptions. DBA 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 the HHRA contains details regarding DBA.

The PBA and DBA incorporated relaxed independence assumptions for the following groups of variables:

Dairy, beef, poultry meat, poultry egg, or produce CRs and exposure duration. Consumption rate and exposure duration were assumed to be dependent because the amount of food eaten varies by age and the amount of homegrown food consumed depends on how long the person has lived on a commercial or backyard farm and how long they have had access to food grown on the floodplain.

Animal diet composition (soil, corn silage, grass, concentrate). The amount of one dietary item consumed by an animal dictates how much of another type the animal will eat. Each item is defined by the fraction of total diet each represents, and the sum of these fractions must equal one.

Cooking loss (CL) and post-cooking loss (PCL) for beef and poultry meat. These two variables could be correlated by cooking method and must not sum to a value greater than one.

Regional adjustment factors for garden produce (fruit and vegetable) consumption. The regional meteorology and cultural practices that dictate the type and amount of vegetables grown and consumed likely also influence the type and amount of fruit that is grown and consumed in the floodplain.

Consumption rates for exposed vegetables, exposed fruit, and root vegetables. Individuals who consume large amounts of one type of produce category likely consume large amounts of other produce categories.

Other variables were assumed to be mutually independent.

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 variability and uncertainty surrounding the probability distributions for each input in a risk assessment are expressed in terms of bounds on the cumulative distribution function. These bounds form a "p-box" for each input variable. For example, the soil-to-plant transfer factors (TFs) are expressed in the first-tier point estimate analysis as single point estimates, 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 TF could possibly be, and above by a value that is known to be as high as the TF 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 TF 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 the HHRA 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 agricultural risk assessment, these two complementary approaches are used together.

6.5 EXPOSURE ASSESSMENT FOR AGRICULTURAL PRODUCT CONSUMPTION SCENARIOS

For each variable, a precise point estimate or a probability distribution was established for the MCA analog and for the DBA. A precise point estimate, interval estimate, or p-box around the Monte Carlo input variable was established for the PBA. The selection of input variables is described below and summarized in Tables 6-1 through 6-12 for the five exposure scenarios under evaluation.

Graphical representations of the distribution of input variables used in the MCA analog and PBA are shown in Figures 6-1 through 6-53. In these figures, as well as the figures showing the cancer risk and noncancer hazard results, the vertical axis is labeled “Exceedance Probability.” This refers to the use of the complementary cumulative distribution. When a probability distribution is displayed on a complementary cumulative axis, the probabilities are read as probabilities of exceeding corresponding values on the horizontal axis. In Figure 6-5, for example, if one were to draw a horizontal line from 0.5 on the exceedance probability axis to the Monte Carlo distribution, and then read the corresponding value on the x-axis, one would read that there is a 50 percent chance that the milk fat content exceeds 4.5%.

The exposure dose was represented as the daily intake of a contaminant an individual receives by consuming agricultural products. Doses were calculated using one of two averaging times:

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

The LADDs and ADDs are expressed as administered (oral) 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).

6.5.1 General Description of Inputs

This section provides a preliminary discussion of exposure parameters common to agricultural exposure scenarios, followed by a presentation of information specific to each scenario in Sections 6.5.2 through 6.5.6.

6.5.1.1 Total PCB Exposure Point Concentration in Soil and Fraction of Agricultural Area in the Floodplain

Exposure estimates were based on tPCB soil EPCs that reflect the range measured in current and potential future agricultural areas and on a range of fractions of agricultural area within the floodplain (i.e., the 1-ppm tPCB isopleth along Reaches 5 and 6, and the 100-year floodplain along Reaches 7, 8, and 9) (see Table 2-2).

This parameter is not discussed further 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 used explicitly only in the cancer model calculations. Averaging time was set at a point estimate of 70 years (25,550 days) 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 is not discussed further in the subsequent scenario-specific discussions.

6.5.1.3 Soil-to-Plant Transfer Factors

Site-specific data were used to estimate transfer of tPCBs from soil to plants. These data are described in Section 2, and the TFs used in the MCA analog and PBA are described for each scenario below.

6.5.1.4 Animal Intake

Section 4.4.2.1 describes the rationale for animal intake estimates. These estimates were based on knowledge of local farm practices and conditions; generally accepted good feeding and management practices for each species; and adaptation of measurements, such as soil ingestion, in the scientific literature to local conditions. The highest and lowest reasonable annual average relative intake estimates for major feed components and soil (from Table 4-7) were used to define an interval of dietary intake for the PBA. The most likely point estimate values were used in the MCA analog because the range used in the PBA largely represents uncertainty about intakes within and among farms in the floodplain.

The major feed components for animals considered in this assessment include roughage and concentrates. Roughage includes corn silage and grass-based feeds grown in the floodplain. Soil ingestion was incorporated for scenarios where animals are expected to graze in the floodplain. Concentrates, such as grains and protein supplements, were assumed to have zero concentrations because these materials are not produced in the floodplain and are not expected to have contaminant concentrations above background levels.

6.5.1.5 Bioconcentration Factors

For the MCA analog, BCFs are point estimates. Some data are available to describe animal-to-animal variation in controlled experiments, but this variability is likely less than the uncertainty associated with use of BCFs from controlled studies to field conditions in the Housatonic River floodplain. The probability boxes for BCFs are defined as intervals representing a range of possible BCFs. The uncertainties in selecting a BCF include measurement error within a study, the applicability of laboratory studies to field conditions, and the applicability of BCFs developed from Aroclor exposures to the environmental mixture of PCBs in the floodplain.

6.5.1.6 Animal Product Fat Content

Total PCB concentrations for dairy, beef, and poultry meat were predicted on a fat basis. Therefore, fat content information for these animal products was needed to convert concentrations to a whole food equivalent. Data from the U.S. Department of Agriculture (USDA) were consulted for each of these animal products. Sufficient data were available to define dairy fat with a lognormal distribution for the MCA analog and an empirical distribution for the PBA. Beef and poultry fat content data were available across a wide range of meat cuts and cooking methods. Beef fat content and poultry fat content both were defined as triangular distributions for the MCA analog and as intervals for the PBA. Total PCB concentrations for eggs and produce were defined on a whole food basis; therefore, fat content data were not needed for these products.

6.5.1.7 Food Consumption Rates

The home-produced food consumption rates (CR) data from EPA's analyses of the 1987-1988 U.S. Department of Agriculture (USDA) Nationwide Food Consumption Survey (NFCS) (EPA, 1997) that were described and used in the point estimate calculations (see Section 4.6.2.2) were also used (as distributions rather than point estimates) in the MCA analog and PBA.

6.5.1.7.1 Derivation of Food Consumption Rates for the MCA Analog

For the MCA analog, age-specific CRs were used to assess animal product and home garden exposure pathways. Age-weighted CRs were calculated for adults and children separately at each percentile. For adults, CRs for the 6-11, 12-19, 20-39, 40-69, and 70+ age groups were weighted by the number of years within each age group and averaged over a 64-year exposure duration (see Section 4.6.2.7), as shown below.

$$CR_{adult} = \frac{\left(5\,\text{years}*\text{CR}_{\text{ages }6-11} + 8\,\text{years}*\text{CR}_{\text{ages }12-19} + 20\,\text{years}*\text{CR}_{\text{ages }20-39} + 30\,\text{years}*\text{CR}_{\text{ages }40-69} + 1\,\text{year}*\text{CR}_{\text{age }70+}\right)}{ED_{adult}}$$

Similarly, to derive child CRs, CRs for the 1-2, 3-5, and 6-11 age groups were weighted by the number of years in each category and averaged over a 6-year child exposure duration, as shown below.

$$CR_{child} = \left(\frac{2\,years*CR_{ages\,1-2} + 3\,years*CR_{ages\,3-5} + 1\,year*CR_{ages\,6-11}}{ED_{child}}\right)$$

To calculate CRs for cancer risk estimates, CRs for all age groups were weighted by the number of years within each age group and averaged over a 70-year exposure duration.

When consumption data were not available for a particular age group (i.e., there were less than 20 observations for that subpopulation), a CR was extrapolated by multiplying home-produced consumption data for a 20-39 year old by a ratio of general population per capita consumption data for the age group of interest and the 20-39 age group. These general population per capita rates were obtained from the 1989-1991 Continuing Survey of Food Intake by Individuals (CSFII) data (EPA, 1997). A ratio was calculated in reference to the 20-39 age group because home-produced data were available for all animal product and home garden items for that age group. This extrapolation approach assumes that the CR ratios between age groups are similar for the general population (on a per capita basis) and the subset of this population that consumes home-produced foods (consumers only). This approach could not be used to extrapolate an exposed-fruit CR for the 1 to 2-year-old age group because there were no per capita data. Therefore, the home-produced exposed-fruit CRs for the 3 to 5 age group were used for the 1 to 2 age group.

General population per capita CRs for some animal products at a few percentiles were zero for the 20-39 age group. In these cases, CRs for these percentiles could not be extrapolated for use in the MCA analog and PBA. Specifically, the 1st percentile was excluded from the CR distributions for dairy and poultry meat. For beef, the 1st and 5th percentiles were excluded from the distribution and for eggs, the 1st, 5th, 10th, 25th, and 50th percentiles were excluded from the distribution. These exposures are at the lower end of the CR distributions, which is of less concern in making risk management decisions than the middle and upper end of the CR distributions.

Occasionally, an extrapolated 95th percentile or 99th percentile exceeded the reported 100th percentile, or maximum, CR. In these cases, the 100th percentile was set equal to the extrapolated lower percentile. The percentile data used for each agricultural product are summarized below:

- Dairy and beef – Adult: 10th through 99th percentile (substituting 99th percentile as value for 100th percentile).
- Dairy – Child: 5th through 95th percentile (substituting 95th percentile as value for 100th percentile).
- Beef – Child: 10th through 99th percentile (substituting 99th percentile as value for 100th percentile).
- Poultry meat – Adult: 5th through 100th percentile.
- Poultry meat – Child: 25th through 100th percentile.
- Poultry eggs- Adult and Child: 75th through 99th percentile (using 99th percentile as value for 100th percentile).
- Exposed fruit, exposed vegetables, and root vegetables – Adult and Child: 1st through 100th percentile.

6.5.1.7.2 Derivation of Food Consumption Rates for PBA

For the PBA, the CR distributions (for all but poultry eggs) were specified using the minimum, maximum, and intervals at the 25th, 50th, and 75th percentiles. Intervals were used at the percentiles to account for measurement error in the underlying CR database. The minimum CR for all agricultural products was set equal to zero. The maximum was calculated as the maximum CR across all percentiles and age groups within a particular age group (adult, teen or child). Intervals at each percentile were calculated from the minimum and maximum values within a particular age group. For poultry eggs, home-produced data were only available for two adult age groups and per capita data were only available for the 75th percentile and above. Therefore, the poultry egg CR p-box was defined only by a minimum, mean, and maximum.

As in the MCA analog, some CRs were extrapolated. In the PBA, uncertainty associated with this extrapolation was accounted for by multiplying CRs by an uncertainty factor (UE). A separate UE was developed for the young child, teen, and adult age groups. UE distributions were estimated separately for the young child, teen, and adult by calculating a ratio of the home-produced CR (CR_{HP}) to the home-produced CR extrapolated from per capita data ($CR_{HP-Extr}$) for all age groups for which home-produced and per capita data were available. These ratios were grouped for adult, teen, and child across all agricultural products to provide a large enough sample size to estimate distributions for UE. This approach assumes that the extrapolation error for different agricultural product CRs has the same distribution. A Visual Basic macro was used to calculate the ratios of CR_{HP} to $CR_{HP-Extr}$ using all available data, and these ratios were fitted to lognormal distributions. The result of multiplying CRs by UEs was truncated at the applicable maximum observed CR in the per capita or home-produced food consumer populations. The per capita data represent a large sample, and the maximum from these data is likely to be a reasonable upper-bound CR, assuming, as is likely, that consumers of home-produced food are on the upper end of the per capita distribution. Data for consumption of home-produced food were available at all percentiles for all age groups and produce categories except for the 1- to 2-year-old child consuming exposed fruit. Because of the minimal need for extrapolation, produce CRs were not adjusted with UE.

6.5.1.8 Cooking Loss and Post-Cooking Loss

Cooking loss, post-cooking loss, and preparation loss data from Table 1 in the USDA publication entitled *Food Yields Summarized by Different Stages of Preparation* (USDA, 1975) were used to define the distributions for cooking loss and post-cooking loss in the MCA analog and PBA. This publication is the source for the mean net cooking loss, mean net post-cooking loss, and mean paring or preparation loss (for fruits) values reported for meats, fruits, and vegetables in EPA, 1997 (Tables 13-5 through 13-7).

6.5.1.9 Exposure Frequency

Exposure frequency reflects the number of days per year that a person may be exposed to contaminants via ingestion of home-produced foods. Assuming a typical vacation period of 2 weeks, a point estimate exposure frequency of 350 days per year was assumed for both the MCA analog and PBA.

This parameter will not be discussed in the subsequent scenario-specific discussions.

6.5.1.10 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.

6.5.2 Commercial Dairy Scenario

6.5.2.1 Soil-to-Corn Silage Transfer Factor

As discussed in Section 4.3.3.2, results from site-specific corn samples were used to estimate soil-to-corn silage transfer factors (TFs) (for discussion of corn data, see Section 2.3.3). Corn stalks and ears were analyzed for tPCBs only, which were detected in 5 out of 10 corn stalk samples. The five detected corn stalk samples were used to estimate tPCB soil-to-corn stalk TFs. Because the corn ears are a protected portion of the silage, as evidenced by no detected concentrations in ears, and corn ears contribute about 50% of the dry matter weight of corn silage (Genter et al., 1970), the soil-to-corn stalk TFs were reduced by ½ to represent soil-to-corn silage TFs. The soil-to-corn silage TF used for the point estimates was used in the MCA analog because insufficient data were available to quantitatively describe variability for this input. The minimum and maximum site-specific soil-to-corn silage TFs were used to construct an interval for the PBA. This p-box was selected because site-specific TFs better indicate the potential for transfer than non-site-specific data, and site-specific data span the range of TFs reported in the literature for corn under field conditions. Figure 6-1 shows the soil-to-corn silage TF input distributions used in the MCA analog (gray line) and PBA (black line).

6.5.2.2 Animal Intake

Lactating cows are not pastured on any of the commercial farms in the Housatonic River floodplain at this time. Thus, there is no ingestion of floodplain soil. In the MCA analog, the roughage portion of the diet was assumed to consist primarily of corn silage (55%), with the remaining fraction of the diet consisting of concentrate that is assumed to be grown outside of the floodplain. In the PBA, the roughage portion of the diet is assumed to consist of 50% to 60% corn silage, with the remaining fraction of the diet consisting of concentrate. Figures 6-2 and 6-3 show the input distributions for proportions of corn silage and concentrate in the diet used in the MCA analog and PBA.

Use of these two inputs (i.e., an interval of [0.5, 0.6] and an interval of 1-[0.5, 0.6]) introduces a repeated parameter that might result in an overestimate of uncertainty. However, the influence of this repeated parameter is small, as described in Section 6.7.1, and sensitivity analyses indicate that the dietary component variables account for only about 9% of the uncertainty and variability in the PBA cancer risk and hazard estimates for the commercial dairy scenario (see Section 6.7).

6.5.2.3 BCF

For the MCA analog, a mammalian BCF of 3.4 was used, which is the mean of applicable values from the literature. The probability box for the mammalian BCF is defined as the range of these applicable BCFs, which are based on cattle exposures to Aroclor 1254 (Fries, 1996a). Because BCFs are defined on the basis of concentration in the total diet, this range of BCFs (3 to 3.6) was selected from studies in which the dietary concentration for the test animals was in the range of dietary concentrations predicted in this assessment (i.e., <1 ppm PCBs). The range of experimental BCFs for Aroclor 1254 is a reasonable surrogate for the tPCB mixture in the floodplain, which most closely resembles Aroclor 1260, assuming that the following two factors influence bioaccumulation approximately equally:

1. Aroclor 1260 is absorbed to a lesser extent than Aroclor 1254, which has a lower K_{ow} (see Figure 4-5), and

2. Aroclor 1254 contains a higher proportion of congeners that are metabolized.

Figure 6-4 shows the mammalian BCF input distributions used in the MCA analog and PBA.

6.5.2.4 Dairy Fat Content

Jersey cows, which have higher butterfat content in their milk than Holsteins, are raised by one Reach 5 dairy farmer; the increased fat content leads to higher risk estimates. The whole milk fat content for "Elite" and "High Rank" cows was obtained from the USDA Animal Improvement Programs Laboratory (AIPL) website (www.aipl.arsusda.gov) and used to define distributions of milk fat content for the MCA analog and PBA. Figure 6-5 shows the milk fat content input distributions used in the MCA analog and PBA. The data fit a lognormal distribution slightly better than a normal distribution.

The fat content of milk from an individual cow can vary depending on such factors as genetics, stage of lactation, and dietary regime, although these factors tend to equalize in a large herd. Fat content measurements for herds can vary depending on how the milk is collected and mixed. The fat content is usually standardized if a single producer processes and sells milk.

The USDA Animal Improvement Programs Laboratory (AIPL) maintains dairy cattle statistics, including whole milk fat content. Lists of Elite and High Rank cows provide data on the fat content of milk of individual cows in 200-animal sets, subdivided into 10 20-animal sets, which are suitable for determining variation in the fat percent of breeds raised in the floodplain (Wiggans, G., personal communication, 2004). Elite cows are those registered with the respective breed associations whereas High Rank cows are those that are not registered. The High Rank cows may be ineligible for registration because they are not purebred or the farmer may have chosen not to go through the effort and expense of registration of an eligible animal. Every 20th animal in the Elite and High Rank cow list was selected to represent a random sample of data from diverse sources (i.e., farms) that had been collected under similar conditions. Although these cows are among the top producers of the respective breeds, the average fat concentrations were similar to the breed averages in the *USDA Summary of Herd Averages* (Table 2) listed elsewhere on the website.

6.5.2.5 Dairy Consumption Rates

The dairy CRs were derived as described in Section 6.5.1.7 and are shown in Figures 6-6, 6-7, and 6-8. In the PBA, these CRs were multiplied by UE inputs to account for extrapolation uncertainty. The UE inputs for the adult, teen, and young child are shown in Figures 6-9, 6-10, and 6-11, respectively.

6.5.2.6 Exposure Duration

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. Uniform distributions were used in the MCA analog, and intervals were used in the PBA because insufficient data are available to refine these assumptions.

The adult ED distributions for backyard farm families were derived from the MDPH *PCB Exposure Assessment Study* (MDPH, 2001) of 1,882 individuals living in the Housatonic River Area. The MDPH study is directly applicable to the resident (i.e., backyard farm) scenarios. The data fit an exponential distribution reasonably well, and this distribution is often used to describe events occurring at random over 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.

MDPH (2001) does not provide data specific to farm families. In the point estimate risk assessment, the ED for the farm family (i.e., CTE = 30 years, RME = 70 years) was assumed to be greater than the ED for the resident (i.e., CTE = 15 years, RME = 45 years) because some farms in the Housatonic River floodplain are multigenerational (Noble, 2002). Therefore, the distribution for years living at a single residence from the MDPH study was modified to estimate an ED distribution specific to farm families, who likely represent the upper-end of the distribution for years living at a single residence. Finley et al. (1994) reported distributions for residential occupancy period for different subpopulations, including residents who own their homes, and farmers. These distributions are based on data from Israeli and Nelson (1992). The mean resident ED from MDPH (2001) was adjusted upward so that the 95^{th} percentile of the ED distribution matched the 95^{th} percentile reported in Finley et al. (1994) for farmers.

The minimum, maximum, and 95% confidence intervals around the mean were used to form a p-box for exposure duration. Confidence intervals for the mean were calculated using the central limit theorem method. Figure 6-12 shows the farmer ED and resident ED input distributions used in the cancer model.

6.5.3 Backyard Beef Scenario

6.5.3.1 Soil-to-Grass-Based Feed Transfer Factor

As discussed in Section 4.3.3.1 and shown in Table 4-4, soil-to-grass TFs were calculated from site-specific soil and grass data pairs. The soil-to-grass TF used for the point estimate risk assessment was used in the MCA analog because insufficient data were available to quantitatively describe variability for this parameter. The minimum and maximum site-specific soil-to-grass TFs were used to construct an interval for the PBA. This p-box was selected because site-specific TFs better indicate the potential for transfer than non-site-specific data, and site-specific data span the range of TFs reported in the literature for grass under field conditions. Figure 6-13 shows the soil-to-grass TF input distributions used in the MCA analog and PBA.

6.5.3.2 Animal Intake

Concentrates and corn silage are less likely to be fed to backyard animals, and the greater dependence on grass-based feed could enhance the level of contaminant intake. When the animals are not on pasture, roughage is assumed to consist of hay from the backyard farm. In the MCA analog, the roughage portion of the diet is assumed to consist primarily of grass (98%), with the remaining fraction of the diet consisting of soil ingestion as a result of grazing in the floodplain. In the PBA, it was assumed that the diet of backyard beef cattle consists of 97% to 99% grass-based feed (pasture grass, hay, or other grass-based feed), with the remaining fraction of the diet consisting of soil ingestion. Figures 6-14 and 6-15 show the input distributions for proportion of corn silage and concentrate in the diet used in the MCA analog and PBA.

6.5.3.3 BCF

The mammalian BCF used for the backyard beef scenario is identical to that used for the commercial dairy scenario for the reasons discussed in Section 4.4.1.2. The MCA analog and PBA BCF inputs are described in Section 6.5.2.3 and shown in Figure 6-4.

6.5.3.4 Bioavailability from Soil Relative to Feed

The mammalian BCF used for tPCBs in this assessment is derived from studies that involve animal exposure to contamination in feed. Use of these BCFs to assess soil exposures might overestimate accumulation because tPCBs might be less bioavailable from soil than from feed. Fries and Paustenbach (1990) reviewed the literature regarding TCDD bioavailability from soil and found bioavailability factors ranging from 0.3 to 0.4. Most studies reviewed by Fries and Paustenbach (1990) involved TCDD in corn oil as a positive control because of the high absorption efficiency. They reported bioavailability factors of 0.5 to 0.6 for rat exposure to TCDD in corn oil. Fewer studies were available involving cattle, reporting bioavailability factors of about 0.5.

The bioavailability from soil relative to feed is simply the ratio of bioavailability from soil (i.e., 0.3 to 0.4) to the bioavailability from feed (i.e., 0.5 to 0.6), which ranges from 0.5 to 0.8 for TCDD. Comparable data are not available for tPCBs. However, because tPCBs and TCDD fall into the same category of relatively persistent, organic, lipophilic compounds, this reduced bioavailability from soil relative to feed would also be expected to occur with tPCBs. Therefore, tPCB soil bioavailability relative to feed was assumed to be between 0.65 and 1 for the PBA. This slightly higher range was chosen due to the uncertainty in extrapolating results from TCDD to the tPCB mixture in the floodplain. The soil bioavailability input was set to 1 in the MCA analog because insufficient data are available for tPCBs to define variability in this value or to define a different “best estimate” value. Figure 6-16 shows the soil bioavailability input distributions used in the MCA analog and PBA.

6.5.3.5 Beef Fat Content

Ranges of total lipid content for select beef products were obtained from the United States Department of Agriculture Agricultural Research Service (USDA ARS) National Nutrient Database for Standard Reference (USDA ARS, 2004). The database is a compilation of published and unpublished data from the food industry, other government agencies, and from research conducted under contracts initiated by USDA ARS. An abbreviated version of the complete database, which summarizes all individual studies by reporting average total lipid content per food product (i.e., beef), was used to determine beef fat content. Total lipid values were reported in grams based on a 100-gram edible portion of cooked meat. Beef was subdivided into the following categories: 75-95% lean ground beef, lean only, and lean and fat. The last two categories included fat trim cuts of 0, $^{1}/_{8}$, ¼, and ½ inch.

The beef fat content input was defined as a triangular distribution in the MCA analog and as an interval for the PBA. The minimum beef fat content (3.9%) represents beef, lean only, trimmed to 0-inch fat, reported to 2 significant figures. The maximum beef fat content (38%) represents beef, separable lean and fat, trimmed to ½-inch fat, reported to 2 significant figures. Data were also available for ground beef, but the range of lipid content for ground beef is within the range of 3.9 to 38%. The mean beef fat content used in the MCA analog (9.9%) is the lipid content of cooked beef, lean and fat, trimmed to ¼ -inch fat (see Table 11-24 in EPA, 1997). Figure 6-17 shows the beef fat content input distributions used in the MCA analog and PBA.

6.5.3.6 Beef Consumption Rates

The beef CRs were derived as described in Section 6.5.1.7 and are shown in Figures 6-18, 6-19, and 6-20. In the PBA, these CRs were multiplied by UE inputs to account for extrapolation uncertainty. The UE inputs for the adult, teen, and young child are shown in Figures 6-9, 6-10, and 6-11, respectively.

6.5.3.7 Preparation and Cooking Loss

Cooking loss and post-cooking loss were defined with triangular distributions in the MCA analog and with intervals in the PBA. The minimum and maximum cooking loss and post-cooking loss values were taken from USDA (1975). The mean cooking and post-cooking losses used in the MCA analog are mean net losses for beef from EPA, 1997. Figures 6-21 and 6-22 show the beef cooking loss and post-cooking loss input distributions used in the MCA analog and PBA.

6.5.3.8 Exposure Duration

The ED distribution for backyard farm families described in Section 6.5.2.6 was used for the backyard beef scenario.

6.5.4 Commercial Poultry Meat Scenario

6.5.4.1 Animal Intake

In the MCA analog it was assumed that ingestion of soil by free-range poultry corresponded to 9% of the diet, with the remaining fraction of the diet consisting of concentrate, which is assumed to be grown outside of the floodplain. In the PBA, it was assumed that ingestion of soil by free-range poultry corresponded to 8% to 12% of the diet, with the remaining fraction of the diet consisting of concentrate. Figures 6-23 and 6-24 show the input distributions for the proportion of soil and concentrate in the diet used in the MCA analog and PBA.

6.5.4.2 BCF

For the MCA analog, a point estimate tPCB BCF of 2.5 was used. The p-box for the poultry adipose tissue BCF is defined as an interval from 2.5 to 4.7. The BCF at the lower end of this interval is the mean of measured BCFs for dioxin-like PCB congeners from a recent study by Hoogenboom et al (2004). The dioxin-like congeners consist of the non-ortho and mono-ortho PCBs that have chlorines in the 4,4' positions. This substitution pattern leads to persistence. Some of the indicator PCB congeners for which Hoogenboom et al. (2004) provide BCFs, notably PCB-52 and PCB-101, do not have chlorines in the 4,4' positions which makes them more readily metabolized. Their resistance to metabolism makes the non-ortho and mono-ortho congeners better surrogates for the highly chlorinated Aroclor 1260 than the indicator congeners that are metabolized. The exposure period in the Hoogenboom et al. (2004) study was 4 weeks, which approximates, but might be shorter than, the exposure time on free-range poultry farms. The application of the Hoogenboom et al. (2004) data in evaluating longer exposure periods is based on the assumption that poultry reached steady state at the end of 4 weeks, reaching a stable BCF because the body fat pool increases proportionately with accumulated feed intake (Fries, 1996b). The upper-end BCF is the mean of poultry adipose BCFs for Aroclor 1254 and Aroclor 1268 from Fries et al., 1977. The exposure period in the Fries et al. study was 9 weeks.

Figure 6-25 shows the poultry adipose tissue BCF input distributions used in the MCA analog and PBA.

6.5.4.3 Bioavailability from Soil Relative to Feed

The poultry meat BCF used for tPCBs in this assessment is derived from studies that involve animal exposure to contamination in feed. Therefore, the potential reduced bioavailability from soil relative to feed was quantified as described in Section 6.5.3.4 and shown in Figure 6-16.

6.5.4.4 Poultry Meat Fat Content

Ranges of total lipid content for selected poultry products were obtained from the USDA ARS National Nutrient Database for Standard Reference (USDA ARS, 2004). An abbreviated version of the complete database, which summarizes all individual studies by reporting average total lipid content per food product, was used to determine poultry fat content. Total lipid values were reported in grams based on a 100-gram edible portion of cooked meat. Poultry records were separated into chicken and turkey categories. Each group was further subdivided into meat only or meat and skin.

The poultry fat content input was defined with a triangular distribution in the MCA analog and an interval for the PBA. The minimum poultry fat content value corresponds to chicken (meat only) and the maximum value corresponds to chicken meat and skin, reported to two significant figures. The mean poultry fat content used in the MCA analog (7.4%) is the lipid content of cooked chicken meat from EPA (Table 11-24, 1997), which was used in the point estimate calculations. Figure 6-26 shows the poultry meat fat content input distributions used in the MCA analog and PBA.

6.5.4.5 Poultry Meat Consumption Rates

The poultry meat CRs were derived as described in Section 6.5.1.7 and are shown in Figures 6-27, 6-28, and 6-29. In the PBA, these CRs were multiplied by UE inputs to account for extrapolation uncertainty. The UE inputs for the adult, teen, and young child are shown in Figures 6-9, 6-10, and 6-11, respectively.

6.5.4.6 Preparation and Cooking Loss

Cooking loss and post-cooking loss were defined with triangular distributions in the MCA analog and with intervals in the PBA. The minimum and maximum cooking loss and post-cooking loss values were taken from USDA (1975). The mean cooking and post-cooking losses used in the MCA analog are mean net losses for poultry from EPA (1997, Table 13-5). Figures 6-30 and 6-31 show the poultry meat cooking loss and post-cooking loss input distributions used in the MCA analog and PBA.

6.5.4.7 Exposure Duration

The ED distribution for commercial farm families described in Section 6.5.2.6 was used for the commercial poultry meat scenario.

6.5.5 Commercial Poultry Egg Scenario

6.5.5.1 BCF

For the MCA analog, a point estimate tPCB BCF of 0.9 was used. The BCF p-box for whole eggs is an interval of 0.57 to 1.1 from Fries et al., 1977. These values are the range of BCFs for Aroclor 1254 and 1268 calculated from a 9-week feeding study of White Leghorn hens. Figure 6-32 shows the poultry egg BCF input distributions used in the MCA analog and PBA.

6.5.5.2 Bioavailability from Soil Relative to Feed

The poultry egg BCF used for tPCBs in this assessment is derived from studies that involve animal exposure to contamination in feed. Therefore, the potential reduced bioavailability from soil relative to feed was quantified as described in Section 6.5.3.4 and shown in Figure 6-16.

6.5.5.3 Poultry Consumption Rates

The poultry egg CRs were derived as described in Section 6.5.1.7 and are shown in Figures 6-33, 6-34, and 6-35. In the PBA, these CRs were multiplied by UE inputs to account for extrapolation uncertainty. The UE inputs for the adult, teen, and young child are shown in Figures 6-9, 6-10, and 6-11, respectively.

6.5.5.4 Preparation and Cooking Loss for Poultry

For poultry eggs, the minimum cooking loss is zero, as assumed in the point estimate. The maximum loss rate is due to discarding shells or from cooking (Table 1 in USDA, 1975). The minimum and maximum loss rates were used to define a uniform distribution for the MCA analog and an interval for the PBA. Figure 6-36 shows the egg cooking loss input distributions used in the MCA analog and PBA. Post-cooking loss is not evaluated for poultry eggs.

6.5.5.5 Exposure Duration

The ED distribution for commercial farm families described in Section 6.5.2.6 was used for the commercial poultry egg scenario.

6.5.6 Commercial Produce Scenario

6.5.6.1 Transfer Factors

The soil-to-exposed vegetable, soil-to-exposed fruit, and soil-to-root vegetable TFs used in the point estimate risk calculations were used in the MCA analog. Intervals were used to define the distribution of soil-to-produce TFs for the PBA of the home garden scenario. All TFs for these garden produce categories are expressed on a wet-weight plant to dry-weight soil basis.

6.5.6.1.1 Soil-to-Exposed Vegetable Transfer Factor

In the MCA analog, the maximum transfer factor (TF) was used. This is the same value for TF that was used in the point estimate risk assessment and was used in the MCA analog because insufficient information was available to define variability for this parameter. In the PBA, an interval was defined ranging from the minimum to the maximum site-specific TF relevant to this produce category (see Table 4-4), including unwashed corn stalk, beet leaf, and turnip leaf TFs. The minimum TF (0.00017) is for Aroclor 1260 in turnip leaves (washed) as reported in Sawhney and Hankin (1984). The maximum TF (0.0018) was calculated from site-specific soil and unwashed corn stalk data. This range encompasses tPCB TFs from the literature that might be applicable to this category (see Table 4-5). Figure 6-37 shows the soil-to-exposed vegetable TF input distributions used in the MCA analog and PBA.

6.5.6.1.2 Soil-to-Root Vegetable Transfer Factor

In the MCA analog, a point estimate value of 0.0003, the TF for Aroclor 1260 in beet roots (washed), was used. This is the same value that was used in the point estimate risk assessment and was used in the MCA analog because insufficient information was available to define variability for this TF. In the PBA, an interval was defined ranging from the minimum to the maximum site-specific TF relevant to this produce category (see Table 4-4), including beet root, turnip root, and carrot root TFs (Sawhney and Hankin, 1984, Iwata et al., 1974). The minimum TF (0.00011) is for Aroclor 1260 in turnip roots (washed) as reported in Sawhney and Hankin (1984). The maximum TF (0.04) is from the Iwata et al. study of unpeeled carrots. This range encompasses tPCB TFs from the literature that might be applicable to this category (see Table 4-5). Figure 6-38 shows the soil-to-exposed vegetable TF input distributions used in the MCA analog and PBA.

6.5.6.1.3 Soil-to-Exposed Fruit Transfer Factor

Site-specific data were not available for exposed fruits. One field study by Chaney et al. (1996) reported a “garden fruit” TF, however the study was based on plants grown in soil on which PCB-contaminated biosolids were applied, and the TFs were calculated using an unpeeled carrot uptake slope. Therefore, as was done in the point estimate risk assessment, the soil-to-exposed vegetable

TFs were used to evaluate uptake from soil to exposed fruit. Figure 6-39 shows the soil-to-exposed vegetable TF input distributions used for exposed fruits in the MCA analog and PBA.

6.5.6.2 Consumption Rates

The produce CRs were derived as described in Section 6.5.1.7 and adjusted to account for regional gardening practices**.** Age-specific Northeast Region CR percentiles are available for "total fruits" and "total vegetables," but these rates are not seasonally adjusted. Seasonally adjusted CR percentiles for the Northeast are available for "total vegetables" and "total fruits;" however, these rates are not necessarily limited to households that garden and are not available for different age ranges. Therefore, adjustment factors (AFs) were estimated to adjust age-specific CRs for the three produce categories to reflect consumption patterns in the Northeast Region. These factors were estimated by calculating the ratio between non-age-specific "total vegetable" and "total fruit" CRs that are not adjusted for region or season with non-age-specific "total vegetable" and "total fruit" CRs for the Northeast Region that are seasonally adjusted. For the MCA analog, the mean ratios for fruit (AF.fruit = 0.07) and vegetables (AF.veg = 0.3) were used as a regional adjustment factors for the produce CRs. For the PBA, ratios were calculated for each percentile in the distributions of "total vegetable" and "total fruit" CRs adjusted and unadjusted for region, and were used to define a regression between the adjusted and unadjusted CRs. Figures 6-40 and 6-41 show input distributions of the regional adjustment factors for fruit and vegetables used in the MCA analog and PBA.

Figures 6-42 to 6-50 show CRs for adult farmers, adult residents, and young children consuming the three produce categories.

6.5.6.3 Preparation and Cooking Loss for Produce

This assessment accounts for cooking loss for vegetables and paring and preparation losses for exposed fruit. Cooking loss and preparation loss were defined as triangular distributions in the MCA analog with the minimum, maximum, and mode equal to the mean. Cooking loss and preparation loss were defined as intervals in the PBA with the minimum and maximum. Figures 6-51, 6-52, and 6-53 show the cooking loss input distributions used in the MCA analog and PBA for exposed vegetables, root vegetables, and exposed fruit, respectively. Post-cooking loss is not evaluated for home garden produce.

6.5.6.3.1 Exposed Vegetables

Cooking loss for exposed vegetables was defined using the range and mean values for exposed vegetables reported by EPA (1997, Table 13-7). The mean was used to represent the mode of the triangular distribution for the MCA analog and the p-box for the PBA.

6.5.6.3.2 Root Vegetables

Cooking loss for root vegetables was defined with the range and mean values for root vegetables (i.e., beets, onions, and carrots) reported by EPA (1997, Table 13-7). The mean was used to represent the mode of the triangular distribution for the MCA analog.

6.5.6.3.3 Exposed Fruit

Paring and preparation loss for exposed fruit was defined with the range and mean values for exposed fruits reported by EPA (1997, Table 13-6), which include losses from removal of drained liquids from canned or frozen forms of fruit. These losses were included in the estimate of losses for exposed fruit because farm families and residents could freeze and preserve/can homegrown garden produce. The mean was used to represent the mode of the triangular distribution for the MCA analog.

6.5.6.4 Exposure Duration

The ED distribution for commercial farm families described in Section 6.5.2.6 was used for the commercial produce scenario.

6.6 RISK CHARACTERIZATION FOR tPCBs

Tables 6-13 through 6-22 show the PBA, MCA analog, and DBA cancer risk and noncancer hazard estimates for tPCBs for all agricultural scenarios. The results of a PBA for PCB-126 for the commercial dairy scenario are shown in Addendum 6.1. This example was chosen because

PCB-126 is the primary contributor to dioxin-like PCB congener cancer risk (see Section 7) and commercial dairy is a current scenario in the Housatonic River floodplain.

Cancer risk and noncancer hazard estimates are presented in matrix format (Table 6-13 through Table 6-22) for different combinations of tPCB EPCs in floodplain soil and fractions of cultivated land or pasture in the floodplain. A separate matrix is provided for each agricultural scenario, with cancer risk and noncancer hazard estimates reported for four tPCB soil EPCs (0.5, 2, 10, and 25 mg/kg) and four fractions of cultivated fields and pastures in the floodplain (0.25, 0.5, 0.75, and 1.0), for a total of 16 combinations of the two factors. The 2 mg/kg concentration is the cleanup level established for residential properties. With the exception of some residential properties along Reaches 5 and 7, the 25 mg/kg concentration reflects the highest tPCB EPC in the floodplain on parcels where agricultural activities occur now or might occur in the future (see Table 2-2). Using these matrices, risk can be estimated for each agricultural scenario for various combinations of tPCB soil EPCs and fractions of farmland for a parcel of interest in the floodplain. An underlying assumption of this approach is that the tPCB concentration in farm soil outside the floodplain is zero. This assumption is likely to underestimate risk slightly, depending upon site-specific background concentrations of tPCBs.

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, the 90^{th}, 95^{th}, and 99^{th}, in this RME range are presented.

6.6.1 Cancer Risks for Agricultural 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.

Cancer risks are shown by selected percentiles. Each cell shows the results of the MCA analog analysis (MCA), dependency bounds analysis (DBA, in brackets), and probability bounds analysis (PBA, in brackets). The DBA indicates the range of possible cancer risk values given any of the possible dependencies between variables in the risk model (see Section 6.3). 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 6-54, 6-57, 6-60, 6-63, and 6-66 show the cancer risks from tPCBs in cumulative exceedance form for the agricultural 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. Volume IV, Appendix C, Section 8, Figure 8-1 and accompanying text provide 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. 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 Agricultural 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. HIs are shown for selected percentiles. Each cell shows the results of the MCA analog (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 6-55, 6-56, 6-58, 6-59, 6-61, 6-62, 6-64, 6-65, 6-67, and 6-68 show HI distributions for the agricultural exposure scenarios.

6.7 SENSITIVITY ANALYSES

Analyses of the sensitivity of the results to variability and uncertainty in the MCA analog and PBA model inputs are presented below for agricultural product exposure scenarios. 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, 2001, Appendix A) and Attachment 5 of the HHRA include more-detailed discussions of sensitivity analyses.

For the PBA, to determine the effect of uncertainty in a variable on the overall uncertainty in the model, each variable containing uncertainty was "pinched," in turn, to the same probability distribution used in the Monte Carlo 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 PBA contain both variability (i.e., the shape of the distribution is specified, and the parameters may or may not contain uncertainty) and uncertainty, each variable in the PBA was next replaced, in turn, by a point estimate (the arithmetic mean of probability distributions and p-boxes, the point estimate analysis value for intervals), 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 the 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 6-23 through 6-25 for the cancer model, adult noncancer model, and child noncancer model, respectively. Sensitivity analyses were conducted assuming a tPCB concentration of 2 mg/kg in soil and all of the animal feed is grown in the floodplain (fraction = 1). The contribution of each variable to uncertainty is expressed as a percentage, 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.

6.7.1 Commercial Dairy

The soil-to-corn silage TF is the major contributor to variability and uncertainty in both cancer and child noncancer results, followed by the CR. For the adult noncancer model, the adult CR contributes most to uncertainty of the adult HI and the soil-to-corn silage TF is the most important variable contributing to uncertainty and variability of the adult HI. The input values used for the soil-to-corn silage TF and fraction of corn silage and concentrate in the diet are the same for the MCA analog and the point estimate, therefore, the percent contribution to uncertainty is the same when pinching these input variables singly to either a precise probability distribution (i.e., remove uncertainty) or to a point estimate (i.e., remove uncertainty and variability). Exposure duration is also a major contributor to uncertainty and variability in the cancer model.

In the cancer model, the adult farmer dairy CR contributes more to uncertainty and variability than uncertainty alone. However, in the adult noncancer model, the converse is true (i.e., the CR contributes more to uncertainty). The adult farmer dairy CR for the cancer model is a “mixture” of the child and adult CR distributions; therefore, there is likely to be more uncertainty and variability in the cancer model results.

In all animal product scenarios, the fractions of food items in the diet are defined as an interval and 1-interval, thereby introducing a repeated parameter into the Risk Calc script. To test the influence of the repeated parameter for the commercial dairy scenario, the area between the lower and upper probability bounds of the “concentration in food” (e.g., C_{food}.dairy) variable when D.cornsilage and D.concentrate were specified as intervals (4.5E-04) was compared to the area of the p-bounds when they were set equal to central tendency point estimates (4.0E-04). Based on this comparison (10% difference), it was determined that specifying an interval and 1-interval did not greatly overestimate the uncertainty and thus was an acceptable way to define the feed intake variables. Results of the sensitivity analyses shown in Tables 6-23 through 6-25 indicate that the dietary component variables account for about 9% of the uncertainty and variability in the p-bounds risk and hazard estimates for the commercial dairy scenario.

6.7.2 Backyard Beef

ED contributes the most to uncertainty and variability in the backyard beef cancer model, followed by beef fat content, soil-to-grass TF, and the adult beef CR. The primary contributor to uncertainty alone in the cancer model is the beef fat content, followed by the soil-to-grass TF, ED, and adult beef CR. For the adult and child noncancer models, the beef fat content, beef CR and soil-to-grass TF are the top three contributors to uncertainty and variability. The beef CR contributes more than the soil-to-grass TF to the uncertainty and variability for the child noncancer HI, whereas the soil-to-grass TF contributes more than the CR for the adult noncancer HI. The input values used for the soil-to-grass TF, fraction of grass and soil in the diet and soil bioavailability are the same for the MCA analog and the point estimate; therefore, the percent contribution to uncertainty is the same when pinching these input variables singly to either a precise probability distribution (i.e., remove uncertainty) or to a point estimate (i.e., remove uncertainty and variability).

As noted above, the beef fat variable is a large contributor to uncertainty and variability in cancer and noncancer results. This is likely a result of using a range of fat content across all possible cuts of meat to define the beef fat interval in the p-bounds analysis. This wide range was used because the specific composition of meat cuts and cooking methods applicable to farm families are not known.

The adult beef CR contributes more to the uncertainty of the adult noncancer hazard while the beef CR in the child noncancer and cancer models contributes more to the uncertainty and the variability. This result is due to the fact that consumption of beef by children (ages 1 to 7) and adults (over a lifetime for the cancer model) are likely to vary more than in the “adult” age group (7-70).

6.7.3 Commercial Poultry Meat

The primary contributor to uncertainty and variability in the commercial poultry cancer and noncancer results was poultry meat fat content, followed by the poultry meat CR, and the poultry adipose tissue BCF. When only uncertainty is considered, the poultry meat CR contributed the most to uncertainty in the noncancer HI results. The input values used for the fraction of soil and concentrate in the diet, soil bioavailability, and the BCF are the same for the MCA analog and the point estimate, therefore, the percent contribution to uncertainty is the same when pinching these input variables singly to either a precise probability distribution (i.e., remove uncertainty) or to a point estimate (i.e., remove uncertainty and variability).

As was the case for beef, the contribution of fat content to uncertainty and variability can be explained by the range of fat content of different parts of the chicken eaten and cooking methods used to define the poultry meat fat interval in the p-bounds analysis.

6.7.4 Commercial Poultry Eggs

The primary contributor to uncertainty and variability in the cancer results is the adult poultry egg CR, followed by exposure duration and child poultry egg CR. For the noncancer models, the CR is the primary contributor to uncertainty and variability. This is not surprising, given that percentile data for egg consumption were limited to the upper end of the distribution (75th percentile and higher). As was the case for poultry meat, the input values used for the fraction of soil and concentrate in the diet, soil bioavailability, and the BCF are the same for the MCA analog and the point estimate, therefore, the percent contribution to uncertainty is the same when pinching these input variables.

6.7.5 Home Garden

The soil-to-root vegetable TF is the primary contributor to uncertainty and variability for the home garden pathway. For the cancer model, the adult root vegetable CR and exposure duration also contribute to uncertainty in the cancer risk result. For the noncancer models, the root vegetable CR is the second largest contributor to uncertainty and variability. The input values used for the TFs and regional adjustment factors are the same for the MCA analog and the point estimate, therefore, the percent contribution to uncertainty is the same when pinching these input variables.

The soil-to-root vegetable TF is such a large contributor to uncertainty and variability due to the wide interval defined for this variable. The root vegetables TF interval for the p-bounds analysis spans two orders of magnitude, due to the inclusion of a maximum TF for unpeeled carrots. Section 4.3.4.2 discusses the literature documenting differences in PCB transfer between peeled and unpeeled roots.

Due to the large contribution of the soil-to-root vegetable TF and the multiplicative nature of the cancer and noncancer models, the root vegetable CR and root vegetable cooking loss contribute more to uncertainty than the exposed fruit or exposed vegetable CRs or cooking loss.

6.8 SOURCES OF UNCERTAINTY

Table 6-26 and Table 6-27 summarize the major assumptions leading to uncertainty in the risk and hazard distribution results used by the MCA analog and PBA analyses for agricultural exposure scenarios. The assumptions marked with an "O" are expected to be optimistic or less-protective 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. The assumptions in the table marked with a "C" are expected to be conservative or more 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 soil-to-plant TFs (TF), and avian bioconcentration factor (BCF), beef and poultry fat content (F), CRs (CR), and exposure duration (ED) have the greatest influence on risk estimates.

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SECTION 6

TABLES

Table 6-1

Summary of Inputs to the Monte Carlo Analog Analyses for the Commercial Dairy Scenario

Inputs to Agricultural Exposure Pathways	Symbol	Units	Min, Max	Central Estimate	Standard Deviation	Distribution Type
PARCEL-SPECIFIC INPUTS						
Soil EPCs for total PCBs (tPCBs)						
Cornfield	$EPC_{cornfield\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)			Point estimate
Fraction of farm area that is on the site (i.e. within the 1-ppm tPCB isopleth)						
Cornfield	$FS_{cornfield}$	unitless	Assumed (0.25, 0.5, 0.75, 1)			Point estimate
OTHER INPUTS						
Soil-to-Plant Modeling						
Soil-to-Corn Silage Transfer Factor	$TF_{cornsilage,PCB}$	dw plant/dw soil	-	0.0012	-	Point estimate
Animal Intake						
Animal Diet Composition						
fraction of diet = corn silage grown on farm	$D_{cornsilage}$	unitless	-	0.55	-	Point estimate
fraction of diet = concentrate (e.g., grain/supplements) from off Site	$D_{concentrate}$	unitless	-	0.45	-	Point estimate
Animal Bioaccumulation						
Mammalian BCFs (fat basis)	$BCF_{mammal,PCB}$	unitless	-	3.4	-	Point estimate
Food Concentration						
Animal product fat content (in "as consumed" food)						
dairy-milk: jersey cows	$F_{dairy\text{-}jersey}$	(mg fat/mg whole food) * 100	3.7, 6.4	4.6	0.52	Lognormal
Cooking loss						
dairy	CL_{dairy}	unitless	-	0	-	Point estimate
Post-cooking loss						
dairy	PCL_{dairy}	unitless	-	0	-	Point estimate
Human Exposure						
Fraction of total PCBs absorbed in GI tract	ABS_{food}	unitless	-	1	-	Point estimate
Food consumption rates (body weight-normalized)						
unit correction factor	UCF	kg whole food/g whole food	-	0.001	-	Point estimate
dairy-milk						
child	$CR_{child,dairy}$	g/kg-day	See Table 6-11 for all consumption rates			Empirical
adult farmer	$CR_{adult,farmer,\ dairy}$	g/kg-day				Empirical
Fraction ingested from the floodplain	FI	unitless		1		Point estimate
Exposure Frequency						
child	EF_{child}	day/year		350		Point estimate
adult farmer	$EF_{adult,farmer}$	day/year		350		Point estimate
Exposure Duration	ED_{cancer}	year	1, 70	19.5	-	Exponential
Averaging Time, Noncancer						
unit correction factor	ATcf	day/year		365		Point estimate
Averaging Time, Cancer	AT_{cancer}	day		25,550		Point estimate
Toxicity Information						
tPCB CSF	CSF_{PCB}	$(mg/kg\text{-}day)^{-1}$		2		Point estimate
tPCB RfD	RfD_{PCB}	mg/kg-day		2E-05		Point estimate

Table 6-2

Summary of Inputs to the Probability Bounds Analyses for the Commercial Dairy Scenario

Inputs to Agricultural Exposure Pathways	Symbol	Units	Min, Max	Central Estimate	Standard Deviation	Distribution Type
PARCEL-SPECIFIC INPUTS						
Soil EPCs for total PCBs (tPCBs)						
Cornfield	$EPC_{cornfield\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)			Point estimate
Fraction of farm area that is on the site (i.e. within the 1-ppm tPCB isopleth)						
Cornfield	$FS_{cornfield}$	unitless	Assumed (0.25, 0.5, 0.75, 1)			Point estimate
OTHER INPUTS						
Soil-to-Plant Modeling						
Soil-to-Corn Silage Transfer Factor	$TF_{cornsilage,PCB}$	dw plant/dw soil	0.00047, 0.0030	[0.00047, 0.0030]	-	Interval
Animal Intake						
Animal Diet Composition						
fraction of diet = corn silage grown on farm	$D_{cornsilage}$	unitless	0.5, 0.6	[0.5, 0.6]	-	Interval
fraction of diet = concentrate (e.g., grain/supplements) from off Site	$D_{concentrate}$	unitless	0.4, 0.5	[0.4, 0.5]	-	Interval
Animal Bioaccumulation						
Mammalian BCFs (fat basis)	$BCF_{mammal,PCB}$	unitless	3, 3.6	[3, 3.6]	-	Interval
Food Concentration						
Animal product fat content (in "as consumed" food)						
dairy-milk: jersey cows	$F_{dairy\text{-}jersey}$	(mg fat/mg whole food) * 100	3.7, 6.4	4.6	0.52	Empirical
Cooking loss						
dairy	CL_{dairy}	unitless	-	0	-	Point estimate
Post-cooking loss						
dairy	PCL_{dairy}	unitless	-	0	-	Point estimate
Human Exposure						
Fraction of total PCBs absorbed in GI tract	ABS_{food}	unitless	-	1	-	Point estimate
Food consumption rates (body weight-normalized)						
unit correction factor	UCF	kg whole food/g whole food	-	0.001	-	Point estimate
uncertainty factor associated with extrapolating child consumption rates	UE.child	unitless	0.3, 5.2	-0.09	0.56	Lognormal
uncertainty factor associated with extrapolating teen consumption rates	UE.teen	unitless	0.27, 2.08	-0.09	0.37	Lognormal
uncertainty factor associated with extrapolating adult consumption rates	UE.adult	unitless	0.14, 3.24	0.125	0.4	Lognormal
dairy-milk						
child	$CR_{child,dairy}$	g/kg-day	See Table 6-12 for all consumption rates			Empirical
adult farmer	$CR_{adult,farmer,\ dairy}$	g/kg-day				Empirical
Fraction ingested from the floodplain	FI	unitless	-	1	-	Point estimate
Exposure Frequency						
child	EF_{child}	day/year	-	350	-	Point estimate
adult farmer	$EF_{adult,farmer}$	day/year	-	350	-	Point estimate
Exposure Duration	ED_{cancer}	year	1, 70	[14.1, 15.4]	[14.3, 15.2]	MMMS
Averaging Time, Noncancer						
unit correction factor	ATcf	day/year	-	365	-	Point estimate
Averaging Time, Cancer	AT_{cancer}	day	-	25,550	-	Point estimate
Toxicity Information						
tPCB CSF	CSF_{PCB}	$(mg/kg\text{-}day)^{-1}$	-	2	-	Point estimate
tPCB RfD	RfD_{PCB}	mg/kg-day	-	2E-05	-	Point estimate

Table 6-3

Summary of Inputs to the Monte Carlo Analog Analyses for the Backyard Beef Scenario

Inputs to Agricultural Exposure Pathways	Symbol	Units	Min, Max	Central Estimate	Standard Deviation	Distribution Type
PARCEL-SPECIFIC INPUTS						
Soil EPCs for total PCBs (tPCBs)						
Pasture	$EPC_{pasture\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)			Point estimate
Hayfield	$EPC_{hayfield\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)			Point estimate
Fraction of farm area that is on the site (i.e. within the 1-ppm tPCB isopleth)						
Pasture	$FS_{pasture}$	unitless	Assumed (0.25, 0.5, 0.75, 1)			Point estimate
Hayfield	$FS_{hayfield}$	unitless	Assumed (0.25, 0.5, 0.75, 1)			Point estimate
OTHER INPUTS						
Soil-to-Plant Modeling						
Soil-to-Grass Transfer Factor						
tPCB	$TF_{grass,PCB}$	dw plant/ dw soil	-	0.036	-	Point estimate
Soil-to-Hay Transfer Factor						
tPCB	$TF_{hay,PCB}$	dw plant/ dw soil	-	0.036	-	Point estimate
Animal Intake						
Animal Diet Composition						
fraction of diet = soil	D_{soil}	unitless	-	0.02	-	Point estimate
fraction of diet = hay or other grass-based feed grown on farm	D_{hay}	unitless	-	0.98	-	Point estimate
fraction of diet = pasture grass on farm	D_{grass}	unitless	-			Point estimate
Soil Bioavailability	$BA_{soil,PCB}$	unitless	-	1	-	Point estimate
Animal Bioaccumulation						
Mammalian BCFs (fat basis)	$BCF_{mammal,PCB}$	unitless	-	3.4	-	Point estimate
Food Concentration						
Animal product fat content (in "as consumed" food)						
beef	F_{beef}	(mg fat/mg whole food) * 100	3.9, 38	9.9	-	Triangular
Cooking loss						
beef	CL_{beef}	unitless	0.19, 0.37	0.27	-	Triangular
Post-cooking loss						
beef	PCL_{beef}	unitless	0.12, 0.38	0.24	-	Triangular
Human Exposure						
Fraction of total PCBs absorbed in GI tract	ABS_{food}	unitless	-	1	-	Point estimate
Food consumption rates (body weight-normalized)						
unit correction factor	UCF	kg whole food/g whole food	-	0.001	-	Point estimate
beef						
child	$CR_{child,beef}$	g/kg-day	See Table 6-11 for all consumption rates			Empirical
adult resident	$CR_{adult,resident,beef}$	g/kg-day				Empirical
Fraction ingested from the floodplain	FI	unitless	-	1	-	Point estimate
Exposure Frequency						
child	EF_{child}	day/year	-	350	-	Point estimate
adult resident	$EF_{adult,resident}$	day/year	-	350	-	Point estimate
Exposure Duration	ED_{cancer}	year	1, 70	15	-	Exponential
Averaging Time, Noncancer						
unit correction factor	$AT_{correction\ factor}$	day/year	-	365	-	Point estimate
Averaging Time, Cancer	AT_{cancer}	day	-	25,550	-	Point estimate
Toxicity Information						
tPCB CSF	CSF_{PCB}	$(mg/kg\text{-}day)^{-1}$	-	2	-	Point estimate
tPCB RfD	RfD_{PCB}	mg/kg-day	-	2E-05	-	Point estimate

Table 6-4

Summary of Inputs to the Probability Bounds Analyses for the Backyard Beef Scenario

Inputs to Agricultural Exposure Pathways	Symbol	Units	Min, Max	Central Estimate	Standard Deviation	Distribution Type
PARCEL-SPECIFIC INPUTS						
Soil EPCs for total PCBs (tPCBs)						
Pasture	$EPC_{pasture\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)			Point estimate
Hayfield	$EPC_{hayfield\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)			Point estimate
Fraction of farm area that is on the site (i.e. within the 1-ppm tPCB isopleth)						
Pasture	$FS_{pasture}$	unitless	Assumed (0.25, 0.5, 0.75, 1)			Point estimate
Hayfield	$FS_{hayfield}$	unitless	Assumed (0.25, 0.5, 0.75, 1)			Point estimate
OTHER INPUTS						
Soil-to-Plant Modeling						
Soil-to-Grass Transfer Factor	$TF_{grass,PCB}$	dw plant/ dw soil	0.0098, 0.094	[0.0098, 0.094]	-	Interval
Soil-to-Hay Transfer Factor	$TF_{hay,PCB}$	dw plant/ dw soil	0.0098, 0.094	[0.0098, 0.094]	-	Interval
Animal Intake						
Animal Diet Composition						
fraction of diet = soil	D_{soil}	unitless	0.01, 0.03	[0.01, 0.03]	-	Interval
fraction of diet = hay or other grass-based feed grown on farm	D_{hay}	unitless	0.97, 0.99	[0.97, 0.99]	-	Interval
fraction of diet = pasture grass on farm	D_{grass}	unitless				
Soil Bioavailability	$BA_{soil,PCB}$	unitless	0.65, 1	[0.65,1]	-	Interval
Animal Bioaccumulation						
Mammalian BCFs (fat basis)	$BCF_{mammal,PCB}$	unitless	3, 3.6	[3, 3.6]	-	Interval
Food Concentration						
Animal product fat content (in "as consumed" food)						
beef	F_{beef}	(mg fat/mg whole food) * 100	3.9, 38	[3.9, 38]	-	Interval
Cooking loss						
beef	CL_{beef}	unitless	0.19, 0.37	[0.19, 0.37]	-	Interval
Post-cooking loss						
beef	PCL_{beef}	unitless	0.12, 0.38	[0.12, 0.38]	-	Interval
Human Exposure						
Fraction of total PCBs absorbed in GI tract	ABS_{food}	unitless	-	1	-	Point estimate
Food consumption rates (body weight-normalized)						
unit correction factor	UCF	kg whole food/g whole	-	0.001	-	Point estimate
uncertainty factor associated with extrapolating child consumption rates	UE.child	unitless	0.3, 5.2	-0.09	0.56	Lognormal
beef						
child	$CR_{child,beef}$	g/kg-day	See Table 6-12 for all consumption rates			Empirical
adult resident	$CR_{adult,resident,beef}$	g/kg-day				Empirical
Fraction ingested from the floodplain	FI	unitless	-	1	-	Point estimate
Exposure Frequency						
child	EF_{child}	day/year	-	350	-	Point estimate
adult resident	$EF_{adult,resident}$	day/year	-	350	-	Point estimate
Exposure Duration	ED_{cancer}	year	1, 70	[14.1, 15.4]	[14.3, 15.2]	MMMS
Averaging Time, Noncancer						
unit correction factor	$AT_{correction\ factor}$	day/year	-	365	-	Point estimate
Averaging Time, Cancer	AT_{cancer}	day	-	25,550	-	Point estimate
Toxicity Information						
tPCB CSF	CSF_{PCB}	$(mg/kg\text{-}day)^{-1}$	-	2	-	Point estimate
tPCB RfD	RfD_{PCB}	mg/kg-day	-	2E-05	-	Point estimate

Table 6-5

Summary of Inputs to the Monte Carlo Analog Analyses for the Commercial Poultry Meat Scenario

Inputs to Agricultural Exposure Pathways	Symbol	Units	Min, Max	Central Estimate	Standard Deviation	Distribution Type
PARCEL-SPECIFIC INPUTS						
Soil EPCs for total PCBs (tPCBs)						
Pasture	$EPC_{pasture\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)			Point estimate
Fraction of farm area that is on the site (i.e. within the 1-ppm tPCB isopleth)						
Pasture	$FS_{pasture}$	unitless	Assumed (0.25, 0.5, 0.75, 1)			Point estimate
OTHER INPUTS						
Animal Intake						
Animal Diet Composition						
fraction of diet = soil	D_{soil}	unitless	-	0.1	-	Point estimate
fraction of diet = concentrate (e.g., grain/supplements) from off Site	$D_{concentrate}$	unitless	-	0.9	-	Point estimate
Soil Bioavailability	$BA_{soil,PCB}$	unitless	-	1	-	Point estimate
Animal Bioaccumulation						
Avian BCFs (fat basis)	$BCF_{poultry\ meat,PCB}$	unitless	-	2.5	-	Point estimate
Food Concentration						
Animal product fat content (in "as consumed" food)						
poultry meat	$F_{poultry,meat}$	(mg fat/mg whole food) * 100	3.0, 24	7.4	-	Triangular
Cooking loss						
poultry meat	$CL_{poultry,meat}$	unitless	0.22, 0.43	0.32	-	Triangular
Post-cooking loss						
poultry meat	$PCL_{poultry,meat}$	unitless	0.22, 0.40	0.31	-	Triangular
Human Exposure						
Fraction of total PCBs absorbed in GI tract	ABS_{food}	unitless	-	1	-	Point estimate
Food consumption rates (body weight-normalized)						
unit correction factor	UCF	kg whole food/ g whole food	-	0.001	-	Point estimate
poultry meat						
child	$CR_{child,poultry,meat}$	g/kg-day	See Table 6-11 for all consumption rates			Empirical
adult farmer	$CR_{adult,farmer,\ poultry,meat}$	g/kg-day				Empirical
Fraction ingested from the floodplain	FI	unitless	-	1	-	Point estimate
Exposure Frequency						
child	EF_{child}	day/year	-	350	-	Point estimate
adult farmer	$EF_{adult,farmer}$	day/year	-	350	-	Point estimate
Exposure Duration	ED_{cancer}	year	1, 70	19.5	-	Exponential
Averaging Time, Noncancer						
unit correction factor	ATcf	day/year	-	365	-	Point estimate
Averaging Time, Cancer	AT_{cancer}	day	-	25,550	-	Point estimate
Toxicity Information						
tPCB CSF	CSF_{PCB}	$(mg/kg\text{-}day)^{-1}$	-	2	-	Point estimate
tPCB RfD	RfD_{PCB}	mg/kg-day	-	2E-05	-	Point estimate

Table 6-6

Summary of Inputs to the Probability Bounds Analyses for the Commercial Poultry Meat Scenario

Inputs to Agricultural Exposure Pathways	Symbol	Units	Min, Max	Central Estimate	Standard Deviation	Distribution Type
PARCEL-SPECIFIC INPUTS						
Soil EPCs for total PCBs (tPCBs)						
Pasture	$EPC_{pasture\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)			Point estimate
Fraction of farm area that is on the site (i.e. within the 1-ppm tPCB isopleth)						
Pasture	$FS_{pasture}$	unitless	Assumed (0.25, 0.5, 0.75, 1)			Point estimate
OTHER INPUTS						
Animal Intake						
Animal Diet Composition						
fraction of diet = soil	D_{soil}	unitless	0.08, 0.12	[0.08, 0.12]	-	Interval
fraction of diet = concentrate (e.g., grain/supplements) from off Site	$D_{concentrate}$	unitless	0.88, 0.92	[0.88, 0.92]	-	Interval
Soil Bioavailability	$BA_{soil,PCB}$	unitless	0.65, 1	[0.65,1]	-	Interval
Animal Bioaccumulation						
Avian BCFs (fat basis)	$BCF_{poultry\ meat,PCB}$	unitless	2.5, 4.7	[2.5, 4.7]	-	Interval
Food Concentration						
Animal product fat content (in "as consumed" food)						
poultry meat	$F_{poultry,meat}$	(mg fat/mg whole food) * 100	3.0, 24	[3.0, 24]	-	Interval
Cooking loss						
poultry meat	$CL_{poultry,meat}$	unitless	0.22, 0.43	[0.22, 0.43]	-	Interval
Post-cooking loss						
poultry meat	$PCL_{poultry,meat}$	unitless	0.22, 0.40	[0.22, 0.40]	-	Interval
Human Exposure						
Fraction of total PCBs absorbed in GI tract	ABS_{food}	unitless	-	1	-	Point estimate
Food consumption rates (body weight-normalized)						
unit correction factor	UCF	kg whole food/ g whole food	-	0.001	-	Point estimate
uncertainty factor associated with extrapolating child consumption rates	UE.child	unitless	0.3, 5.2	-0.09	0.56	Lognormal
uncertainty factor associated with extrapolating teen consumption rates	UE.teen	unitless	0.27, 2.08	-0.09	0.37	Lognormal
uncertainty factor associated with extrapolating adult consumption rates	UE.adult	unitless	0.14, 3.24	0.125	0.4	Lognormal
poultry meat						
child	$CR_{child,poultry,meat}$	g/kg-day	See Table 6-12 for all consumption rates			Empirical
adult farmer	$CR_{adult,farmer,\ poultry,meat}$	g/kg-day				Empirical
Fraction ingested from the floodplain	FI	unitless	-	1	-	Point estimate
Exposure Frequency						
child	EF_{child}	day/year	-	350	-	Point estimate
adult farmer	$EF_{adult,farmer}$	day/year	-	350	-	Point estimate
Exposure Duration	ED_{cancer}	year	1, 70	[14.1, 15.4]	[14.3, 15.2]	MMMS
Averaging Time, Noncancer						
unit correction factor	ATcf	day/year	-	365	-	Point estimate
Averaging Time, Cancer	AT_{cancer}	day	-	25,550	-	Point estimate
Toxicity Information						
tPCB CSF	CSF_{PCB}	$(mg/kg\text{-}day)^{-1}$	-	2	-	Point estimate
tPCB RfD	RfD_{PCB}	mg/kg-day	-	2E-05	-	Point estimate

Table 6-7

Summary of Inputs to the Monte Carlo Analog Analyses for the Commercial Poultry Egg Scenario

Inputs to Agricultural Exposure Pathways	Symbol	Units	Min, Max	Central Estimate	Standard Deviation	Distribution Type
PARCEL-SPECIFIC INPUTS						
Soil EPCs for total PCBs (tPCBs)						
Pasture	$EPC_{pasture\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)			Point estimate
Fraction of farm area that is on the site (i.e. within the 1-ppm tPCB isopleth)						
Pasture	$FS_{pasture}$	unitless	Assumed (0.25, 0.5, 0.75, 1)			Point estimate
OTHER INPUTS						
Animal Intake						
Animal Diet Composition						
fraction of diet = soil	D_{soil}	unitless	-	0.1	-	Point estimate
fraction of diet = concentrate (e.g., grain/supplements) from off Site	$D_{concentrate}$	unitless	-	0.9	-	Point estimate
Soil Bioavailability	$BA_{soil,PCB}$	unitless	-	1	-	Point estimate
Animal Bioaccumulation						
Avian BCFs (whole food basis)	$BCF_{poultry\ egg,PCB}$	unitless	-	0.9	-	Point estimate
Food Concentration						
Cooking loss						
poultry eggs	$CL_{poultry,egg}$	unitless	0, 0.15	[0, 0.15]	-	Uniform
Post-cooking loss						
poultry eggs	$PCL_{poultry,egg}$	unitless	-	0	-	Point estimate
Human Exposure						
Fraction of total PCBs absorbed in GI tract	ABS_{food}	unitless	-	1	-	Point estimate
Food consumption rates (body weight-normalized)						
unit correction factor	UCF	kg whole food/ g whole food	-	0.001	-	Point estimate
poultry eggs						
child	$CR_{child,poultry,eggs}$	g/kg-day	See Table 6-11 for all consumption rates			Empirical
adult farmer	$CR_{adult,farmer,\ poultry,eggs}$	g/kg-day				Empirical
Fraction ingested from the floodplain	FI	unitless	-	1	-	Point estimate
Exposure Frequency						
child	EF_{child}	day/year	-	350	-	Point estimate
adult farmer	$EF_{adult,farmer}$	day/year	-	350	-	Point estimate
Exposure Duration	ED_{cancer}	year	1, 70	19.5	-	Exponential
Averaging Time, Noncancer						
unit correction factor	ATcf	day/year	-	365	-	Point estimate
Averaging Time, Cancer	AT_{cancer}	day	-	25,550	-	Point estimate
Toxicity Information						
tPCB CSF	CSF_{PCB}	$(mg/kg\text{-}day)^{-1}$	-	2	-	Point estimate
tPCB RfD	RfD_{PCB}	mg/kg-day	-	2E-05	-	Point estimate

Table 6-8

Summary of Inputs to the Probability Bounds Analyses for the Commercial Poultry Egg Scenario

Inputs to Agricultural Exposure Pathways	Symbol	Units	Min, Max	Central Estimate	Standard Deviation	Distribution Type
PARCEL-SPECIFIC INPUTS						
Soil EPCs for total PCBs (tPCBs)						
Pasture	$EPC_{pasture\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)			Point estimate
Fraction of farm area that is on the site (i.e. within the 1-ppm tPCB isopleth)						
Pasture	$FS_{pasture}$	unitless	Assumed (0.25, 0.5, 0.75, 1)			Point estimate
OTHER INPUTS						
Animal Intake						
Animal Diet Composition						
fraction of diet = soil	D_{soil}	unitless	0.08, 0.12	[0.08, 0.12]	-	Interval
fraction of diet = concentrate (e.g., grain/supplements) from off Site	$D_{concentrate}$	unitless	0.88, 0.92	[0.88, 0.92]	-	Interval
Soil Bioavailability	$BA_{soil,PCB}$	unitless	0.65, 1	[0.65,1]	-	Interval
Animal Bioaccumulation						
Avian BCFs (whole food basis)	$BCF_{poultry\ egg,PCB}$	unitless	0.57, 1.1	[0.57, 1.1]	-	Interval
Food Concentration						
Cooking loss						
poultry eggs	$CL_{poultry,egg}$	unitless	0, 0.15	[0, 0.15]	-	Interval
Post-cooking loss						
poultry eggs	$PCL_{poultry,egg}$	unitless	-	0	-	Point estimate
Human Exposure						
Fraction of total PCBs absorbed in GI tract	ABS_{food}	unitless	-	1	-	Point estimate
Food consumption rates (body weight-normalized)						
unit correction factor	UCF	kg whole food/g whole	-	0.001	-	Point estimate
uncertainty factor associated with extrapolating child consumption rates	UE.child	unitless	0.3, 5.2	-0.09	0.56	Lognormal
uncertainty factor associated with extrapolating teen consumption rates	UE.teen	unitless	0.27, 2.08	-0.09	0.37	Lognormal
uncertainty factor associated with extrapolating adult consumption rates	UE.adult	unitless	0.14, 3.24	0.125	0.4	Lognormal
poultry eggs						
child	$CR_{child,poultry,eggs}$	g/kg-day	See Table 6-12 for all consumption rates			Empirical
adult farmer	$CR_{adult,farmer,\ poultry,eggs}$	g/kg-day				Empirical
Fraction ingested from the floodplain	FI	unitless	-	1	-	Point estimate
Exposure Frequency						
child	EF_{child}	day/year	-	350	-	Point estimate
adult farmer	$EF_{adult,farmer}$	day/year	-	350	-	Point estimate
Exposure Duration	ED_{cancer}	year	1, 70	[14.1, 15.4]	[14.3, 15.2]	MMMS
Averaging Time, Noncancer						
unit correction factor	ATcf	day/year	-	365	-	Point estimate
Averaging Time, Cancer	ATc	day	-	25,550	-	Point estimate
Toxicity Information						
tPCB CSF	CSF_{PCB}	$(mg/kg\text{-}day)^{-1}$	-	2	-	Point estimate
tPCB RfD	RfD_{PCB}	mg/kg-day	-	2E-05	-	Point estimate

Table 6-9

Summary of Inputs to the Monte Carlo Analog Analyses for the Commercial Produce Scenario

Inputs to Agricultural Exposure Pathways	Symbol	Units	Min, Max	Central Estimate	Standard Deviation	Distribution Type
PARCEL-SPECIFIC INPUTS						
Soil EPCs for total PCBs (tPCBs)						
Garden	$EPC_{garden\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)			Point estimate
Fraction of farm area that is on the site (i.e. within the 1-ppm tPCB isopleth)						
Garden	FS_{garden}	unitless	Assumed (0.25, 0.5, 0.75, 1)			Point estimate
OTHER INPUTS						
Soil-to-Plant Modeling						
Soil-to-Exposed Vegetable Transfer Factor						
tPCB	$TF_{expveg,PCB}$	ww plant/ dw soil	-	0.0018	-	Point estimate
Soil-to-Exposed Fruit Transfer Factor						
tPCB	$TF_{fruit,PCB}$	ww plant/ dw soil	-	0.0018	-	Point estimate
Soil-to-Root Vegetable Transfer Factor						
tPCB	$TF_{rtveg,PCB}$	ww plant/ dw soil	-	0.00030	-	Point estimate
Food Concentration						
Cooking loss						
exposed vegetables	CL_{expveg}	unitless	0, 0.64	0.16	-	Triangular
exposed fruit	CL_{fruit}	unitless	0, 0.41	0.25	-	Triangular
root vegetables	CL_{rtveg}	unitless	0, 0.63	0.17	-	Triangular
Post-cooking loss						
exposed vegetables	PCL_{expveg}	unitless	-	0	-	Point estimate
exposed fruit	PCL_{fruit}	unitless	-	0	-	Point estimate
root vegetables	PCL_{rtveg}	unitless	-	0	-	Point estimate
Human Exposure						
Fraction of total PCBs absorbed in GI tract	ABS_{food}	unitless	-	1	-	Point estimate
Food consumption rates (body weight-normalized)						
unit correction factor	UCF	kg whole food/g whole	-	0.001	-	Point estimate
regional adjustment factor for garden produce consumption						
exposed fruit	AF_{fruit}	unitless	-	0.07	-	Point estimate
vegetables (exposed & root)	$AF_{vegetables}$	unitless	-	0.3	-	Point estimate
exposed vegetables						
child	$CR_{child,expveg}$	g/kg-day	See Table 6-11 for all consumption rates			Empirical
adult farmer	$CR_{adult,farmer,\ expveg}$	g/kg-day				Empirical
exposed fruit						
child	$CR_{child,fruit}$	g/kg-day	See Table 6-11 for all consumption rates			Empirical
adult farmer	$CR_{adult,farmer,\ fruit}$	g/kg-day				Empirical
root vegetables						
child	$CR_{child,rtveg}$	g/kg-day	See Table 6-11 for all consumption rates			Empirical
adult farmer	$CR_{adult,farmer,\ rtveg}$	g/kg-day				Empirical
Fraction ingested from the floodplain	FI	unitless	-	1	-	Point estimate
Exposure Frequency						
child	EF_{child}	day/year	-	350	-	Point estimate
adult farmer	$EF_{adult,farmer}$	day/year	-	350	-	Point estimate
Exposure Duration	ED_{cancer}	year	1, 70	19.5	-	Exponential
Averaging Time, Noncancer						
unit correction factor	$AT_{correction\ factor}$	day/year	-	365	-	Point estimate
Averaging Time, Cancer	AT_{cancer}	day	-	25,550	-	Point estimate
Toxicity Information						
tPCB CSF	CSF_{PCB}	$(mg/kg\text{-}day)^{-1}$	-	2	-	Point estimate
tPCB RfD	RfD_{PCB}	mg/kg-day	-	2E-05	-	Point estimate

Table 6-10

Summary of Inputs to the Probability Bounds Analyses for the Commercial Produce Scenario

Inputs to Agricultural Exposure Pathways	Symbol	Units	Min, Max	Central Estimate	Standard Deviation	Distribution Type
PARCEL-SPECIFIC INPUTS						
Soil EPCs for total PCBs (tPCBs)						
Garden	$EPC_{garden\ soil,PCB}$	mg/kg,dw	Assumed (0.5, 2, 10, 25)			Point estimate
Fraction of farm area that is on the site (i.e. within the 1-ppm tPCB isopleth)						
Garden	FS_{garden}	unitless	Assumed (0.25, 0.5, 0.75, 1)			Point estimate
OTHER INPUTS						
Soil-to-Plant Modeling						
Soil-to-Exposed Vegetable Transfer Factor						
tPCB	$TF_{expveg,PCB}$	ww plant/dw soil	0.00017, 0.0018	[0.00017, 0.0018]	-	Interval
Soil-to-Exposed Fruit Transfer Factor						
tPCB	$TF_{fruit,PCB}$	ww plant/dw soil	0.00017, 0.0018	[0.00017, 0.0018]	-	Interval
Soil-to-Root Vegetable Transfer Factor						
tPCB	$TF_{rtveg,PCB}$	ww plant/dw soil	0.00011, 0.04	[0.00011, 0.04]	-	Interval
Food Concentration						
Cooking loss						
exposed vegetables	CL_{expveg}	unitless	0, 0.64	[0, 0.64]	-	Interval
exposed fruit	CL_{fruit}	unitless	0, 0.41	[0, 0.41]	-	Interval
root vegetables	CL_{rtveg}	unitless	0, 0.63	[0, 0.63]	-	Interval
Post-cooking loss						
exposed vegetables	PCL_{expveg}	unitless	-	0	-	Point estimate
exposed fruit	PCL_{fruit}	unitless	-	0	-	Point estimate
root vegetables	PCL_{rtveg}	unitless	-	0	-	Point estimate
Human Exposure						
Fraction of total PCBs absorbed in GI tract	ABS_{food}	unitless	-	1	-	Point estimate
Food consumption rates (body weight-normalized)						
unit correction factor	UCF	kg whole food/g	-	0.001	-	Point estimate
regional adjustment factor for garden produce consumption						
exposed fruit	AF_{fruit}	unitless	-	0.0747	0.0048	Student's t
vegetables (exposed & root)	$AF_{vegetables}$	unitless	-	0.277	0.022	Student's t
exposed vegetables						
child	$CR_{child,expveg}$	g/kg-day	See Table 6-12 for all consumption rates			Empirical
adult farmer	$CR_{adult,farmer,\ expveg}$	g/kg-day				Empirical
exposed fruit						
child	$CR_{child,fruit}$	g/kg-day	See Table 6-12 for all consumption rates			Empirical
adult farmer	$CR_{adult,farmer,\ fruit}$	g/kg-day				Empirical
root vegetables						
child	$CR_{child,rtveg}$	g/kg-day	See Table 6-12 for all consumption rates			Empirical
adult farmer	$CR_{adult,farmer,\ rtveg}$	g/kg-day				Empirical
Fraction ingested from the floodplain	FI	unitless	-	1	-	Point estimate
Exposure Frequency						
child	EF_{child}	day/year	-	350	-	Point estimate
adult farmer	$EF_{adult,farmer}$	day/year	-	350	-	Point estimate
Exposure Duration	ED_{cancer}	year	1, 70	[14.1, 15.4]	[14.3, 15.2]	MMMS
Averaging Time, Noncancer						
unit correction factor	$AT_{correction\ factor}$	day/year	-	365	-	Point estimate
Averaging Time, Cancer	At_{cancer}	day	-	25,550	-	Point estimate
Toxicity Information						
tPCB CSF	CSF_{PCB}	(mg/kg-day)-1	-	2	-	Point estimate
tPCB RfD	RfD_{PCB}	mg/kg-day	-	2E-05	-	Point estimate

Table 6-11
Age-Weighted Food Consumption Rates for Monte Carlo Analog Analysis

	Percentile of the distribution									
	P1	**P5**	**P10**	**P25**	**P50**	**P75**	**P90**	**P95**	**P99**	**P100**
Consumer Only Intake of Home Produced Dairy (g/kg-day)										
Adult resident/farmer	---	0.865	0.856	3.13	8.58	15.1	18.0	21.7	23.7	22.1
Child	---	9.35	9.95	24.1	47.9	70.3	74.1	82.9	78.1	41.5
Cancer (Child + Adult)	---	1.59	1.64	4.93	11.9	19.9	22.8	27.0	28.4	23.8
Consumer Only Intake of Home Produced Beef (g/kg-day)										
Adult resident/farmer	---	---	0.459	0.823	1.58	2.65	4.84	6.06	7.03	7.01
Child	---	---	0.725	1.20	2.89	4.86	9.27	11.1	14.5	10.2
Cancer (Child + Adult)	---	---	0.482	0.856	1.69	2.84	5.22	6.49	7.67	7.28
Consumer Only Intake of Home Produced Poultry (g/kg-day)										
Adult resident/farmer	---	0.356	0.386	0.547	1.05	2.08	2.60	3.87	4.94	5.11
Child	---	0.750	1.08	1.07	2.11	2.88	3.56	6.15	8.55	10.7
Cancer (Child + Adult)	---	0.415	0.458	0.605	1.17	2.18	2.73	4.13	5.35	5.71
Consumer Only Intake of Home Produced Eggs (g/kg-day)										
Adult resident/farmer	---	---	---	---	---	0.846	1.34	1.72	2.18	1.92
Child	---	---	---	---	---	1.91	3.24	4.73	8.49	4.32
Cancer (Child + Adult)	---	---	---	---	---	0.94	1.50	1.98	2.72	2.12
Consumer Only Intake of Homegrown Exposed Fruit (g/kg-day)										
Adult resident/farmer	0.0663	0.149	0.237	0.409	0.707	1.53	2.88	4.22	12.2	12.2
Child	0.00	0.0285	0.435	1.10	2.01	3.13	6.57	8.02	35.1	35.2
Cancer (Child + Adult)	0.0606	0.139	0.254	0.468	0.818	1.66	3.20	4.55	14.1	14.2
Consumer Only Intake of Homegrown Exposed Vegetables (g/kg-day)										
Adult resident/farmer	0.00417	0.0961	0.180	0.375	0.784	1.64	3.02	4.46	8.44	17.3
Child	0.00760	0.0907	0.318	0.742	1.32	2.94	5.84	8.02	9.93	10.7
Cancer (Child + Adult)	0.00446	0.0956	0.192	0.406	0.830	1.75	3.26	4.77	8.56	16.7
Consumer Only Intake of Homegrown Root Vegetables (g/kg-day)										
Adult resident/farmer	0.00657	0.0347	0.0999	0.238	0.617	1.31	2.57	3.53	7.20	9.18
Child	0.0553	0.0577	0.138	0.271	0.625	2.34	5.19	6.76	7.08	7.08
Cancer (Child + Adult)	0.0107	0.0366	0.103	0.241	0.618	1.40	2.79	3.81	7.19	9.00

Notes:
Shaded cells indicate percentile data that were used to define consumption rate distributions in the monte carlo analog analysis.

Table 6-12

Food Consumption Rates for Probability Bounds Analysis

	Minimum	Mean	Maximum	Percentiles of the distribution P25 Min	P25 Max	P50 Min	P50 Max	P75 Min	P75 Max	Max for truncation
Consumer Only Intake of Home Produced Dairy (g/kg-day)										
Adult resident/farmer (20-70+)	0	-	23	1.9	2.9	5.5	7.4	10	12	43
Teen (6-19)	0	-	53	4.6	13	13	29	22	45	63
Child (1-5)	0	-	101	24	30	48	57	68	87	109
Consumer Only Intake of Home Produced Beef (g/kg-day)										
Adult resident/farmer (20-70+)	0	-	8.3	0.35	0.83	1.1	1.6	2.0	2.7	NA
Teen (6-19)	0	-	13	0.90	1.3	1.5	2.1	2.4	4.4	NA
Child (1-5)	0	-	16	1.2	1.2	2.9	3.3	4.7	5.3	16
Consumer Only Intake of Home Produced Poultry (g/kg-day)										
Adult resident/farmer (20-70+)	0	-	5.2	0.41	0.56	0.77	1.2	1.2	2.7	6.2
Teen (6-19)	0	-	8.4	0.27	0.94	0.47	1.9	0.64	2.4	8.4
Child (1-5)	0	-	14	1.0	1.2	2.1	2.2	2.9	3.0	14
Consumer Only Intake of Home Produced Eggs (g/kg-day)										
Adult resident/farmer (20-70+)	0	0.61	2.5	---	---	---	---	0.61	0.84	5.4
Teen (6-19)	0	0.74	4.3	---	---	---	---	0.64	1.4	6.3
Child (1-5)	0	1.7	11	---	---	---	---	1.7	2.6	10.8
Consumer Only Intake of Homegrown Exposed Fruit (g/kg-day)										
Adult resident/farmer (20-70+)	0	-	13	0.30	0.57	0.62	0.96	1.1	1.7	NA
Teen (6-19)	0	-	16	0.40	0.62	0.61	1.1	2.3	2.9	NA
Child (1-5)	0	-	49	1.0	1.5	1.8	2.7	2.6	4.0	NA
Consumer Only Intake of Homegrown Exposed Vegetables (g/kg-day)										
Adult resident/farmer (20-70+)	0	-	21	0.26	0.52	0.56	1.1	1.3	2.4	NA
Teen (6-19)	0	-	13	0.30	0.31	0.64	0.66	1.5	1.6	NA
Child (1-5)	0	-	12	0.58	1.2	1.2	1.9	2.5	4.2	NA
Consumer Only Intake of Homegrown Root Vegetables (g/kg-day)										
Adult resident/farmer (20-70+)	0	-	13	0.20	0.38	0.56	0.85	1.2	1.7	NA
Teen (6-19)	0	-	7.5	0.23	0.27	0.52	0.57	1.4	1.6	NA
Child (1-5)	0	-	10	0.23	0.36	0.46	0.92	1.7	3.7	NA

Table 6-12

Food Consumption Rates for Probability Bounds Analysis

Notes:
Minimum and maximum consumption rates for the adult are the minimum and maximum consumption rates for the 20-39, 40-69 and 70+ age categories.

Minimum and maximum consumption rates for the teen are the minimum and maximum consumption rates for the 6-11 and 12-19 age categories.

Minimum and maximum consumption rates for the child are the minimum and maximum consumption rates for the 1-2 and 3-5 age categories.

Consumption rates were extrapolated where home produced data was missing. These extrapolated consumption rates were included in our min and max calculations.

NA = Not Applicable. If home produced consumption data were available at all percentiles for a particular age group and food product, no extrapolation error was incorporated and the distribution was not truncated.

The mean consumption rate is reported for poultry eggs because P25 and P50 percentile data were not available for this food product, thus we used the "minmaxmean' function to define the pbox.

Table 6-13

Cancer Risk Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Commercial Dairy Consumption

P-BOUNDS

Total PCB Concentration in Cornfield (mg/kg	Fraction of Cornfield in the Floodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	[0E+00 1E-6]	[3E-10, 2E-06]	[7E-10, 3E-06]	[9E-10, 5E-06]	[1E-09, 7E-06]	[3E-09, 1E-05]
0.5	0.50	[0E+00 2E-6]	[5E-10, 4E-06]	[1E-09, 7E-06]	[2E-09, 1E-05]	[2E-09, 1E-05]	[5E-09, 2E-05]
0.5	0.75	[0E+00 3E-6]	[8E-10, 5E-06]	[2E-09, 1E-05]	[3E-09, 1E-05]	[4E-09, 2E-05]	[8E-09, 3E-05]
0.5	1.0	[0E+00 4E-6]	[1E-09, 7E-06]	[3E-09, 1E-05]	[4E-09, 2E-05]	[5E-09, 3E-05]	[1E-08, 4E-05]
2	0.25	[0E+00 4E-6]	[1E-09, 7E-06]	[3E-09, 1E-05]	[4E-09, 2E-05]	[5E-09, 3E-05]	[1E-08, 4E-05]
2	0.50	[0E+00 8E-6]	[2E-09, 1E-05]	[5E-09, 3E-05]	[8E-09, 4E-05]	[1E-08, 6E-05]	[2E-08, 8E-05]
2	0.75	[0E+00 1E-5]	[3E-09, 2E-05]	[8E-09, 4E-05]	[1E-08, 6E-05]	[1E-08, 9E-05]	[3E-08, 1E-04]
2	1.0	[0E+00 2E-5]	[4E-09, 3E-05]	[1E-08, 5E-05]	[2E-08, 8E-05]	[2E-08, 1E-04]	[4E-08, 2E-04]
10	0.25	[0E+00 2E-5]	[5E-09, 4E-05]	[1E-08, 7E-05]	[2E-08, 1E-04]	[2E-08, 1E-04]	[5E-08, 2E-04]
10	0.50	[0E+00 4E-5]	[1E-08, 7E-05]	[3E-08, 1E-04]	[4E-08, 2E-04]	[5E-08, 3E-04]	[1E-07, 4E-04]
10	0.75	[0E+00 6E-5]	[2E-08, 1E-04]	[4E-08, 2E-04]	[6E-08, 3E-04]	[7E-08, 4E-04]	[2E-07, 6E-04]
10	1.0	[0E+00 8E-5]	[2E-08, 1E-04]	[5E-08, 3E-04]	[8E-08, 4E-04]	[1E-07, 6E-04]	[2E-07, 8E-04]
25	0.25	[0E+00 5E-5]	[1E-08, 9E-05]	[3E-08, 2E-04]	[5E-08, 2E-04]	[6E-08, 4E-04]	[1E-07, 5E-04]
25	0.50	[0E+00 1E-4]	[3E-08, 2E-04]	[7E-08, 3E-04]	[9E-08, 5E-04]	[1E-07, 7E-04]	[3E-07, 1E-03]
25	0.75	[0E+00 1E-4]	[4E-08, 3E-04]	[1E-07, 5E-04]	[1E-07, 7E-04]	[2E-07, 1E-03]	[4E-07, 1E-03]
25	1.0	[0E+00 2E-4]	[5E-08, 4E-04]	[1E-07, 7E-04]	[2E-07, 1E-03]	[2E-07, 1E-03]	[5E-07, 2E-03]

MONTE CARLO ANALOG

Total PCB Concentration in Cornfield (mg/kg	Fraction of Cornfield in the Floodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	1.E-08	4.E-08	1.E-07	2.E-07	3.E-07	5.E-07
0.5	0.50	3.E-08	8.E-08	2.E-07	4.E-07	6.E-07	1.E-06
0.5	0.75	4.E-08	1.E-07	3.E-07	7.E-07	9.E-07	1.E-06
0.5	1.0	5.E-08	2.E-07	4.E-07	9.E-07	1.E-06	2.E-06
2	0.25	5.E-08	2.E-07	4.E-07	9.E-07	1.E-06	2.E-06
2	0.50	1.E-07	3.E-07	9.E-07	2.E-06	2.E-06	4.E-06
2	0.75	2.E-07	5.E-07	1.E-06	3.E-06	4.E-06	6.E-06
2	1.0	2.E-07	7.E-07	2.E-06	3.E-06	5.E-06	8.E-06
10	0.25	3.E-07	8.E-07	2.E-06	4.E-06	6.E-06	1.E-05
10	0.50	5.E-07	2.E-06	4.E-06	9.E-06	1.E-05	2.E-05
10	0.75	8.E-07	2.E-06	7.E-06	1.E-05	2.E-05	3.E-05
10	1.0	1.E-06	3.E-06	9.E-06	2.E-05	2.E-05	4.E-05
25	0.25	6.E-07	2.E-06	5.E-06	1.E-05	2.E-05	2.E-05
25	0.50	1.E-06	4.E-06	1.E-05	2.E-05	3.E-05	5.E-05
25	0.75	2.E-06	6.E-06	2.E-05	3.E-05	5.E-05	7.E-05
25	1.0	3.E-06	8.E-06	2.E-05	4.E-05	6.E-05	1.E-04

DEPENDENCY BOUNDS

Total PCB Concentration in Cornfield (mg/kg	Fraction of Cornfield in the Floodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	[2E-09, 6E-08]	[9E-09, 1E-07]	[3E-08, 3E-07]	[4E-08, 5E-07]	[5E-08, 6E-07]	[6E-08, 8E-07]
0.5	0.50	[4E-09, 1E-07]	[2E-08, 3E-07]	[5E-08, 5E-07]	[8E-08, 9E-07]	[1E-07, 1E-06]	[1E-07, 2E-06]
0.5	0.75	[7E-09, 2E-07]	[3E-08, 4E-07]	[8E-08, 8E-07]	[1E-07, 1E-06]	[1E-07, 2E-06]	[2E-07, 2E-06]
0.5	1.0	[9E-09, 2E-07]	[4E-08, 5E-07]	[1E-07, 1E-06]	[2E-07, 2E-06]	[2E-07, 2E-06]	[2E-07, 3E-06]
2	0.25	[9E-09, 2E-07]	[4E-08, 5E-07]	[1E-07, 1E-06]	[2E-07, 2E-06]	[2E-07, 2E-06]	[2E-07, 3E-06]
2	0.50	[2E-08, 5E-07]	[7E-08, 1E-06]	[2E-07, 2E-06]	[3E-07, 4E-06]	[4E-07, 5E-06]	[4E-07, 6E-06]
2	0.75	[3E-08, 7E-07]	[1E-07, 2E-06]	[3E-07, 3E-06]	[5E-07, 6E-06]	[6E-07, 7E-06]	[7E-07, 9E-06]
2	1.0	[4E-08, 9E-07]	[1E-07, 2E-06]	[4E-07, 4E-06]	[7E-07, 7E-06]	[8E-07, 1E-05]	[9E-07, 1E-05]
10	0.25	[4E-08, 1E-06]	[2E-07, 3E-06]	[5E-07, 5E-06]	[8E-07, 9E-06]	[1E-06, 1E-05]	[1E-06, 2E-05]
10	0.50	[9E-08, 2E-06]	[4E-07, 5E-06]	[1E-06, 1E-05]	[2E-06, 2E-05]	[2E-06, 2E-05]	[2E-06, 3E-05]
10	0.75	[1E-07, 3E-06]	[5E-07, 8E-06]	[2E-06, 2E-05]	[2E-06, 3E-05]	[3E-06, 4E-05]	[3E-06, 5E-05]
10	1.0	[2E-07, 5E-06]	[7E-07, 1E-05]	[2E-06, 2E-05]	[3E-06, 4E-05]	[4E-06, 5E-05]	[4E-06, 6E-05]
25	0.25	[1E-07, 3E-06]	[5E-07, 7E-06]	[1E-06, 1E-05]	[2E-06, 2E-05]	[2E-06, 3E-05]	[3E-06, 4E-05]
25	0.50	[2E-07, 6E-06]	[9E-07, 1E-05]	[3E-06, 3E-05]	[4E-06, 5E-05]	[5E-06, 6E-05]	[6E-06, 8E-05]
25	0.75	[3E-07, 9E-06]	[1E-06, 2E-05]	[4E-06, 4E-05]	[6E-06, 7E-05]	[7E-06, 9E-05]	[8E-06, 1E-04]
25	1.0	[4E-07, 1E-05]	[2E-06, 3E-05]	[5E-06, 5E-05]	[8E-06, 9E-05]	[1E-05, 1E-04]	[1E-05, 2E-04]

Table 6-14

Noncancer Hazard Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Commercial Dairy Consumption

P-BOUNDS

Receptor	Total PCB Concentration in Cornfield (mg/kg dw)	Fraction of Cornfield in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	[0, 0.023]	[0.00041, 0.041]	[0.00096, 0.077]	[0.0015, 0.1]	[0.0016, 0.11]	[0.002, 0.15]
	0.5	0.50	[0, 0.046]	[0.00083, 0.082]	[0.0019, 0.15]	[0.003, 0.21]	[0.0033, 0.22]	[0.0041, 0.3]
	0.5	0.75	[0, 0.069]	[0.0012, 0.12]	[0.0028, 0.23]	[0.0045, 0.31]	[0.005, 0.34]	[0.0062, 0.46]
	0.5	1.0	[0, 0.092]	[0.00166, 0.16]	[0.0038, 0.3]	[0.0061, 0.42]	[0.0067, 0.45]	[0.0083, 0.61]
	2	0.25	[0, 0.092]	[0.00166, 0.16]	[0.0038, 0.3]	[0.0061, 0.42]	[0.0067, 0.45]	[0.0083, 0.61]
	2	0.50	[0, 0.18]	[0.00333, 0.33]	[0.0077, 0.61]	[0.012, 0.84]	[0.013, 0.91]	[0.016, 1.2]
	2	0.75	[0, 0.27]	[0.005, 0.49]	[0.011, 0.92]	[0.018, 1.2]	[0.02, 1.3]	[0.024, 1.8]
	2	1.0	[0, 0.36]	[0.00667, 0.66]	[0.015, 1.2]	[0.024, 1.6]	[0.027, 1.8]	[0.033, 2.4]
	10	0.25	[0, 0.46]	[0.00834, 0.82]	[0.019, 1.5]	[0.03, 2.1]	[0.033, 2.2]	[0.041, 3]
	10	0.50	[0, 0.92]	[0.016, 1.6]	[0.038, 3]	[0.061, 4.2]	[0.067, 4.5]	[0.083, 6.1]
	10	0.75	[0, 1.3]	[0.025, 2.4]	[0.057, 4.6]	[0.091, 6.3]	[0.1, 6.8]	[0.12, 9.2]
	10	1.0	[0, 1.8]	[0.033, 3.3]	[0.077, 6.1]	[0.12, 8.4]	[0.13, 9.1]	[0.16, 12]
	25	0.25	[0, 1.1]	[0.02, 2]	[0.048, 3.8]	[0.076, 5.2]	[0.084, 5.7]	[0.1, 7.7]
	25	0.50	[0, 2.3]	[0.041, 4.1]	[0.096, 7.7]	[0.15, 10]	[0.16, 11]	[0.2, 15]
	25	0.75	[0, 3.4]	[0.062, 6.2]	[0.14, 11]	[0.22, 15]	[0.25, 17]	[0.31, 23]
	25	1.0	[0, 4.6]	[0.083, 8.2]	[0.19, 15]	[0.3, 21]	[0.33, 22]	[0.41, 30]
Child	0.5	0.25	[0, 0.12]	[0.0026, 0.18]	[0.0052, 0.2]	[0.0067, 0.24]	[0.0074, 0.27]	[0.0081, 0.27]
	0.5	0.50	[0, 0.25]	[0.0052, 0.36]	[0.01, 0.4]	[0.013, 0.49]	[0.014, 0.54]	[0.016, 0.54]
	0.5	0.75	[0, 0.37]	[0.0079, 0.54]	[0.015, 0.6]	[0.0203, 0.74]	[0.022, 0.81]	[0.024, 0.81]
	0.5	1.0	[0, 0.5]	[0.01, 0.72]	[0.021, 0.81]	[0.027, 0.99]	[0.029, 1]	[0.032, 1]
	2	0.25	[0, 0.5]	[0.01, 0.72]	[0.021, 0.81]	[0.027, 0.99]	[0.029, 1]	[0.032, 1]
	2	0.50	[0, 1]	[0.021, 1.4]	[0.042, 1.6]	[0.054, 1.9]	[0.059, 2.1]	[0.065, 2.1]
	2	0.75	[0, 1.5]	[0.031, 2.1]	[0.063, 2.4]	[0.081, 2.9]	[0.089, 3.2]	[0.098, 3.2]
	2	1.0	[0, 2]	[0.042, 2.9]	[0.084, 3.2]	[0.1, 3.9]	[0.11, 4.3]	[0.13, 4.3]
	10	0.25	[0, 2.5]	[0.052, 3.6]	[0.1, 4]	[0.13, 4.9]	[0.14, 5.4]	[0.16, 5.4]
	10	0.50	[0, 5]	[0.1, 7.2]	[0.21, 8.1]	[0.27, 9.9]	[0.29, 10]	[0.32, 10]
	10	0.75	[0, 7.5]	[0.15, 10]	[0.31, 12]	[0.4, 14]	[0.44, 16]	[0.49, 16]
	10	1.0	[0, 10]	[0.21, 14]	[0.42, 16]	[0.54, 19]	[0.59, 21]	[0.65, 21]
	25	0.25	[0, 6.2]	[0.13, 9.1]	[0.26, 10]	[0.33, 12]	[0.37, 13]	[0.4, 13]
	25	0.50	[0, 13]	[0.26, 18]	[0.52, 20]	[0.67, 24]	[0.74, 27]	[0.81, 27]
	25	0.75	[0, 19]	[0.39, 27]	[0.79, 30]	[1, 37]	[1.1, 40]	[1.2, 40]
	25	1.0	[0, 25]	[0.52, 36]	[1, 40]	[1.3, 49]	[1.4, 54]	[1.6, 54]

MONTE CARLO ANALOG

Receptor	Total PCB Concentration in Cornfield (mg/kg dw)	Fraction of Cornfield in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	0.0019	0.0052	0.0091	0.012	0.013	0.015
	0.5	0.50	0.0038	0.010	0.018	0.023	0.026	0.030
	0.5	0.75	0.0057	0.016	0.027	0.035	0.039	0.046
	0.5	1.0	0.0076	0.021	0.036	0.046	0.052	0.061
	2	0.25	0.0076	0.021	0.036	0.046	0.052	0.061
	2	0.50	0.015	0.042	0.072	0.092	0.10	0.12
	2	0.75	0.023	0.063	0.11	0.14	0.16	0.18
	2	1.0	0.030	0.083	0.14	0.18	0.21	0.24
	10	0.25	0.038	0.10	0.18	0.23	0.26	0.30
	10	0.50	0.076	0.21	0.36	0.46	0.52	0.61
	10	0.75	0.113	0.31	0.54	0.69	0.78	0.91
	10	1.0	0.15	0.42	0.72	0.92	1.0	1.2
	25	0.25	0.095	0.26	0.45	0.58	0.65	0.76
	25	0.50	0.19	0.52	0.91	1.2	1.3	1.5
	25	0.75	0.28	0.78	1.4	1.7	2.0	2.3
	25	1.0	0.38	1.0	1.8	2.3	2.6	3.0
Child	0.5	0.25	0.014	0.029	0.041	0.048	0.051	0.057
	0.5	0.50	0.029	0.058	0.083	0.096	0.10	0.11
	0.5	0.75	0.043	0.087	0.12	0.14	0.15	0.17
	0.5	1.0	0.058	0.12	0.17	0.19	0.21	0.23
	2	0.25	0.058	0.12	0.17	0.19	0.21	0.23
	2	0.50	0.12	0.23	0.33	0.38	0.41	0.46
	2	0.75	0.17	0.35	0.50	0.58	0.62	0.68
	2	1.0	0.23	0.46	0.66	0.77	0.82	0.91
	10	0.25	0.29	0.58	0.83	0.96	1.03	1.14
	10	0.50	0.58	1.16	1.65	1.92	2.06	2.28
	10	0.75	0.87	1.73	2.48	2.88	3.09	3.42
	10	1.0	1.16	2.31	3.31	3.84	4.11	4.56
	25	0.25	0.72	1.4	2.1	2.4	2.6	2.8
	25	0.50	1.4	2.9	4.1	4.8	5.1	5.7
	25	0.75	2.2	4.3	6.2	7.2	7.7	8.5
	25	1.0	2.9	5.8	8.3	9.6	10	11

Table 6-14

Noncancer Hazard Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Commercial Dairy Consumption

DEPENDENCY BOUNDS

Receptor	Total PCB Concentration in Cornfield (mg/kg dw)	Fraction of Cornfield in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	[0.0017, 0.002]	[0.005, 0.0053]	[0.0088, 0.0092]	[0.011, 0.011]	[0.012, 0.013]	[0.014, 0.015]
	0.5	0.50	[0.0035, 0.004]	[0.01, 0.01]	[0.017, 0.018]	[0.022, 0.023]	[0.025, 0.026]	[0.029, 0.031]
	0.5	0.75	[0.0053, 0.006]	[0.015, 0.016]	[0.026, 0.027]	[0.033, 0.035]	[0.037, 0.04]	[0.043, 0.047]
	0.5	1.0	[0.0071, 0.008]	[0.02, 0.021]	[0.035, 0.036]	[0.045, 0.047]	[0.05, 0.053]	[0.058, 0.063]
	2	0.25	[0.0071, 0.008]	[0.02, 0.021]	[0.035, 0.036]	[0.045, 0.047]	[0.05, 0.053]	[0.058, 0.063]
	2	0.50	[0.014, 0.016]	[0.04, 0.042]	[0.071, 0.073]	[0.09, 0.094]	[0.1, 0.1]	[0.11, 0.12]
	2	0.75	[0.021, 0.024]	[0.06, 0.064]	[0.1, 0.11]	[0.13, 0.14]	[0.15, 0.16]	[0.17, 0.19]
	2	1.0	[0.028, 0.032]	[0.08, 0.085]	[0.14, 0.14]	[0.18, 0.18]	[0.2, 0.21]	[0.23, 0.25]
	10	0.25	[0.035, 0.04]	[0.1, 0.1]	[0.17, 0.18]	[0.22, 0.23]	[0.25, 0.26]	[0.29, 0.31]
	10	0.50	[0.071, 0.08]	[0.2, 0.21]	[0.35, 0.36]	[0.45, 0.47]	[0.5, 0.53]	[0.58, 0.63]
	10	0.75	[0.1, 0.12]	[0.3, 0.32]	[0.53, 0.55]	[0.67, 0.7]	[0.75, 0.8]	[0.87, 0.95]
	10	1.0	[0.14, 0.16]	[0.4, 0.42]	[0.71, 0.73]	[0.9, 0.94]	[1, 1]	[1.1, 1.2]
	25	0.25	[0.088, 0.1]	[0.25, 0.26]	[0.44, 0.46]	[0.56, 0.59]	[0.63, 0.67]	[0.72, 0.79]
	25	0.50	[0.17, 0.2]	[0.5, 0.53]	[0.88, 0.92]	[1.1, 1.1]	[1.2, 1.3]	[1.4, 1.5]
	25	0.75	[0.26, 0.3]	[0.75, 0.8]	[1.3, 1.3]	[1.6, 1.7]	[1.8, 2]	[2.1, 2.3]
	25	1.0	[0.35, 0.4]	[1, 1]	[1.7, 1.8]	[2.2, 2.3]	[2.5, 2.6]	[2.9, 3.1]
Child	0.5	0.25	[0.013, 0.015]	[0.028, 0.029]	[0.04, 0.041]	[0.047, 0.048]	[0.05, 0.052]	[0.055, 0.058]
	0.5	0.50	[0.027, 0.03]	[0.056, 0.059]	[0.081, 0.083]	[0.094, 0.097]	[0.1, 0.1]	[0.11, 0.11]
	0.5	0.75	[0.041, 0.045]	[0.084, 0.088]	[0.12, 0.12]	[0.14, 0.14]	[0.15, 0.15]	[0.16, 0.17]
	0.5	1.0	[0.055, 0.06]	[0.11, 0.11]	[0.16, 0.16]	[0.18, 0.19]	[0.2, 0.2]	[0.22, 0.23]
	2	0.25	[0.055, 0.06]	[0.11, 0.11]	[0.16, 0.16]	[0.18, 0.19]	[0.2, 0.2]	[0.22, 0.23]
	2	0.50	[0.11, 0.12]	[0.22, 0.23]	[0.32, 0.33]	[0.37, 0.38]	[0.4, 0.41]	[0.44, 0.46]
	2	0.75	[0.16, 0.18]	[0.33, 0.35]	[0.48, 0.5]	[0.56, 0.58]	[0.6, 0.62]	[0.66, 0.7]
	2	1.0	[0.22, 0.24]	[0.45, 0.47]	[0.65, 0.66]	[0.75, 0.77]	[0.81, 0.83]	[0.88, 0.93]
	10	0.25	[0.27, 0.3]	[0.56, 0.59]	[0.81, 0.83]	[0.94, 0.97]	[1, 1]	[1.1, 1.1]
	10	0.50	[0.55, 0.6]	[1.1, 1.1]	[1.6, 1.6]	[1.8, 1.9]	[2, 2]	[2.2, 2.3]
	10	0.75	[0.82, 0.9]	[1.6, 1.7]	[2.4, 2.5]	[2.8, 2.9]	[3, 3.1]	[3.3, 3.5]
	10	1.0	[1.1, 1.2]	[2.2, 2.3]	[3.2, 3.3]	[3.7, 3.8]	[4, 4.1]	[4.4, 4.6]
	25	0.25	[0.69, 0.75]	[1.4, 1.4]	[2, 2]	[2.3, 2.4]	[2.5, 2.6]	[2.7, 2.9]
	25	0.50	[1.3, 1.5]	[2.8, 2.9]	[4, 4.1]	[4.7, 4.8]	[5, 5.2]	[5.5, 5.8]
	25	0.75	[2, 2.2]	[4.2, 4.4]	[6.1, 6.2]	[7.1, 7.2]	[7.6, 7.8]	[8.2, 8.8]
	25	1.0	[2.7, 3]	[5.6, 5.9]	[8.1, 8.3]	[9.5, 9.7]	[10, 10]	[11, 11]

Table 6-15

Cancer Risk Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Backyard Beef Consumption

P-BOUNDS

Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Foodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	[0E+00 3E-5]	[2E-09, 6E-05]	[4E-09, 2E-04]	[5E-09, 2E-04]	[5E-09, 4E-04]	[6E-09, 5E-04]
0.5	0.50	[0E+00 7E-5]	[3E-09, 1E-04]	[8E-09, 3E-04]	[1E-08, 5E-04]	[1E-08, 8E-04]	[1E-08, 9E-04]
0.5	0.75	[0E+00 1E-4]	[5E-09, 2E-04]	[1E-08, 5E-04]	[2E-08, 7E-04]	[2E-08, 1E-03]	[2E-08, 1E-03]
0.5	1.0	[0E+00 1E-4]	[7E-09, 2E-04]	[2E-08, 7E-04]	[2E-08, 1E-03]	[2E-08, 2E-03]	[2E-08, 2E-03]
2	0.25	[0E+00 1E-4]	[7E-09, 2E-04]	[2E-08, 7E-04]	[2E-08, 1E-03]	[2E-08, 2E-03]	[2E-08, 2E-03]
2	0.50	[0E+00 3E-4]	[1E-08, 5E-04]	[3E-08, 1E-03]	[4E-08, 2E-03]	[4E-08, 3E-03]	[5E-08, 4E-03]
2	0.75	[0E+00 4E-4]	[2E-08, 7E-04]	[5E-08, 2E-03]	[6E-08, 3E-03]	[6E-08, 5E-03]	[7E-08, 6E-03]
2	1.0	[0E+00 5E-4]	[3E-08, 9E-04]	[6E-08, 3E-03]	[8E-08, 4E-03]	[8E-08, 6E-03]	[1E-07, 7E-03]
10	0.25	[0E+00 7E-4]	[3E-08, 1E-03]	[8E-08, 3E-03]	[1E-07, 5E-03]	[1E-07, 8E-03]	[1E-07, 9E-03]
10	0.50	[0E+00 1E-3]	[7E-08, 2E-03]	[2E-07, 7E-03]	[2E-07, 1E-02]	[2E-07, 2E-02]	[2E-07, 2E-02]
10	0.75	[0E+00 2E-3]	[1E-07, 3E-03]	[2E-07, 1E-02]	[3E-07, 1E-02]	[3E-07, 2E-02]	[4E-07, 3E-02]
10	1.0	[0E+00 3E-3]	[1E-07, 5E-03]	[3E-07, 1E-02]	[4E-07, 2E-02]	[4E-07, 3E-02]	[5E-07, 4E-02]
25	0.25	[0E+00 2E-3]	[8E-08, 3E-03]	[2E-07, 9E-03]	[3E-07, 1E-02]	[3E-07, 2E-02]	[3E-07, 2E-02]
25	0.50	[0E+00 3E-3]	[2E-07, 6E-03]	[4E-07, 2E-02]	[5E-07, 2E-02]	[5E-07, 4E-02]	[6E-07, 5E-02]
25	0.75	[0E+00 5E-3]	[3E-07, 9E-03]	[6E-07, 3E-02]	[8E-07, 4E-02]	[8E-07, 6E-02]	[9E-07, 7E-02]
25	1.0	[0E+00 7E-3]	[3E-07, 1E-02]	[8E-07, 3E-02]	[1E-06, 5E-02]	[1E-06, 8E-02]	[1E-06, 9E-02]

MONTE CARLO ANALOG

Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Foodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	3.E-07	8.E-07	2.E-06	5.E-06	8.E-06	2.E-05
0.5	0.50	5.E-07	2.E-06	5.E-06	1.E-05	2.E-05	3.E-05
0.5	0.75	8.E-07	2.E-06	7.E-06	2.E-05	2.E-05	5.E-05
0.5	1.0	1.E-06	3.E-06	9.E-06	2.E-05	3.E-05	6.E-05
2	0.25	1.E-06	3.E-06	9.E-06	2.E-05	3.E-05	6.E-05
2	0.50	2.E-06	7.E-06	2.E-05	4.E-05	6.E-05	1.E-04
2	0.75	3.E-06	1.E-05	3.E-05	6.E-05	9.E-05	2.E-04
2	1.0	4.E-06	1.E-05	4.E-05	8.E-05	1.E-04	3.E-04
10	0.25	5.E-06	2.E-05	5.E-05	1.E-04	2.E-04	3.E-04
10	0.50	1.E-05	3.E-05	9.E-05	2.E-04	3.E-04	6.E-04
10	0.75	2.E-05	5.E-05	1.E-04	3.E-04	5.E-04	1.E-03
10	1.0	2.E-05	7.E-05	2.E-04	4.E-04	6.E-04	1.E-03
25	0.25	1.E-05	4.E-05	1.E-04	3.E-04	4.E-04	8.E-04
25	0.50	3.E-05	8.E-05	2.E-04	5.E-04	8.E-04	2.E-03
25	0.75	4.E-05	1.E-04	3.E-04	8.E-04	1.E-03	2.E-03
25	1.0	5.E-05	2.E-04	5.E-04	1.E-03	2.E-03	3.E-03

DEPENDENCY BOUNDS

Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Foodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	[5E-08, 2E-06]	[2E-07, 4E-06]	[4E-07, 9E-06]	[7E-07, 2E-05]	[9E-07, 3E-05]	[1E-06, 4E-05]
0.5	0.50	[9E-08, 3E-06]	[3E-07, 8E-06]	[8E-07, 2E-05]	[1E-06, 4E-05]	[2E-06, 5E-05]	[3E-06, 9E-05]
0.5	0.75	[1E-07, 5E-06]	[5E-07, 1E-05]	[1E-06, 3E-05]	[2E-06, 6E-05]	[3E-06, 8E-05]	[4E-06, 1E-04]
0.5	1.0	[2E-07, 7E-06]	[7E-07, 2E-05]	[2E-06, 4E-05]	[3E-06, 7E-05]	[4E-06, 1E-04]	[5E-06, 2E-04]
2	0.25	[2E-07, 7E-06]	[7E-07, 2E-05]	[2E-06, 4E-05]	[3E-06, 7E-05]	[4E-06, 1E-04]	[5E-06, 2E-04]
2	0.50	[4E-07, 1E-05]	[1E-06, 3E-05]	[3E-06, 7E-05]	[6E-06, 1E-04]	[8E-06, 2E-04]	[1E-05, 4E-04]
2	0.75	[6E-07, 2E-05]	[2E-06, 5E-05]	[5E-06, 1E-04]	[9E-06, 2E-04]	[1E-05, 3E-04]	[2E-05, 5E-04]
2	1.0	[7E-07, 3E-05]	[3E-06, 6E-05]	[7E-06, 1E-04]	[1E-05, 3E-04]	[2E-05, 4E-04]	[2E-05, 7E-04]
10	0.25	[9E-07, 3E-05]	[3E-06, 8E-05]	[8E-06, 2E-04]	[1E-05, 4E-04]	[2E-05, 5E-04]	[3E-05, 9E-04]
10	0.50	[2E-06, 7E-05]	[7E-06, 2E-04]	[2E-05, 4E-04]	[3E-05, 7E-04]	[4E-05, 1E-03]	[5E-05, 2E-03]
10	0.75	[3E-06, 1E-04]	[1E-05, 2E-04]	[3E-05, 6E-04]	[4E-05, 1E-03]	[6E-05, 2E-03]	[8E-05, 3E-03]
10	1.0	[4E-06, 1E-04]	[1E-05, 3E-04]	[3E-05, 7E-04]	[6E-05, 1E-03]	[8E-05, 2E-03]	[1E-04, 4E-03]
25	0.25	[2E-06, 8E-05]	[9E-06, 2E-04]	[2E-05, 5E-04]	[4E-05, 9E-04]	[5E-05, 1E-03]	[6E-05, 2E-03]
25	0.50	[5E-06, 2E-04]	[2E-05, 4E-04]	[4E-05, 9E-04]	[7E-05, 2E-03]	[9E-05, 3E-03]	[1E-04, 4E-03]
25	0.75	[7E-06, 3E-04]	[3E-05, 6E-04]	[6E-05, 1E-03]	[1E-04, 3E-03]	[1E-04, 4E-03]	[2E-04, 7E-03]
25	1.0	[9E-06, 3E-04]	[3E-05, 8E-04]	[8E-05, 2E-03]	[1E-04, 4E-03]	[2E-04, 5E-03]	[3E-04, 9E-03]

Table 6-16

Noncancer Hazard Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Backyard Beef Consumption

P-BOUNDS

Receptor	Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	[0, 0.94]	[0.0039, 1.5]	[0.0066, 3.1]	[0.0088, 5.9]	[0.0088, 5.9]	[0.01, 9.5]
	0.5	0.50	[0, 1.8]	[0.0078, 3]	[0.013, 6.3]	[0.017, 11]	[0.017, 11]	[0.021, 19]
	0.5	0.75	[0, 2.8]	[0.011, 4.5]	[0.019, 9.5]	[0.026, 17]	[0.026, 17]	[0.032, 28]
	0.5	1.0	[0, 3.7]	[0.015, 6]	[0.026, 12]	[0.035, 23]	[0.035, 23]	[0.042, 38]
	2	0.25	[0, 3.7]	[0.015, 6]	[0.026, 12]	[0.035, 23]	[0.035, 23]	[0.042, 38]
	2	0.50	[0, 7.5]	[0.031, 12]	[0.052, 25]	[0.07, 47]	[0.07, 47]	[0.085, 76]
	2	0.75	[0, 11]	[0.047, 18]	[0.079, 38]	[0.1, 71]	[0.1, 71]	[0.12, 114]
	2	1.0	[0, 15]	[0.062, 24]	[0.1, 50]	[0.14, 95]	[0.14, 95]	[0.17, 153]
	10	0.25	[0, 18]	[0.078, 30]	[0.13, 63]	[0.17, 118]	[0.17, 118]	[0.21, 191]
	10	0.50	[0, 37]	[0.15, 60]	[0.26, 127]	[0.35, 237]	[0.35, 237]	[0.42, 382]
	10	0.75	[0, 56]	[0.23, 91]	[0.39, 191]	[0.52, 356]	[0.52, 356]	[0.64, 573]
	10	1.0	[0, 75]	[0.31, 121]	[0.52, 254]	[0.7, 475]	[0.7, 475]	[0.85, 765]
	25	0.25	[0, 47]	[0.19, 75]	[0.33, 159]	[0.44, 297]	[0.44, 297]	[0.53, 478]
	25	0.50	[0, 94]	[0.39, 151]	[0.66, 318]	[0.88, 594]	[0.88, 594]	[1, 956]
	25	0.75	[0, 142]	[0.58, 227]	[0.99, 477]	[1.3, 891]	[1.3, 891]	[1.6, 1434]
	25	1.0	[0, 189]	[0.78, 303]	[1.3, 637]	[1.7, 1188]	[1.7, 1188]	[2.1, 1912]
Child	0.5	0.25	[0, 2.4]	[0.003, 5.1]	[0.0076, 10]	[0.0099, 11]	[0.011, 11]	[0.012, 11]
	0.5	0.50	[0, 4.8]	[0.0061, 10]	[0.015, 21]	[0.019, 23]	[0.022, 23]	[0.024, 23]
	0.5	0.75	[0, 7.2]	[0.0092, 15]	[0.022, 31]	[0.029, 34]	[0.033, 34]	[0.036, 34]
	0.5	1.0	[0, 9.6]	[0.012, 20]	[0.03, 42]	[0.039, 46]	[0.045, 46]	[0.048, 46]
	2	0.25	[0, 9.6]	[0.012, 20]	[0.03, 42]	[0.039, 46]	[0.045, 46]	[0.048, 46]
	2	0.50	[0, 19]	[0.024, 40]	[0.06, 84]	[0.079, 92]	[0.09, 92]	[0.097, 92]
	2	0.75	[0, 29]	[0.036, 61]	[0.091, 126]	[0.11, 138]	[0.13, 138]	[0.14, 138]
	2	1.0	[0, 38]	[0.049, 81]	[0.12, 169]	[0.15, 184]	[0.18, 184]	[0.19, 184]
	10	0.25	[0, 48]	[0.061, 102]	[0.15, 211]	[0.19, 230]	[0.22, 230]	[0.24, 230]
	10	0.50	[0, 96]	[0.12, 204]	[0.3, 423]	[0.39, 460]	[0.45, 460]	[0.48, 460]
	10	0.75	[0, 145]	[0.18, 306]	[0.45, 634]	[0.59, 690]	[0.67, 690]	[0.73, 690]
	10	1.0	[0, 193]	[0.24, 408]	[0.6, 846]	[0.79, 920]	[0.9, 920]	[0.97, 920]
	25	0.25	[0, 121]	[0.15, 255]	[0.38, 528]	[0.49, 575]	[0.56, 575]	[0.6, 575]
	25	0.50	[0, 242]	[0.3, 511]	[0.76, 1057]	[0.99, 1150]	[1.1, 1150]	[1.2, 1150]
	25	0.75	[0, 363]	[0.46, 766]	[1.1, 1586]	[1.4, 1725]	[1.6, 1725]	[1.8, 1725]
	25	1.0	[0, 484]	[0.61, 1022]	[1.5, 2115]	[1.9, 2301]	[2.3, 2301]	[2.4, 2301]

MONTE CARLO ANALOG

Receptor	Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	0.072	0.15	0.29	0.51	0.68	1.1
	0.5	0.50	0.14	0.30	0.58	1.0	1.4	2.2
	0.5	0.75	0.22	0.45	0.87	1.5	2.0	3.3
	0.5	1.0	0.29	0.60	1.2	2.0	2.7	4.4
	2	0.25	0.29	0.60	1.2	2.0	2.7	4.4
	2	0.50	0.58	1.2	2.3	4.0	5.5	8.9
	2	0.75	0.87	1.8	3.5	6.1	8.2	13
	2	1.0	1.2	2.4	4.7	8.1	11	18
	10	0.25	1.4	3.0	5.8	10	14	22
	10	0.50	2.9	6.0	12	20	27	44
	10	0.75	4.3	9.0	17	30	41	67
	10	1.0	5.8	12	23	40	55	89
	25	0.25	3.6	7.5	15	25	34	56
	25	0.50	7.2	15	29	51	68	111
	25	0.75	11	22	44	76	102	167
	25	1.0	14	30	58	101	136	222
Child	0.5	0.25	0.12	0.26	0.54	0.96	1.3	2.1
	0.5	0.50	0.23	0.52	1.1	1.9	2.6	4.3
	0.5	0.75	0.35	0.78	1.6	2.9	3.9	6.4
	0.5	1.0	0.46	1.0	2.2	3.8	5.2	8.6
	2	0.25	0.46	1.0	2.2	3.8	5.2	8.6
	2	0.50	0.93	2.1	4.3	7.6	10	17
	2	0.75	1.4	3.1	6.5	11	16	26
	2	1.0	1.9	4.2	8.6	15	21	34
	10	0.25	2.3	5.2	11	19	26	43
	10	0.50	4.6	10	22	38	52	86
	10	0.75	7.0	16	32	57	78	129
	10	1.0	9.3	21	43	76	104	172
	25	0.25	5.8	13	27	48	65	107
	25	0.50	12	26	54	96	130	215
	25	0.75	17	39	81	143	196	322
	25	1.0	23	52	108	191	261	429

Table 6-16

Noncancer Hazard Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Backyard Beef Consumption

DEPENDENCY BOUNDS

Receptor	Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	[0.061, 0.085]	[0.13, 0.17]	[0.25, 0.34]	[0.42, 0.59]	[0.55, 0.81]	[0.76, 1.4]
	0.5	0.50	[0.12, 0.17]	[0.26, 0.34]	[0.5, 0.67]	[0.84, 1.2]	[1.1, 1.6]	[1.5, 2.8]
	0.5	0.75	[0.18, 0.25]	[0.39, 0.52]	[0.75, 1]	[1.2, 1.8]	[1.6, 2.4]	[2.2, 4.2]
	0.5	1.0	[0.25, 0.34]	[0.51, 0.69]	[1, 1.3]	[1.6, 2.4]	[2.2, 3.2]	[3, 5.6]
	2	0.25	[0.25, 0.34]	[0.51, 0.69]	[1, 1.3]	[1.6, 2.4]	[2.2, 3.2]	[3, 5.6]
	2	0.50	[0.49, 0.68]	[1, 1.4]	[2, 2.7]	[3.3, 4.7]	[4.4, 6.5]	[6.1, 11]
	2	0.75	[0.74, 1]	[1.5, 2.1]	[3, 4]	[5, 7.1]	[6.6, 9.7]	[9.1, 17]
	2	1.0	[0.98, 1.4]	[2.1, 2.8]	[4, 5.4]	[6.7, 9.4]	[8.8, 13]	[12, 22]
	10	0.25	[1.2, 1.7]	[2.6, 3.1]	[5, 6.7]	[8.4, 12]	[11, 16]	[15, 28]
	10	0.50	[2.5, 3.4]	[5.1, 6.9]	[10, 13]	[16, 24]	[22, 32]	[30, 56]
	10	0.75	[3.7, 5.1]	[7.7, 10]	[15, 20]	[25, 36]	[33, 48]	[45, 85]
	10	1.0	[1.9, 6.8]	[10, 14]	[20, 27]	[33, 47]	[44, 65]	[61, 113]
	25	0.25	[3.1, 4.2]	[6.4, 8.6]	[12, 16]	[21, 30]	[27, 40]	[38, 71]
	25	0.50	[6.1, 8.5]	[13, 17]	[25, 34]	[42, 59]	[55, 81]	[76, 142]
	25	0.75	[9.2, 13]	[19, 26]	[37, 50]	[63, 88]	[83, 122]	[114, 213]
	25	1.0	[12, 17]	[26, 34]	[50, 67]	[84, 119]	[110, 162]	[153, 284]
Child	0.5	0.25	[0.1, 0.14]	[0.22, 0.3]	[0.46, 0.62]	[0.79, 1.1]	[1, 1.5]	[1.4, 2.7]
	0.5	0.50	[0.19, 0.27]	[0.45, 0.61]	[0.92, 1.2]	[1.5, 2.2]	[2.1, 3.1]	[2.9, 5.5]
	0.5	0.75	[0.29, 0.41]	[0.67, 0.91]	[1.4, 1.8]	[2.3, 3.4]	[3.1, 4.6]	[4.3, 8.2]
	0.5	1.0	[0.39, 0.55]	[0.9, 1.2]	[1.8, 2.4]	[3.1, 4.5]	[4.2, 6.2]	[5.8, 11]
	2	0.25	[0.39, 0.55]	[0.9, 1.2]	[1.8, 2.4]	[3.1, 4.5]	[4.2, 6.2]	[5.8, 11]
	2	0.50	[0.78, 1.1]	[1.8, 2.4]	[3.7, 4.9]	[6.3, 9]	[8.4, 12]	[11, 22]
	2	0.75	[1.2, 1.6]	[2.7, 3.6]	[5.5, 7.4]	[9.5, 13]	[12, 18]	[17, 33]
	2	1.0	[1.6, 2.2]	[3.6, 4.8]	[7.4, 9.9]	[12, 18]	[16, 24]	[23, 44]
	10	0.25	[2, 2.7]	[4.5, 6.1]	[9.2, 12]	[15, 22]	[21, 31]	[29, 55]
	10	0.50	[3.9, 5.5]	[9, 12]	[18, 25]	[31, 45]	[42, 62]	[58, 110]
	10	0.75	[5.9, 8.2]	[13, 18]	[28, 37]	[47, 68]	[63, 93]	[87, 165]
	10	1.0	[7.8, 11]	[18, 24]	[37, 50]	[63, 90]	[84, 124]	[117, 221]
	25	0.25	[4.9, 6.8]	[11, 15]	[23, 31]	[39, 56]	[52, 78]	[73, 138]
	25	0.50	[9.8, 14]	[22, 30]	[46, 62]	[79, 113]	[105, 156]	[146, 276]
	25	0.75	[15, 20]	[34, 45]	[69, 94]	[118, 169]	[157, 234]	[219, 414]
	25	1.0	[19, 27]	[45, 61]	[92, 125]	[158, 225]	[210, 312]	[292, 553]

Table 6-17

Cancer Risk Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Commercial Poultry Meat Consumption

P-BOUNDS

Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	[0E+00 3E-5]	[1E-09, 6E-05]	[3E-09, 9E-05]	[4E-09, 1E-04]	[4E-09, 2E-04]	[6E-09, 3E-04]
0.5	0.50	[0E+00 7E-5]	[3E-09, 1E-04]	[6E-09, 2E-04]	[8E-09, 2E-04]	[9E-09, 3E-04]	[1E-08, 6E-04]
0.5	0.75	[0E+00 1E-4]	[4E-09, 2E-04]	[8E-09, 3E-04]	[1E-08, 4E-04]	[1E-08, 5E-04]	[2E-08, 8E-04]
0.5	1.0	[0E+00 1E-4]	[6E-09, 2E-04]	[1E-08, 3E-04]	[2E-08, 5E-04]	[2E-08, 7E-04]	[2E-08, 1E-03]
2	0.25	[0E+00 1E-4]	[6E-09, 2E-04]	[1E-08, 3E-04]	[2E-08, 5E-04]	[2E-08, 7E-04]	[2E-08, 1E-03]
2	0.50	[0E+00 3E-4]	[1E-08, 5E-04]	[2E-08, 7E-04]	[3E-08, 1E-03]	[4E-08, 1E-03]	[5E-08, 2E-03]
2	0.75	[0E+00 4E-4]	[2E-08, 7E-04]	[3E-08, 1E-03]	[5E-08, 1E-03]	[5E-08, 2E-03]	[7E-08, 3E-03]
2	1.0	[0E+00 5E-4]	[2E-08, 9E-04]	[4E-08, 1E-03]	[6E-08, 2E-03]	[7E-08, 3E-03]	[1E-07, 4E-03]
10	0.25	[0E+00 7E-4]	[3E-08, 1E-03]	[6E-08, 2E-03]	[8E-08, 2E-03]	[9E-08, 3E-03]	[1E-07, 6E-03]
10	0.50	[0E+00 1E-3]	[6E-08, 2E-03]	[1E-07, 3E-03]	[2E-07, 5E-03]	[2E-07, 7E-03]	[2E-07, 1E-02]
10	0.75	[0E+00 2E-3]	[9E-08, 4E-03]	[2E-07, 5E-03]	[2E-07, 7E-03]	[3E-07, 1E-02]	[4E-07, 2E-02]
10	1.0	[0E+00 3E-3]	[1E-07, 5E-03]	[2E-07, 7E-03]	[3E-07, 1E-02]	[4E-07, 1E-02]	[5E-07, 2E-02]
25	0.25	[0E+00 2E-3]	[7E-08, 3E-03]	[1E-07, 4E-03]	[2E-07, 6E-03]	[2E-07, 8E-03]	[3E-07, 1E-02]
25	0.50	[0E+00 3E-3]	[1E-07, 6E-03]	[3E-07, 9E-03]	[4E-07, 1E-02]	[4E-07, 2E-02]	[6E-07, 3E-02]
25	0.75	[0E+00 5E-3]	[2E-07, 9E-03]	[4E-07, 1E-02]	[6E-07, 2E-02]	[7E-07, 2E-02]	[9E-07, 4E-02]
25	1.0	[0E+00 7E-3]	[3E-07, 1E-02]	[6E-07, 2E-02]	[8E-07, 2E-02]	[9E-07, 3E-02]	[1E-06, 6E-02]

MONTE CARLO ANALOG

Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	2.E-07	6.E-07	2.E-06	3.E-06	5.E-06	1.E-05
0.5	0.50	4.E-07	1.E-06	3.E-06	7.E-06	1.E-05	2.E-05
0.5	0.75	6.E-07	2.E-06	5.E-06	1.E-05	1.E-05	3.E-05
0.5	1.0	8.E-07	2.E-06	6.E-06	1.E-05	2.E-05	4.E-05
2	0.25	8.E-07	2.E-06	6.E-06	1.E-05	2.E-05	4.E-05
2	0.50	2.E-06	5.E-06	1.E-05	3.E-05	4.E-05	8.E-05
2	0.75	2.E-06	7.E-06	2.E-05	4.E-05	6.E-05	1.E-04
2	1.0	3.E-06	1.E-05	2.E-05	5.E-05	8.E-05	2.E-04
10	0.25	4.E-06	1.E-05	3.E-05	7.E-05	1.E-04	2.E-04
10	0.50	8.E-06	2.E-05	6.E-05	1.E-04	2.E-04	4.E-04
10	0.75	1.E-05	4.E-05	9.E-05	2.E-04	3.E-04	6.E-04
10	1.0	2.E-05	5.E-05	1.E-04	3.E-04	4.E-04	8.E-04
25	0.25	1.E-05	3.E-05	8.E-05	2.E-04	2.E-04	5.E-04
25	0.50	2.E-05	6.E-05	2.E-04	3.E-04	5.E-04	1.E-03
25	0.75	3.E-05	9.E-05	2.E-04	5.E-04	7.E-04	1.E-03
25	1.0	4.E-05	1.E-04	3.E-04	7.E-04	1.E-03	2.E-03

DEPENDENCY BOUNDS

Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	[6E-08, 1E-06]	[2E-07, 2E-06]	[4E-07, 5E-06]	[6E-07, 1E-05]	[8E-07, 2E-05]	[1E-06, 3E-05]
0.5	0.50	[1E-07, 2E-06]	[3E-07, 5E-06]	[7E-07, 1E-05]	[1E-06, 2E-05]	[2E-06, 3E-05]	[2E-06, 5E-05]
0.5	0.75	[2E-07, 3E-06]	[5E-07, 7E-06]	[1E-06, 2E-05]	[2E-06, 3E-05]	[2E-06, 5E-05]	[3E-06, 8E-05]
0.5	1.0	[2E-07, 4E-06]	[7E-07, 9E-06]	[1E-06, 2E-05]	[2E-06, 4E-05]	[3E-06, 6E-05]	[4E-06, 1E-04]
2	0.25	[2E-07, 4E-06]	[7E-07, 9E-06]	[1E-06, 2E-05]	[2E-06, 4E-05]	[3E-06, 6E-05]	[4E-06, 1E-04]
2	0.50	[5E-07, 8E-06]	[1E-06, 2E-05]	[3E-06, 4E-05]	[5E-06, 8E-05]	[6E-06, 1E-04]	[8E-06, 2E-04]
2	0.75	[7E-07, 1E-05]	[2E-06, 3E-05]	[4E-06, 6E-05]	[7E-06, 1E-04]	[9E-06, 2E-04]	[1E-05, 3E-04]
2	1.0	[9E-07, 2E-05]	[3E-06, 4E-05]	[6E-06, 8E-05]	[1E-05, 2E-04]	[1E-05, 2E-04]	[2E-05, 4E-04]
10	0.25	[1E-06, 2E-05]	[3E-06, 5E-05]	[7E-06, 1E-04]	[1E-05, 2E-04]	[2E-05, 3E-04]	[2E-05, 5E-04]
10	0.50	[2E-06, 4E-05]	[7E-06, 9E-05]	[1E-05, 2E-04]	[2E-05, 4E-04]	[3E-05, 6E-04]	[4E-05, 1E-03]
10	0.75	[3E-06, 6E-05]	[1E-05, 1E-04]	[2E-05, 3E-04]	[4E-05, 6E-04]	[5E-05, 9E-04]	[6E-05, 2E-03]
10	1.0	[5E-06, 8E-05]	[1E-05, 2E-04]	[3E-05, 4E-04]	[5E-05, 8E-04]	[6E-05, 1E-03]	[8E-05, 2E-03]
25	0.25	[3E-06, 5E-05]	[8E-06, 1E-04]	[2E-05, 3E-04]	[3E-05, 5E-04]	[4E-05, 8E-04]	[5E-05, 1E-03]
25	0.50	[6E-06, 1E-04]	[2E-05, 2E-04]	[4E-05, 5E-04]	[6E-05, 1E-03]	[8E-05, 2E-03]	[1E-04, 3E-03]
25	0.75	[9E-06, 2E-04]	[3E-05, 3E-04]	[5E-05, 8E-04]	[9E-05, 2E-03]	[1E-04, 2E-03]	[2E-04, 4E-03]
25	1.0	[1E-05, 2E-04]	[3E-05, 5E-04]	[7E-05, 1E-03]	[1E-04, 2E-03]	[2E-04, 3E-03]	[2E-04, 5E-03]

Table 6-18

Noncancer Hazard Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Commercial Poultry Meat Consumption

P-BOUNDS

Receptor	Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	[0, 0.85]	[0.0025, 1.6]	[0.0047, 3.1]	[0.0064, 3.1]	[0.0075, 3.1]	[0.0081, 4.1]
	0.5	0.50	[0, 1.7]	[0.005, 3.1]	[0.0094, 6.1]	[0.013, 6.1]	[0.015, 6.1]	[0.016, 8.3]
	0.5	0.75	[0, 2.6]	[0.0075, 4.7]	[0.014, 9.2]	[0.019, 9.2]	[0.022, 9.2]	[0.024, 12]
	0.5	1.0	[0, 3.4]	[0.01, 6.2]	[0.019, 12]	[0.025, 12]	[0.03, 12]	[0.032, 17]
	2	0.25	[0, 3.4]	[0.01, 6.2]	[0.019, 12]	[0.025, 12]	[0.03, 12]	[0.032, 17]
	2	0.50	[0, 6.8]	[0.2, 12]	[0.038, 25]	[0.051, 25]	[0.06, 25]	[0.065, 33]
	2	0.75	[0, 10]	[0.03, 19]	[0.057, 37]	[0.076, 37]	[0.09, 37]	[0.097, 50]
	2	1.0	[0, 14]	[0.04, 25]	[0.075, 49]	[0.1, 49]	[0.12, 49]	[0.13, 66]
	10	0.25	[0, 17]	[0.05, 31]	[0.094, 61]	[0.13, 61]	[0.15, 61]	[0.16, 83]
	10	0.50	[0, 34]	[0.1, 62]	[0.19, 123]	[0.25, 123]	[0.3, 123]	[0.32, 165]
	10	0.75	[0, 51]	[0.15, 94]	[0.28, 184]	[0.38, 184]	[0.45, 184]	[0.48, 248]
	10	1.0	[0, 68]	[0.2, 125]	[0.68, 246]	[0.51, 246]	[0.6, 246]	[0.65, 331]
	25	0.25	[0, 43]	[0.12, 78]	[0.24, 153]	[0.31, 153]	[0.37, 153]	[0.4, 207]
	25	0.50	[0, 85]	[0.25, 156]	[0.47, 307]	[0.64, 307]	[0.75, 307]	[0.81, 414]
	25	0.75	[0, 128]	[0.37, 234]	[0.71, 460]	[0.95, 460]	[1.1, 460]	[1.1, 620]
	25	1.0	[0, 171]	[0.5, 312]	[0.94, 614]	[1.3, 614]	[1.5, 614]	[1.6, 827]
Child	0.5	0.25	[0, 1.4]	[0.005, 2]	[0.01, 4.1]	[0.013, 7]	[0.014, 7]	[0.015, 7]
	0.5	0.50	[0, 2.7]	[0.01, 4]	[0.02, 8.2]	[0.026, 14]	[0.028, 14]	[0.029, 14]
	0.5	0.75	[0, 4.1]	[0.015, 6]	[0.03, 12]	[0.039, 21]	[0.042, 21]	[0.044, 21]
	0.5	1.0	[0, 5.4]	[0.2, 8]	[0.041, 16]	[0.052, 28]	[0.056, 28]	[0.059, 28]
	2	0.25	[0, 5.4]	[0.2, 8]	[0.041, 16]	[0.052, 28]	[0.056, 28]	[0.059, 28]
	2	0.50	[0, 11]	[0.039, 16]	[0.081, 33]	[0.1, 56]	[0.11, 56]	[0.12, 56]
	2	0.75	[0, 16]	[0.059, 24]	[0.12, 49]	[0.16, 84]	[0.17, 84]	[0.18, 84]
	2	1.0	[0, 22]	[0.079, 32]	[0.16, 66]	[0.21, 112]	[0.22, 112]	[0.24, 112]
	10	0.25	[0, 27]	[0.099, 40]	[0.2, 82]	[0.26, 140]	[0.28, 140]	[0.29, 140]
	10	0.50	[0, 54]	[0.2, 79]	[0.41, 165]	[0.52, 280]	[0.56, 280]	[0.59, 280]
	10	0.75	[0, 82]	[0.3, 119]	[0.61, 247]	[0.78, 421]	[0.83, 421]	[0.88, 421]
	10	1.0	[0, 109]	[0.39, 159]	[0.81, 329]	[1, 561]	[1.1, 561]	[1.2, 561]
	25	0.25	[0, 68]	[0.25, 99]	[0.51, 206]	[0.65, 350]	[0.69, 350]	[0.74, 350]
	25	0.50	[0, 136]	[0.49, 199]	[1, 411]	[1.3, 701]	[1.4, 701]	[1.5, 701]
	25	0.75	[0, 204]	[0.74, 298]	[1.5, 617]	[1.9, 1051]	[2.1, 1051]	[2.2, 1051]
	25	1.0	[0, 272]	[0.99, 397]	[2, 823]	[2.6, 1402]	[2.8, 1402]	[2.9, 1402]

MONTE CARLO ANALOG

Receptor	Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	0.041	0.079	0.15	0.25	0.32	0.52
	0.5	0.50	0.082	0.16	0.30	0.50	0.64	1.0
	0.5	0.75	0.12	0.24	0.46	0.74	0.96	1.6
	0.5	1.0	0.16	0.32	0.61	0.99	1.3	2.1
	2	0.25	0.16	0.32	0.61	0.99	1.3	2.1
	2	0.50	0.33	0.64	1.2	2.0	2.6	4.2
	2	0.75	0.49	0.95	1.8	3.0	3.8	6.3
	2	1.0	0.65	1.3	2.4	4.0	5.1	8.4
	10	0.25	0.82	1.6	3.0	5.0	6.4	10
	10	0.50	1.6	3.2	6.1	9.9	13	21
	10	0.75	2.4	4.8	9.1	15	19	31
	10	1.0	3.3	6.4	12	20	26	42
	25	0.25	2.0	4.0	7.6	12	16	26
	25	0.50	4.1	7.9	15	25	32	52
	25	0.75	6.1	12	23	37	48	79
	25	1.0	8.2	16	30	50	64	105
Child	0.5	0.25	0.070	0.14	0.24	0.36	0.48	0.88
	0.5	0.50	0.14	0.28	0.48	0.73	0.97	1.8
	0.5	0.75	0.21	0.42	0.71	1.1	1.5	2.6
	0.5	1.0	0.28	0.56	0.95	1.5	1.9	3.5
	2	0.25	0.28	0.56	0.95	1.5	1.9	3.5
	2	0.50	0.56	1.1	1.9	2.9	3.9	7.0
	2	0.75	0.84	1.7	2.9	4.4	5.8	11
	2	1.0	1.1	2.2	3.8	5.8	7.7	14
	10	0.25	1.4	2.8	4.8	7.3	9.7	18
	10	0.50	2.8	5.6	9.5	15	19	35
	10	0.75	4.2	8.4	14	22	29	53
	10	1.0	5.6	11	19	29	39	70
	25	0.25	3.5	7.0	12	18	24	44
	25	0.50	7.0	14	24	36	48	88
	25	0.75	10	21	36	55	73	132
	25	1.0	14	28	48	73	97	176

Table 6-18

Noncancer Hazard Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Commercial Poultry Meat Consumption

DEPENDENCY BOUNDS

Receptor	Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	[0.035, 0.047]	[0.069, 0.091]	[0.13, 0.18]	[0.21, 0.29]	[0.26, 0.38]	[0.35, 0.69]
	0.5	0.50	[0.07, 0.095]	[0.14, 0.18]	[0.26, 0.35]	[0.42, 0.58]	[0.52, 0.75]	[0.7, 1.4]
	0.5	0.75	[0.11, 0.14]	[0.21, 0.27]	[0.39, 0.53]	[0.63, 0.87]	[0.78, 1.1]	[1.1, 2.1]
	0.5	1.0	[0.14, 0.19]	[0.27, 0.37]	[0.53, 0.7]	[0.84, 1.2]	[1, 1.5]	[1.4, 2.7]
	2	0.25	[0.14, 0.19]	[0.27, 0.37]	[0.53, 0.7]	[0.84, 1.2]	[1, 1.5]	[1.4, 2.7]
	2	0.50	[0.28, 0.38]	[0.55, 0.73]	[1.1, 1.4]	[1.7, 2.3]	[2.1, 3]	[2.8, 5.5]
	2	0.75	[0.42, 0.57]	[0.82, 1.1]	[1.6, 2.1]	[2.5, 3.5]	[3.1, 4.5]	[4.2, 8.2]
	2	1.0	[0.56, 0.76]	[1.1, 1.5]	[2.1, 2.8]	[3.4, 4.6]	[4.2, 6]	[5.6, 11]
	10	0.25	[0.7, 0.95]	[1.4, 1.8]	[2.6, 3.5]	[4.2, 5.8]	[5.2, 7.6]	[7, 14]
	10	0.50	[4.1, 1.9]	[2.7, 3.7]	[5.3, 7]	[8.4, 12]	[10, 15]	[14, 27]
	10	0.75	[2.1, 2.8]	[4.1, 5.5]	[7.9, 11]	[13, 17]	[16, 23]	[21, 41]
	10	1.0	[2.8, 3.8]	[5.5, 7.3]	[11, 14]	[17, 23]	[21, 30]	[28, 55]
	25	0.25	[1.8, 2.4]	[3.4, 4.6]	[6.6, 8.8]	[10, 14]	[13, 19]	[18, 34]
	25	0.50	[3.5, 4.7]	[6.9, 9.1]	[13, 18]	[21, 29]	[26, 38]	[35, 69]
	25	0.75	[5.3, 7.1]	[10, 14]	[20, 26]	[31, 43]	[39, 57]	[53, 103]
	25	1.0	[7, 9.5]	[14, 18]	[26, 35]	[42, 58]	[52, 75]	[70, 137]
Child	0.5	0.25	[0.059, 0.083]	[0.12, 0.16]	[0.21, 0.27]	[0.31, 0.42]	[0.38, 0.58]	[0.55, 1.2]
	0.5	0.50	[0.12, 0.17]	[0.24, 0.32]	[0.41, 0.54]	[0.62, 0.85]	[0.76, 1.2]	[1.1, 2.4]
	0.5	0.75	[0.18, 0.25]	[0.37, 0.48]	[0.62, 0.82]	[0.92, 1.3]	[1.1, 1.7]	[1.7, 3.6]
	0.5	1.0	[0.23, 0.33]	[0.49, 0.64]	[0.83, 1.1]	[1.2, 1.7]	[1.5, 2.3]	[2.2, 4.8]
	2	0.25	[0.23, 0.33]	[0.49, 0.64]	[0.83, 1.1]	[1.2, 1.7]	[1.5, 2.3]	[2.2, 4.8]
	2	0.50	[0.47, 0.66]	[0.97, 1.3]	[1.7, 2.2]	[2.5, 3.4]	[3, 4.6]	[4.4, 9.6]
	2	0.75	[0.7, 0.99]	[1.5, 1.9]	[2.5, 3.3]	[3.7, 5.1]	[4.6, 7]	[6.6, 14]
	2	1.0	[0.94, 1.3]	[1.9, 2.6]	[3.3, 4.4]	[4.9, 6.8]	[6.1, 9.3]	[8.8, 19]
	10	0.25	[1.2, 1.7]	[2.4, 3.2]	[4.1, 5.4]	[6.2, 8.5]	[7.6, 12]	[11, 24]
	10	0.50	[2.3, 3.3]	[4.9, 6.4]	[8.3, 11]	[12, 17]	[15, 23]	[22, 48]
	10	0.75	[3.2, 5]	[7.3, 9.6]	[12, 16]	[18, 25]	[23, 35]	[33, 72]
	10	1.0	[4.7, 6.6]	[9.7, 13]	[17, 22]	[25, 34]	[30, 46]	[44, 96]
	25	0.25	[2.9, 4.1]	[6.1, 7.8]	[10, 14]	[15, 21]	[19, 29]	[28, 60]
	25	0.50	[5.9, 8.2]	[12, 16]	[21, 27]	[31, 42]	[38, 58]	[55, 120]
	25	0.75	[8.8, 12]	[18, 24]	[31, 41]	[46, 64]	[57, 87]	[83, 179]
	25	1.0	[12, 17]	[24, 32]	[41, 54]	[62, 85]	[76, 116]	[110, 239]

Table 6-19

Cancer Risk Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Commercial Poultry Egg Consumption

P-BOUNDS

Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	[0E+00 4E-5]	[0E+00 6E-05]	[0E+00 1E-04]	[9E-09, 2E-04]	[2E-08, 2E-04]	[2E-08, 3E-04]
0.5	0.50	[0E+00 8E-5]	[0E+00 1E-04]	[0E+00 2E-04]	[2E-08, 3E-04]	[4E-08, 4E-04]	[4E-08, 7E-04]
0.5	0.75	[0E+00 1E-4]	[0E+00 2E-04]	[0E+00 4E-04]	[3E-08, 5E-04]	[5E-08, 6E-04]	[7E-08, 1E-03]
0.5	1.0	[0E+00 2E-4]	[0E+00 2E-04]	[0E+00 5E-04]	[4E-08, 7E-04]	[7E-08, 9E-04]	[9E-08, 1E-03]
2	0.25	[0E+00 2E-4]	[0E+00 2E-04]	[0E+00 5E-04]	[4E-08, 7E-04]	[7E-08, 9E-04]	[9E-08, 1E-03]
2	0.50	[0E+00 3E-4]	[0E+00 5E-04]	[0E+00 1E-03]	[7E-08, 1E-03]	[1E-07, 2E-03]	[2E-07, 3E-03]
2	0.75	[0E+00 5E-4]	[0E+00 7E-04]	[0E+00 1E-03]	[1E-07, 2E-03]	[2E-07, 3E-03]	[3E-07, 4E-03]
2	1.0	[0E+00 7E-4]	[0E+00 1E-03]	[0E+00 2E-03]	[1E-07, 3E-03]	[3E-07, 3E-03]	[4E-07, 5E-03]
10	0.25	[0E+00 8E-4]	[0E+00 1E-03]	[0E+00 2E-03]	[2E-07, 3E-03]	[4E-07, 4E-03]	[4E-07, 7E-03]
10	0.50	[0E+00 2E-3]	[0E+00 2E-03]	[0E+00 5E-03]	[4E-07, 7E-03]	[7E-07, 9E-03]	[9E-07, 1E-02]
10	0.75	[0E+00 2E-3]	[0E+00 4E-03]	[0E+00 7E-03]	[5E-07, 1E-02]	[1E-06, 1E-02]	[1E-06, 2E-02]
10	1.0	[0E+00 3E-3]	[0E+00 5E-03]	[0E+00 1E-02]	[7E-07, 1E-02]	[1E-06, 2E-02]	[2E-06, 3E-02]
25	0.25	[0E+00 2E-3]	[0E+00 3E-03]	[0E+00 6E-03]	[5E-07, 9E-03]	[9E-07, 1E-02]	[1E-06, 2E-02]
25	0.50	[0E+00 4E-3]	[0E+00 6E-03]	[0E+00 1E-02]	[9E-07, 2E-02]	[2E-06, 2E-02]	[2E-06, 3E-02]
25	0.75	[0E+00 6E-3]	[0E+00 9E-03]	[0E+00 2E-02]	[1E-06, 3E-02]	[3E-06, 3E-02]	[3E-06, 5E-02]
25	1.0	[0E+00 8E-3]	[0E+00 1E-02]	[0E+00 2E-02]	[2E-06, 3E-02]	[4E-06, 4E-02]	[4E-06, 7E-02]

MONTE CARLO ANALOG

Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	6.E-07	2.E-06	5.E-06	1.E-05	1.E-05	3.E-05
0.5	0.50	1.E-06	4.E-06	1.E-05	2.E-05	3.E-05	5.E-05
0.5	0.75	2.E-06	6.E-06	1.E-05	3.E-05	4.E-05	8.E-05
0.5	1.0	2.E-06	8.E-06	2.E-05	4.E-05	6.E-05	1.E-04
2	0.25	2.E-06	8.E-06	2.E-05	4.E-05	6.E-05	1.E-04
2	0.50	5.E-06	2.E-05	4.E-05	8.E-05	1.E-04	2.E-04
2	0.75	7.E-06	2.E-05	6.E-05	1.E-04	2.E-04	3.E-04
2	1.0	1.E-05	3.E-05	8.E-05	2.E-04	2.E-04	4.E-04
10	0.25	1.E-05	4.E-05	1.E-04	2.E-04	3.E-04	5.E-04
10	0.50	2.E-05	8.E-05	2.E-04	4.E-04	6.E-04	1.E-03
10	0.75	4.E-05	1.E-04	3.E-04	6.E-04	9.E-04	2.E-03
10	1.0	5.E-05	2.E-04	4.E-04	8.E-04	1.E-03	2.E-03
25	0.25	3.E-05	1.E-04	2.E-04	5.E-04	7.E-04	1.E-03
25	0.50	6.E-05	2.E-04	5.E-04	1.E-03	1.E-03	3.E-03
25	0.75	9.E-05	3.E-04	7.E-04	2.E-03	2.E-03	4.E-03
25	1.0	1.E-04	4.E-04	1.E-03	2.E-03	3.E-03	5.E-03

DEPENDENCY BOUNDS

Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	[1E-07, 4E-06]	[5E-07, 7E-06]	[1E-06, 2E-05]	[2E-06, 3E-05]	[2E-06, 4E-05]	[2E-06, 5E-05]
0.5	0.50	[2E-07, 7E-06]	[9E-07, 1E-05]	[2E-06, 3E-05]	[4E-06, 6E-05]	[4E-06, 8E-05]	[5E-06, 1E-04]
0.5	0.75	[3E-07, 1E-05]	[1E-06, 2E-05]	[4E-06, 5E-05]	[6E-06, 9E-05]	[6E-06, 1E-04]	[7E-06, 2E-04]
0.5	1.0	[4E-07, 1E-05]	[2E-06, 3E-05]	[5E-06, 6E-05]	[7E-06, 1E-04]	[9E-06, 2E-04]	[1E-05, 2E-04]
2	0.25	[4E-07, 1E-05]	[2E-06, 3E-05]	[5E-06, 6E-05]	[7E-06, 1E-04]	[9E-06, 2E-04]	[1E-05, 2E-04]
2	0.50	[8E-07, 3E-05]	[4E-06, 6E-05]	[1E-05, 1E-04]	[1E-05, 2E-04]	[2E-05, 3E-04]	[2E-05, 4E-04]
2	0.75	[1E-06, 4E-05]	[6E-06, 9E-05]	[1E-05, 2E-04]	[2E-05, 4E-04]	[3E-05, 5E-04]	[3E-05, 7E-04]
2	1.0	[2E-06, 6E-05]	[8E-06, 1E-04]	[2E-05, 3E-04]	[3E-05, 5E-04]	[3E-05, 7E-04]	[4E-05, 9E-04]
10	0.25	[2E-06, 7E-05]	[9E-06, 1E-04]	[2E-05, 3E-04]	[4E-05, 6E-04]	[4E-05, 8E-04]	[5E-05, 1E-03]
10	0.50	[4E-06, 1E-04]	[2E-05, 3E-04]	[5E-05, 6E-04]	[7E-05, 1E-03]	[9E-05, 2E-03]	[1E-04, 2E-03]
10	0.75	[6E-06, 2E-04]	[3E-05, 4E-04]	[7E-05, 1E-03]	[1E-04, 2E-03]	[1E-04, 2E-03]	[1E-04, 3E-03]
10	1.0	[8E-06, 3E-04]	[4E-05, 6E-04]	[1E-04, 1E-03]	[1E-04, 2E-03]	[2E-04, 3E-03]	[2E-04, 4E-03]
25	0.25	[5E-06, 2E-04]	[2E-05, 4E-04]	[6E-05, 8E-04]	[9E-05, 2E-03]	[1E-04, 2E-03]	[1E-04, 3E-03]
25	0.50	[1E-05, 4E-04]	[5E-05, 7E-04]	[1E-04, 2E-03]	[2E-04, 3E-03]	[2E-04, 4E-03]	[2E-04, 5E-03]
25	0.75	[2E-05, 5E-04]	[7E-05, 1E-03]	[2E-04, 2E-03]	[3E-04, 5E-03]	[3E-04, 6E-03]	[4E-04, 8E-03]
25	1.0	[2E-05, 7E-04]	[9E-05, 1E-03]	[2E-04, 3E-03]	[4E-04, 6E-03]	[4E-04, 8E-03]	[5E-04, 1E-02]

Table 6-20

Noncancer Hazard Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Commercial Poultry Egg Consumption

P-BOUNDS

Receptor	Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	[0, 1.4]	[0, 2.1]	[0, 3]	[0.02, 4.1]	[0.032, 4.3]	[0.039, 5]
	0.5	0.50	[0, 2.7]	[0, 4.1]	[0, 6]	[0.041, 8.3]	[0.064, 8.5]	[0.079, 10]
	0.5	0.75	[0, 4.1]	[0, 6.2]	[0, 9]	[0.061, 12]	[0.095, 13]	[0.12, 15]
	0.5	1.0	[0, 5.4]	[0, 8.2]	[0, 12]	[0.081, 17]	[0.13, 17]	[0.16, 20]
	2	0.25	[0, 5.4]	[0, 8.2]	[0, 12]	[0.081, 17]	[0.13, 17]	[0.16, 20]
	2	0.50	[0, 11]	[0, 16]	[0, 24]	[0.16, 33]	[0.25, 34]	[0.31, 40]
	2	0.75	[0, 16]	[0, 25]	[0, 36]	[0.24, 50]	[0.38, 51]	[0.47, 60]
	2	1.0	[0, 22]	[0, 33]	[0, 48]	[0.33, 66]	[0.51, 68]	[0.63, 80]
	10	0.25	[0, 27]	[0, 41]	[0, 60]	[0.41, 83]	[0.64, 85]	[0.79, 100]
	10	0.50	[0, 54]	[0, 82]	[0, 120]	[0.81, 165]	[1.3, 171]	[1.6, 200]
	10	0.75	[0, 81]	[0, 123]	[0, 181]	[1.2, 248]	[1.9, 256]	[2.4, 300]
	10	1.0	[0, 108]	[0, 164]	[0, 241]	[1.6, 331]	[2.5, 341]	[3.1, 401]
	25	0.25	[0, 68]	[0, 103]	[0, 151]	[1, 201]	[1.6, 213]	[2, 250]
	25	0.50	[0, 135]	[0, 205]	[0, 301]	[2, 414]	[3.2, 426]	[3.9, 501]
	25	0.75	[0, 203]	[0, 307]	[0, 452]	[3, 621]	[4.8, 640]	[5.9, 754]
	25	1.0	[0, 270]	[0, 410]	[0, 602]	[4, 827]	[6.4, 853]	[7.9, 1002]
Child	0.5	0.25	[0, 3.6]	[0, 6.3]	[0, 8.5]	[0.02, 8.5]	[0.041, 8.5]	[0.06, 8.5]
	0.5	0.50	[0, 7.2]	[0, 13]	[0, 17]	[0.04, 17]	[0.082, 17]	[0.12, 17]
	0.5	0.75	[0, 11]	[0, 19]	[0, 26]	[0.06, 26]	[0.12, 26]	[0.18, 26]
	0.5	1.0	[0, 14]	[0, 25]	[0, 34]	[0.08, 34]	[0.16, 34]	[0.24, 34]
	2	0.25	[0, 14]	[0, 25]	[0, 34]	[0.08, 37]	[0.16, 34]	[0.24, 34]
	2	0.50	[0, 29]	[0, 50]	[0, 68]	[0.16, 68]	[0.33, 68]	[0.48, 68]
	2	0.75	[0, 43]	[0, 75]	[0, 103]	[0.24, 103]	[0.49, 103]	[0.72, 103]
	2	1.0	[0, 58]	[0, 100]	[0, 137]	[0.32, 137]	[0.65, 137]	[0.96, 137]
	10	0.25	[0, 72]	[0, 126]	[0, 171]	[0.4, 171]	[0.82, 171]	[1.2, 171]
	10	0.50	[0, 144]	[0, 251]	[0, 342]	[0.8, 342]	[1.6, 342]	[2.4, 342]
	10	0.75	[0, 216]	[0, 377]	[0, 513]	[1.2, 513]	[2.5, 513]	[3.6, 513]
	10	1.0	[0, 288]	[0, 502]	[0, 684]	[1.6, 684]	[3.3, 684]	[4.8, 684]
	25	0.25	[0, 180]	[0, 314]	[0, 427]	[1, 427]	[2, 427]	[3, 427]
	25	0.50	[0, 359]	[0, 628]	[0, 854]	[2, 854]	[4.1, 854]	[6, 854]
	25	0.75	[0, 539]	[0, 942]	[0, 1282]	[3, 1282]	[6.1, 1282]	[9, 1282]
	25	1.0	[0, 719]	[0, 1256]	[0, 1709]	[4, 1709]	[8.2, 1709]	[12, 1709]

MONTE CARLO ANALOG

Receptor	Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	0.14	0.28	0.43	0.67	0.84	1.0
	0.5	0.50	0.28	0.56	0.85	1.3	1.7	2.1
	0.5	0.75	0.41	0.83	1.3	2.0	2.5	3.1
	0.5	1.0	0.55	1.1	1.7	2.7	3.4	4.2
	2	0.25	0.55	1.1	1.7	2.7	3.4	4.2
	2	0.50	1.1	2.2	3.4	5.3	6.7	8.4
	2	0.75	1.7	3.3	5.1	8.0	10	13
	2	1.0	2.2	4.4	6.8	11	13	17
	10	0.25	2.8	5.6	8.5	13	17	21
	10	0.50	5.5	11	17	27	34	42
	10	0.75	8.3	17	26	40	51	63
	10	1.0	11	22	34	53	67	84
	25	0.25	6.9	14	21	33	42	52
	25	0.50	14	28	43	67	84	105
	25	0.75	21	42	64	100	126	157
	25	1.0	28	56	85	134	169	210
Child	0.5	0.25	0.31	0.63	0.96	1.6	2.3	3.9
	0.5	0.50	0.62	1.3	1.9	3.2	4.7	7.8
	0.5	0.75	0.93	1.9	2.9	4.9	7.0	12
	0.5	1.0	1.2	2.5	3.9	6.5	9.4	16
	2	0.25	1.2	2.5	3.9	6.5	9.4	16
	2	0.50	2.5	5.0	7.7	13	19	31
	2	0.75	3.7	7.5	12	19	28	47
	2	1.0	5.0	10	15	26	37	62
	10	0.25	6.2	13	19	32	47	78
	10	0.50	12	25	39	65	94	155
	10	0.75	19	38	58	97	141	233
	10	1.0	25	50	77	130	187	310
	25	0.25	16	31	48	81	117	194
	25	0.50	31	63	96	162	234	388
	25	0.75	47	94	145	243	351	581
	25	1.0	62	126	193	324	468	775

Table 6-20

Noncancer Hazard Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Commercial Poultry Egg Consumption

DEPENDENCY BOUNDS

Receptor	Total PCB Concentration in Pasture (mg/kg dw)	Fraction of Pasture in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	[0.13, 0.14]	[0.27, 0.28]	[0.42, 0.44]	[0.64, 0.69]	[0.8, 0.89]	[1, 1.1]
	0.5	0.50	[0.26, 0.29]	[0.54, 0.57]	[0.83, 0.87]	[1.3, 1.4]	[1.6, 1.8]	[2, 2.2]
	0.5	0.75	[0.4, 0.43]	[0.82, 0.85]	[1.3, 1.3]	[1.9, 2.1]	[2.4, 2.7]	[3, 3.3]
	0.5	1.0	[0.53, 0.57]	[1.1, 1.1]	[1.7, 1.7]	[2.6, 2.8]	[3.2, 3.5]	[4, 4.4]
	2	0.25	[0.53, 0.57]	[1.1, 1.1]	[1.7, 1.7]	[2.6, 2.8]	[3.2, 3.5]	[4, 4.4]
	2	0.50	[1.1, 1.1]	[2.2, 2.3]	[3.3, 3.5]	[5.2, 5.5]	[6.4, 7.1]	[8, 8.8]
	2	0.75	[1.6, 1.7]	[3.3, 3.4]	[5, 5.2]	[7.7, 8.3]	[9.6, 11]	[12, 13]
	2	1.0	[2.1, 2.3]	[4.4, 4.5]	[6.7, 7]	[10, 11]	[13, 14]	[16, 18]
	10	0.25	[2.6, 2.9]	[5.4, 5.7]	[8.3, 8.7]	[13, 14]	[16, 18]	[20, 22]
	10	0.50	[5.3, 5.7]	[11, 11]	[16.7, 17]	[26, 28]	[32, 35]	[40, 44]
	10	0.75	[7.9, 8.6]	[16, 17]	[25, 26]	[39, 41]	[48, 53]	[60, 66]
	10	1.0	[11, 11]	[22, 23]	[33, 35]	[52, 55]	[64, 71]	[80, 88]
	25	0.25	[6.6, 7.2]	[14, 14]	[21, 22]	[32, 35]	[40, 44]	[50, 55]
	25	0.50	[13, 14]	[27, 28]	[42, 44]	[64, 69]	[80, 89]	[100, 110]
	25	0.75	[20, 21]	[41, 43]	[63, 65]	[97, 104]	[120, 133]	[150, 165]
	25	1.0	[26, 29]	[54, 57]	[83, 87]	[129, 138]	[160, 177]	[200, 219]
Child	0.5	0.25	[0.3, 0.32]	[0.61, 0.64]	[0.94, 0.99]	[1.5, 1.7]	[2.1, 2.6]	[3.5, 4.2]
	0.5	0.50	[0.6, 0.65]	[1.2, 1.3]	[2, 2]	[3.1, 3.4]	[4.3, 5.1]	[7, 8.5]
	0.5	0.75	[0.89, 0.97]	[1.8, 1.9]	[2.8, 3]	[4.6, 5.7]	[6.4, 7.7]	[11, 13]
	0.5	1.0	[1.2, 1.3]	[2.5, 2.6]	[3.8, 4]	[6.2, 6.8]	[8.5, 10]	[14, 17]
	2	0.25	[1.2, 1.3]	[2.5, 2.6]	[3.8, 4]	[6.2, 6.8]	[8.5, 10]	[14, 17]
	2	0.50	[2.4, 2.6]	[4.9, 5.1]	[7.5, 7.9]	[12, 14]	[17, 20]	[28, 34]
	2	0.75	[3.6, 3.9]	[7.4, 7.7]	[11, 12]	[19, 20]	[26, 31]	[42, 51]
	2	1.0	[4.8, 5.2]	[9.8, 10]	[15, 16]	[25, 27]	[34, 41]	[56, 68]
	10	0.25	[6, 6.5]	[12, 13]	[19, 20]	[31, 34]	[43, 51]	[70, 85]
	10	0.50	[12, 13]	[25, 26]	[38, 39]	[62, 68]	[85, 102]	[141, 169]
	10	0.75	[18, 19]	[37, 38]	[57, 59]	[93, 102]	[128, 153]	[211, 254]
	10	1.0	[24, 26]	[49, 51]	[75, 79]	[124, 135]	[171, 204]	[281, 339]
	25	0.25	[15, 16]	[31, 32]	[47, 49]	[77, 85]	[107, 128]	[176, 212]
	25	0.50	[30, 32]	[61, 64]	[94, 99]	[155, 169]	[213, 255]	[352, 424]
	25	0.75	[45, 49]	[92, 96]	[141, 148]	[232, 254]	[320, 383]	[527, 635]
	25	1.0	[60, 65]	[123, 128]	[188, 197]	[310, 339]	[427, 510]	[703, 847]

Table 6-21

Cancer Risk Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Commercial Produce Consumption

P-BOUNDS

Total PCB Concentration in Home Garden (mg/kg dw)	Fraction of Home Garden in the Floodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	[0E+00 4E-06]	[1E-11, 6E-06]	[3E-11, 2E-05]	[7E-11, 4E-05]	[7E-11, 4E-05]	[1E-10, 5E-05]
0.5	0.50	[0E+00 8E-06]	[3E-11, 1E-05]	[6E-11, 3E-05]	[1E-10, 8E-05]	[1E-10, 9E-05]	[2E-10, 9E-05]
0.5	0.75	[0E+00 1E-05]	[4E-11, 2E-05]	[9E-11, 5E-05]	[2E-10, 1E-04]	[2E-10, 1E-04]	[3E-10, 1E-04]
0.5	1.0	[0E+00 2E-05]	[6E-11, 3E-05]	[1E-10, 7E-05]	[3E-10, 2E-04]	[3E-10, 2E-04]	[4E-10, 2E-04]
2	0.25	[0E+00 2E-05]	[6E-11, 3E-05]	[1E-10, 7E-05]	[3E-10, 2E-04]	[3E-10, 2E-04]	[4E-10, 2E-04]
2	0.50	[0E+00 3E-05]	[1E-10, 5E-05]	[2E-10, 1E-04]	[5E-10, 3E-04]	[5E-10, 4E-04]	[9E-10, 4E-04]
2	0.75	[0E+00 5E-05]	[2E-10, 8E-05]	[4E-10, 2E-04]	[8E-10, 5E-04]	[8E-10, 5E-04]	[1E-09, 6E-04]
2	1.0	[0E+00 7E-05]	[2E-10, 1E-04]	[5E-10, 3E-04]	[1E-09, 7E-04]	[1E-09, 7E-04]	[2E-09, 7E-04]
10	0.25	[0E+00 8E-05]	[3E-10, 1E-04]	[6E-10, 3E-04]	[1E-09, 8E-04]	[1E-09, 9E-04]	[2E-09, 9E-04]
10	0.50	[0E+00 2E-04]	[6E-10, 3E-04]	[1E-09, 7E-04]	[3E-09, 2E-03]	[3E-09, 2E-03]	[4E-09, 2E-03]
10	0.75	[0E+00 3E-04]	[8E-10, 4E-04]	[2E-09, 1E-03]	[4E-09, 3E-03]	[4E-09, 3E-03]	[6E-09, 3E-03]
10	1.0	[0E+00 3E-04]	[1E-09, 5E-04]	[2E-09, 1E-03]	[5E-09, 3E-03]	[5E-09, 4E-03]	[9E-09, 4E-03]
25	0.25	[0E+00 2E-04]	[7E-10, 3E-04]	[2E-09, 9E-04]	[3E-09, 2E-03]	[3E-09, 2E-03]	[5E-09, 2E-03]
25	0.50	[0E+00 4E-04]	[1E-09, 6E-04]	[3E-09, 2E-03]	[7E-09, 4E-03]	[7E-09, 4E-03]	[1E-08, 5E-03]
25	0.75	[0E+00 6E-04]	[2E-09, 9E-04]	[5E-09, 3E-03]	[1E-08, 6E-03]	[1E-08, 7E-03]	[2E-08, 7E-03]
25	1.0	[0E+00 8E-04]	[3E-09, 1E-03]	[6E-09, 3E-03]	[1E-08, 8E-03]	[1E-08, 9E-03]	[2E-08, 9E-03]

MONTE CARLO ANALOG

Total PCB Concentration in Home Garden (mg/kg dw)	Fraction of Home Garden in the Floodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	9.E-09	3.E-08	6.E-08	1.E-07	2.E-07	5.E-07
0.5	0.50	2.E-08	5.E-08	1.E-07	3.E-07	4.E-07	9.E-07
0.5	0.75	3.E-08	8.E-08	2.E-07	4.E-07	6.E-07	1.E-06
0.5	1.0	4.E-08	1.E-07	2.E-07	5.E-07	8.E-07	2.E-06
2	0.25	4.E-08	1.E-07	2.E-07	5.E-07	8.E-07	2.E-06
2	0.50	7.E-08	2.E-07	5.E-07	1.E-06	2.E-06	4.E-06
2	0.75	1.E-07	3.E-07	7.E-07	2.E-06	2.E-06	6.E-06
2	1.0	1.E-07	4.E-07	1.E-06	2.E-06	3.E-06	7.E-06
10	0.25	2.E-07	5.E-07	1.E-06	3.E-06	4.E-06	9.E-06
10	0.50	4.E-07	1.E-06	2.E-06	5.E-06	8.E-06	2.E-05
10	0.75	5.E-07	2.E-06	4.E-06	8.E-06	1.E-05	3.E-05
10	1.0	7.E-07	2.E-06	5.E-06	1.E-05	2.E-05	4.E-05
25	0.25	5.E-07	1.E-06	3.E-06	7.E-06	1.E-05	2.E-05
25	0.50	9.E-07	3.E-06	6.E-06	1.E-05	2.E-05	5.E-05
25	0.75	1.E-06	4.E-06	9.E-06	2.E-05	3.E-05	7.E-05
25	1.0	2.E-06	5.E-06	1.E-05	3.E-05	4.E-05	9.E-05

DEPENDENCY BOUNDS

Total PCB Concentration in Home Garden (mg/kg dw)	Fraction of Home Garden in the Floodplain	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	[7E-10, 9E-08]	[3E-09, 2E-07]	[7E-09, 4E-07]	[1E-08, 8E-07]	[1E-08, 1E-06]	[1E-08, 2E-06]
0.5	0.50	[1E-09, 2E-07]	[6E-09, 3E-07]	[1E-08, 8E-07]	[2E-08, 2E-06]	[3E-08, 2E-06]	[3E-08, 3E-06]
0.5	0.75	[2E-09, 3E-07]	[9E-09, 5E-07]	[2E-08, 1E-06]	[3E-08, 2E-06]	[4E-08, 3E-06]	[4E-08, 5E-06]
0.5	1.0	[3E-09, 3E-07]	[1E-08, 7E-07]	[3E-08, 2E-06]	[4E-08, 3E-06]	[5E-08, 4E-06]	[6E-08, 7E-06]
2	0.25	[3E-09, 3E-07]	[1E-08, 7E-07]	[3E-08, 2E-06]	[4E-08, 3E-06]	[5E-08, 4E-06]	[6E-08, 7E-06]
2	0.50	[5E-09, 7E-07]	[2E-08, 1E-06]	[6E-08, 3E-06]	[9E-08, 7E-06]	[1E-07, 9E-06]	[1E-07, 1E-05]
2	0.75	[8E-09, 1E-06]	[3E-08, 2E-06]	[9E-08, 5E-06]	[1E-07, 1E-05]	[2E-07, 1E-05]	[2E-07, 2E-05]
2	1.0	[1E-08, 1E-06]	[5E-08, 3E-06]	[1E-07, 6E-06]	[2E-07, 1E-05]	[2E-07, 2E-05]	[2E-07, 3E-05]
10	0.25	[1E-08, 2E-06]	[6E-08, 3E-06]	[1E-07, 8E-06]	[2E-07, 2E-05]	[3E-07, 2E-05]	[3E-07, 3E-05]
10	0.50	[3E-08, 3E-06]	[1E-07, 7E-06]	[3E-07, 2E-05]	[4E-07, 3E-05]	[5E-07, 4E-05]	[6E-07, 7E-05]
10	0.75	[4E-08, 5E-06]	[2E-07, 1E-05]	[4E-07, 2E-05]	[7E-07, 5E-05]	[8E-07, 7E-05]	[9E-07, 1E-04]
10	1.0	[5E-08, 7E-06]	[2E-07, 1E-05]	[6E-07, 3E-05]	[9E-07, 7E-05]	[1E-06, 9E-05]	[1E-06, 1E-04]
25	0.25	[3E-08, 4E-06]	[1E-07, 9E-06]	[4E-07, 2E-05]	[6E-07, 4E-05]	[6E-07, 5E-05]	[7E-07, 8E-05]
25	0.50	[7E-08, 9E-06]	[3E-07, 2E-05]	[7E-07, 4E-05]	[1E-06, 8E-05]	[1E-06, 1E-04]	[1E-06, 2E-04]
25	0.75	[1E-07, 1E-05]	[4E-07, 3E-05]	[1E-06, 6E-05]	[2E-06, 1E-04]	[2E-06, 2E-04]	[2E-06, 2E-04]
25	1.0	[1E-07, 2E-05]	[6E-07, 3E-05]	[1E-06, 8E-05]	[2E-06, 2E-04]	[3E-06, 2E-04]	[3E-06, 3E-04]

Table 6-22

Noncancer Hazard Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Commercial Produce Consumption

P-BOUNDS

Receptor	Total PCB Concentration in Home Garden (mg/kg dw)	Fraction of Home Garden in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	[0, 0.096]	[0.000024, 0.17]	[0.000053, 0.24]	[0.00011, 1]	[0.00012, 1.1]	[0.00012, 1.1]
	0.5	0.50	[0, 0.19]	[0.000048, 0.33]	[0.00011, 0.47]	[0.00023, 2.1]	[0.00023, 2.1]	[0.00024, 2.3]
	0.5	0.75	[0, 0.29]	[0.000072, 0.5]	[0.00016, 71]	[0.00034, 3.1]	[0.00035, 3.2]	[0.00036, 3.4]
	0.5	1.0	[0, 0.38]	[0.000097, 0.66]	[0.00021, 0.95]	[0.00046, 4.1]	[0.00047, 4.2]	[0.00048, 4.5]
	2	0.25	[0, 0.38]	[0.000097, 0.66]	[0.00021, 0.95]	[0.00046, 4.1]	[0.00047, 4.2]	[0.00048, 4.5]
	2	0.50	[0, 0.77]	[0.00019, 1.3]	[0.00042, 1.9]	[0.00092, 8.2]	[0.00094, 8.5]	[0.00096, 9.1]
	2	0.75	[0, 1.2]	[0.00029, 2]	[0.00064, 2.8]	[0.0014, 12]	[0.0014, 13]	[0.0014, 14]
	2	1.0	[0, 1.5]	[0.00039, 2.6]	[0.00085, 3.8]	[0.0018, 16]	[0.0019, 17]	[0.0019, 18]
	10	0.25	[0, 1.9]	[0.00048, 3.3]	[0.0011, 4.7]	[0.0023, 21]	[0.0023, 21]	[0.0024, 23]
	10	0.50	[0, 3.8]	[0.00097, 6.6]	[0.0021, 9.5]	[0.0046, 41]	[0.0047, 42]	[0.0048, 45]
	10	0.75	[0, 5.8]	[0.0014, 9.9]	[0.0032, 14]	[0.0069, 62]	[0.007, 64]	[0.0072, 68]
	10	1.0	[0, 7.7]	[0.0019, 13]	[0.0042, 19]	[0.0092, 82]	[0.0094, 85]	[0.0096, 91]
	25	0.25	[0, 4.8]	[0.0012, 8.3]	[0.0027, 12]	[0.0057, 51]	[0.0059, 53]	[0.006, 57]
	25	0.50	[0, 9.6]	[0.0024, 17]	[0.0053, 24]	[0.011, 103]	[0.012, 106]	[0.012, 114]
	25	0.75	[0, 14]	[0.0036, 25]	[0.008, 36]	[0.017, 154]	[0.018, 159]	[0.018, 171]
	25	1.0	[0, 19]	[0.0048, 33]	[0.011, 47]	[0.023, 206]	[0.023, 212]	[0.024, 227]
Child	0.5	0.25	[0, 0.12]	[0.000055, 0.17]	[0.00011, 0.4]	[0.00023, 0.86]	[0.00024, 0.88]	[0.00024, 0.94]
	0.5	0.50	[0, 0.25]	[0.00011, 0.34]	[0.00022, 0.8]	[0.00046, 1.7]	[0.00047, 1.8]	[0.00048, 1.9]
	0.5	0.75	[0, 0.37]	[0.00017, 0.51]	[0.00033, 1.2]	[0.0007, 2.6]	[0.00071, 2.6]	[0.00072, 2.8]
	0.5	1.0	[0, 0.5]	[0.00022, 0.68]	[0.00044, 1.6]	[0.00093, 3.4]	[0.00095, 3.5]	[0.00096, 3.8]
	2	0.25	[0, 0.5]	[0.00022, 0.68]	[0.00044, 1.6]	[0.00093, 3.4]	[0.00095, 3.5]	[0.00096, 3.8]
	2	0.50	[0, 0.99]	[0.00044, 1.4]	[0.00088, 3.2]	[0.0019, 6.8]	[0.0019, 7.1]	[0.0019, 7.5]
	2	0.75	[0, 1.5]	[0.00066, 2.1]	[0.0013, 4.8]	[0.0028, 10]	[0.0028, 11]	[0.0029, 11]
	2	1.0	[0, 2]	[0.00088, 2.7]	[0.0018, 6.4]	[0.0037, 14]	[0.0038, 14]	[0.0038, 15]
	10	0.25	[0, 2.5]	[0.0011, 3.4]	[0.0022, 8]	[0.0046, 17]	[0.0047, 18]	[0.0048, 19]
	10	0.50	[0, 5]	[0.0022, 6.8]	[0.0044, 16]	[0.0093, 34]	[0.0095, 35]	[0.0096, 38]
	10	0.75	[0, 7.4]	[0.0033, 10]	[0.0066, 24]	[0.014, 51]	[0.014, 53]	[0.014, 57]
	10	1.0	[0, 9.9]	[0.0044, 14]	[0.0088, 32]	[0.019, 68]	[0.019, 71]	[0.019, 75]
	25	0.25	[0, 6.2]	[0.0028, 8.6]	[0.0055, 20]	[0.012, 43]	[0.012, 44]	[0.012, 47]
	25	0.50	[0, 12]	[0.0055, 17]	[0.011, 40]	[0.023, 86]	[0.024, 88]	[0.024, 94]
	25	0.75	[0, 19]	[0.0083, 26]	[0.017, 60]	[0.035, 128]	[0.036, 132]	[0.036, 141]
	25	1.0	[0, 25]	[0.011, 34]	[0.022, 80]	[0.046, 171]	[0.047, 176]	[0.048, 188]

MONTE CARLO ANALOG

Receptor	Total PCB Concentration in Home Garden (mg/kg dw)	Fraction of Home Garden in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	0.0019	0.0032	0.0057	0.0093	0.013	0.028
	0.5	0.50	0.0038	0.0065	0.011	0.019	0.027	0.056
	0.5	0.75	0.0057	0.0097	0.017	0.028	0.040	0.084
	0.5	1.0	0.0075	0.013	0.023	0.037	0.054	0.11
	2	0.25	0.0075	0.013	0.023	0.037	0.054	0.11
	2	0.50	0.015	0.026	0.045	0.075	0.11	0.22
	2	0.75	0.023	0.039	0.068	0.11	0.16	0.34
	2	1.0	0.030	0.052	0.091	0.15	0.21	0.45
	10	0.25	0.038	0.065	0.11	0.19	0.27	0.56
	10	0.50	0.075	0.13	0.23	0.37	0.54	1.1
	10	0.75	0.11	0.19	0.34	0.56	0.80	1.7
	10	1.0	0.15	0.26	0.45	0.75	1.1	2.2
	25	0.25	0.094	0.16	0.28	0.47	0.67	1.4
	25	0.50	0.19	0.32	0.57	0.93	1.3	2.8
	25	0.75	0.28	0.48	0.85	1.4	2.0	4.2
	25	1.0	0.38	0.65	1.1	1.9	2.7	5.6
Child	0.5	0.25	0.0036	0.0059	0.011	0.018	0.023	0.032
	0.5	0.50	0.0072	0.012	0.021	0.036	0.046	0.064
	0.5	0.75	0.011	0.018	0.032	0.055	0.069	0.095
	0.5	1.0	0.014	0.024	0.042	0.073	0.092	0.13
	2	0.25	0.014	0.024	0.042	0.073	0.092	0.13
	2	0.50	0.029	0.047	0.085	0.15	0.18	0.25
	2	0.75	0.043	0.071	0.13	0.22	0.28	0.38
	2	1.0	0.058	0.095	0.17	0.29	0.37	0.51
	10	0.25	0.072	0.12	0.21	0.36	0.46	0.64
	10	0.50	0.14	0.24	0.42	0.73	0.92	1.3
	10	0.75	0.22	0.36	0.64	1.1	1.4	1.9
	10	1.0	0.29	0.47	0.85	1.5	1.8	2.5
	25	0.25	0.18	0.30	0.53	0.91	1.2	1.6
	25	0.50	0.36	0.59	1.1	1.8	2.3	3.2
	25	0.75	0.54	0.89	1.6	2.7	3.5	4.8
	25	1.0	0.72	1.2	2.1	3.6	4.6	6.4

Table 6-22

Noncancer Hazard Results of the Probability Bounds Risk Analysis, Monte Carlo Analog Analysis and Dependency Bounds for Commercial Produce Consumption

DEPENDENCY BOUNDS

Receptor	Total PCB Concentration in Home Garden (mg/kg dw)	Fraction of Home Garden in the Floodplain	Noncancer hazard percentiles					
						RME range		
			25%	50%	75%	90%	95%	99%
Adult	0.5	0.25	[0.00082, 0.0045]	[0.0018, 0.0064]	[0.0038, 0.01]	[0.007, 0.019]	[0.0096, 0.026]	[0.016, 0.04]
	0.5	0.50	[0.0016, 0.0089]	[0.0036, 0.013]	[0.0077, 0.021]	[0.014, 0.038]	[0.019, 0.052]	[0.032, 0.08]
	0.5	0.75	[0.0025, 0.013]	[0.0054, 0.019]	[0.012, 0.031]	[0.021, 0.058]	[0.029, 0.077]	[0.049, 0.12]
	0.5	1.0	[0.0033, 0.018]	[0.0072, 0.025]	[0.015, 0.042]	[0.028, 0.077]	[0.038, 0.1]	[0.065, 0.16]
	2	0.25	[0.0033, 0.018]	[0.0072, 0.025]	[0.015, 0.042]	[0.028, 0.077]	[0.038, 0.1]	[0.065, 0.16]
	2	0.50	[0.0065, 0.036]	[0.014, 0.051]	[0.031, 0.084]	[0.056, 0.15]	[0.077, 0.21]	[0.13, 0.32]
	2	0.75	[0.0098, 0.053]	[0.022, 0.076]	[0.046, 0.13]	[0.084, 0.23]	[0.12, 0.31]	[0.19, 0.48]
	2	1.0	[0.013, 0.071]	[0.029, 0.1]	[0.062, 0.17]	[0.11, 0.31]	[0.15, 0.41]	[0.26, 0.64]
	10	0.25	[0.016, 0.089]	[0.036, 0.13]	[0.077, 0.21]	[0.14, 0.38]	[0.19, 0.52]	[0.32, 0.8]
	10	0.50	[0.033, 0.18]	[0.072, 0.25]	[0.15, 0.42]	[0.28, 0.77]	[0.38, 1]	[0.65, 1.6]
	10	0.75	[0.049, 0.27]	[0.11, 0.38]	[0.23, 0.63]	[0.42, 1.2]	[0.58, 1.5]	[0.97, 2.4]
	10	1.0	[0.065, 0.36]	[0.14, 0.51]	[0.31, 0.84]	[0.56, 1.5]	[0.77, 2.1]	[1.3, 3.2]
	25	0.25	[0.041, 0.22]	[0.09, 0.32]	[0.19, 0.52]	[0.35, 0.96]	[0.48, 1.3]	[0.81, 2]
	25	0.50	[0.082, 0.45]	[0.18, 0.64]	[0.38, 1]	[0.7, 1.9]	[0.96, 2.6]	[1.6, 4]
	25	0.75	[0.12, 0.67]	[0.27, 0.96]	[0.58, 1.6]	[1, 2.9]	[1.4, 3.9]	[2.4, 6]
	25	1.0	[0.16, 0.89]	[0.36, 1.3]	[0.77, 2.1]	[1.4, 3.8]	[1.9, 5.2]	[3.2, 8]
Child	0.5	0.25	[0.0016, 0.0084]	[0.0031, 0.012]	[0.0069, 0.018]	[0.013, 0.029]	[0.019, 0.041]	[0.023, 8]
	0.5	0.50	[0.0031, 0.017]	[0.0062, 0.024]	[0.014, 0.037]	[0.026, 0.059]	[0.034, 0.082]	[0.046, 0.11]
	0.5	0.75	[0.0047, 0.025]	[0.0094, 0.036]	[0.021, 0.055]	[0.04, 0.088]	[0.051, 0.12]	[0.068, 0.17]
	0.5	1.0	[0.0063, 0.034]	[0.012, 0.048]	[0.028, 0.073]	[0.053, 0.12]	[0.068, 0.16]	[0.091, 0.23]
	2	0.25	[0.0063, 0.034]	[0.012, 0.048]	[0.028, 0.073]	[0.053, 0.12]	[0.068, 0.16]	[0.091, 0.23]
	2	0.50	[0.013, 0.067]	[0.025, 0.096]	[0.055, 0.15]	[0.11, 0.24]	[0.14, 0.33]	[0.18, 0.46]
	2	0.75	[0.019, 0.1]	[0.037, 0.14]	[0.083, 0.22]	[0.16, 0.35]	[0.21, 0.49]	[0.27, 0.68]
	2	1.0	[0.025, 0.13]	[0.05, 0.19]	[0.11, 0.29]	[0.21, 0.47]	[0.27, 0.65]	[0.36, 0.91]
	10	0.25	[0.031, 0.17]	[0.062, 0.24]	[0.14, 0.37]	[0.26, 0.59]	[0.34, 0.82]	[0.46, 1.1]
	10	0.50	[0.063, 0.34]	[0.12, 0.48]	[0.28, 0.73]	[0.53, 1.2]	[0.68, 1.6]	[0.91, 2.3]
	10	0.75	[0.094, 0.51]	[0.19, 0.72]	[0.41, 1.1]	[0.79, 1.8]	[1, 2.5]	[1.4, 3.4]
	10	1.0	[0.16, 0.67]	[0.25, 0.96]	[0.55, 1.5]	[1.1, 2.4]	[1.4, 3.3]	[1.8, 4.6]
	25	0.25	[0.078, 0.42]	[0.16, 0.6]	[0.35, 0.91]	[0.66, 1.5]	[0.86, 2]	[1.1, 2.9]
	25	0.50	[0.16, 0.84]	[0.31, 1.2]	[0.69, 1.8]	[1.3, 2.9]	[1.7, 4.1]	[2.3, 5.7]
	25	0.75	[0.23, 1.3]	[0.47, 1.8]	[1, 2.7]	[2, 4.4]	[2.6, 6.1]	[3.4, 8.6]
	25	1.0	[0.31, 1.7]	[0.62, 2.4]	[1.4, 3.7]	[2.6, 5.9]	[3.4, 8.2]	[4.6, 11]

Table 6-23

Sensitivity Analyses for the Probabilistic Cancer Model

Commercial Farm Family: Dairy Consumption

Variable	Units	Probability bounds: Remove uncertainty	Probability bounds: Remove uncertainty and variability
Soil-to-Corn Silage Transfer Factor	dw plant/ dw soil	60	60
Fraction of diet (corn silage grown on farm & concentrate (e.g., grain/supplements) from off Site)	unitless	8.3	8.3
Mammalian BCF (fat basis)	unitless	5.6	0.0034
Milk fat content: jersey cows	mg fat/mg whole food	10	13
Child dairy consumption rate	g/kg-day	13	19
Adult farmer dairy consumption rate	g/kg-day	45	55
Exposure duration	year	21	49

Backyard Farm Family: Beef Consumption

Variable	Units	Probability bounds: Remove uncertainty	Probability bounds: Remove uncertainty and variability
Soil-to-Grass Transfer Factor	dw plant/ dw soil	47	47
Fraction of diet (soil & grass, hay or other grass-based feed grown on farm)	unitless	8.9	8.9
Soil Bioavailability	unitless	0.00044	0.00044
Mammalian BCF (fat basis)	unitless	5.6	0.00039
Beef fat content	mg fat/mg whole food	52	74
Beef cooking loss & post cooking loss	unitless	14	22
Child beef consumption rate	g/kg-day	11	13
Adult resident beef consumption rate	g/kg-day	29	47
Exposure duration	year	32	77

Table 6-23

Sensitivity Analyses for the Probabilistic Cancer Model

Commercial Farm Family: Poultry Meat Consumption

Variable	Units	Probability bounds	
		Remove uncertainty	Remove uncertainty and variability
Fraction of diet (floodplain soil & concentrate (e.g., grain/supplements) from off Site)	unitless	17	17
Soil Bioavailability	unitless	0.0012	0.0012
Avian BCF (fat basis)	unitless	47	47
Poultry meat fat content	mg fat/mg whole food	50	69
Poultry meat cooking loss & post cooking loss	unitless	14	23
Child poultry meat consumption rate	g/kg-day	11	13
Adult farmer poultry meat consumption rate	g/kg-day	46	66
Exposure duration	year	29	44

Commercial Farm Family: Poultry Egg Consumption

Variable	Units	Probability bounds	
		Remove uncertainty	Remove uncertainty and variability
Fraction of diet (floodplain soil & concentrate (e.g., grain/supplements) from off Site)	unitless	17	17
Soil Bioavailability	unitless	0.0013	0.0013
Avian BCF (whole food basis)	unitless	18	18
Poultry egg cooking loss	unitless	6.4	0.00040
Child poultry egg consumption rate	g/kg-day	22	24
Adult farmer poultry egg consumption rate	g/kg-day	56	66
Exposure duration	year	23	43

Table 6-23

Sensitivity Analyses for the Probabilistic Cancer Model

Commercial Farm Family: Produce Consumption

Variable	Units	Probability bounds	
		Remove uncertainty	Remove uncertainty and variability
Soil-to-Exposed Vegetable Transfer Factor	ww plant/dw soil	0.0027	0.0027
Soil-to-Exposed Fruit Transfer Factor	ww plant/dw soil	0.0011	0.0011
Soil-to-Root Vegetable Transfer Factor	ww plant/dw soil	89	89
Exposed vegetable cooking loss	unitless	0.24	2.4
Exposed fruit cooking loss	unitless	0.057	1.3
Root vegetable cooking loss	unitless	8.2	14
Regional adjustment factor for fruit consumption	unitless	1.2	1.2
Regional adjustment factor for vegetable consumption	unitless	11	11
Child exposed vegetable consumption rate	g/kg-day	0.0052	0.25
Child exposed fruit consumption rate	g/kg-day	2.2	3.8
Child root vegetable consumption rate	g/kg-day	3.7	9.2
Adult exposed vegetable consumption rate	g/kg-day	6.2	9.4
Adult exposed fruit consumption rate	g/kg-day	0.58	1.6
Adult root vegetable consumption rate	g/kg-day	43	66
Exposure duration	year	22	46

Notes:
Values are precentages.
Sensitivity analyses are conducted using results assuming a tPCB concentration of 2 mg/kg in soil and all of the animal feed is grown in the floodplain (Fraction = 1).

Table 6-24

Sensitivity Analyses for the Probabilistic Noncancer Model for Adults

Commercial Farm Family: Dairy Consumption

Variable	Units	Probability bounds Remove uncertainty	 Remove uncertainty and variability
Soil-to-Corn Silage Transfer Factor	dw plant/ dw soil	63	63
Fraction of diet (corn silage grown on farm & concentrate (e.g., grain/supplements) from off Site)	unitless	8.5	8.5
Mammalian BCF (fat basis)	unitless	5.8	0.24
Milk fat content: jersey cows	mg fat/mg whole food	10	12
Adult farmer dairy consumption rate	g/kg-day	66	56

Backyard Farm Family: Beef Consumption

Variable	Units	Probability bounds Remove uncertainty	 Remove uncertainty and variability
Soil-to-Grass Transfer Factor	dw plant/ dw soil	47	47
Fraction of diet (soil & grass, hay or other grass-based feed grown on farm)	unitless	9.0	9.0
Soil Bioavailability	unitless	0.031	0.031
Mammalian BCF (fat basis)	unitless	5.6	0.028
Beef fat content	mg fat/mg whole food	53	74
Beef cooking loss		15	22
Adult resident beef consumption rate	g/kg-day	43	24

Table 6-24

Sensitivity Analyses for the Probabilistic Noncancer Model for Adults

Commercial Farm Family: Poultry Meat Consumption

Variable	Units	Probability bounds	
		Remove uncertainty	Remove uncertainty and variability
Fraction of diet (floodplain soil & concentrate (e.g., grain/supplements) from off Site)	unitless	17	17
Soil Bioavailability	unitless	0.083	0.083
Avian BCF (fat basis)	unitless	47	47
Poultry meat fat content	mg fat/mg whole food	51	69
Poultry meat cooking loss & post cooking loss	unitless	15	23
Adult farmer poultry meat consumption rate	g/kg-day	61	65

Commercial Farm Family: Poultry Egg Consumption

Variable	Units	Probability bounds	
		Remove uncertainty	Remove uncertainty and variability
Fraction of diet (floodplain soil & concentrate (e.g., grain/supplements) from off Site)	unitless	17	17
Soil Bioavailability	unitless	0.10	0.10
Avian BCF (whole food basis)	unitless	18	18
Poultry egg cooking loss	unitless	6.7	0.033
Adult farmer poultry egg consumption rate	g/kg-day	81	81

Table 6-24

Sensitivity Analyses for the Probabilistic Noncancer Model for Adults

Commercial Farm Family: Produce Consumption

Variable	Units	Probability bounds	
		Remove uncertainty	Remove uncertainty and variability
Soil-to-Exposed Vegetable Transfer Factor	ww plant/dw soil	0.12	0.12
Soil-to-Exposed Fruit Transfer Factor	ww plant/dw soil	0.05	0.05
Soil-to-Root Vegetable Transfer Factor	ww plant/dw soil	90	90
Exposed vegetable cooking loss	unitless	1.0	2.4
Exposed fruit cooking loss	unitless	0.22	1.1
Root vegetable cooking loss	unitless	13	14
Regional adjustment factor for fruit consumption	unitless	0.99	0.99
Regional adjustment factor for vegetable consumption	unitless	5.5	5.5
Adult exposed vegetable consumption rate	g/kg-day	10	17
Adult exposed fruit consumption rate	g/kg-day	1.5	4.0
Adult root vegetable consumption rate	g/kg-day	51	71

Notes:
Values are precentages.
Sensitivity analyses are conducted using results assuming a tPCB concentration of 2 mg/kg in soil and all of the animal feed is grown in the floodplain (Fraction = 1).

Table 6-25

Sensitivity Analyses for the Probabilistic Noncancer Model for Children

Commercial Farm Family: Dairy Consumption

Variable	Units	Probability bounds Remove uncertainty	 Remove uncertainty and variability
Soil-to-Corn Silage Transfer Factor	dw plant/ dw soil	64	64
Fraction of diet (corn silage grown on farm & concentrate (e.g., grain/supplements) from off Site)	unitless	8.7	8.7
Mammalian BCF (fat basis)	unitless	5.9	0.37
Milk fat content: jersey cows	mg fat/mg whole food	11	12
Child dairy consumption rate	g/kg-day	49	52

Backyard Farm Family: Beef Consumption

Variable	Units	Probability bounds Remove uncertainty	 Remove uncertainty and variability
Soil-to-Grass Transfer Factor	dw plant/ dw soil	47	47
Fraction of diet (soil & grass, hay or other grass-based feed grown on farm)	unitless	8.9	8.9
Soil Bioavailability	unitless	0.016	0.016
Mammalian BCF (fat basis)	unitless	5.6	0.014
Beef fat content	mg fat/mg whole food	53	74
Beef cooking loss		15	22
Child beef consumption rate	g/kg-day	54	57

Table 6-25

Sensitivity Analyses for the Probabilistic Noncancer Model for Children

Commercial Farm Family: Poultry Meat Consumption

Variable	Units	Probability bounds	
		Remove uncertainty	Remove uncertainty and variability
Fraction of diet (floodplain soil & concentrate (e.g., grain/supplements) from off Site)	unitless	17	17
Soil Bioavailability	unitless	0.10	0.10
Avian BCF (fat basis)	unitless	47	47
Poultry meat fat content	mg fat/mg whole food	51	70
Poultry meat cooking loss & post cooking loss	unitless	15	23
Child poultry meat consumption rate	g/kg-day	64	64

Commercial Farm Family: Poultry Egg Consumption

Variable	Units	Probability bounds	
		Remove uncertainty	Remove uncertainty and variability
Fraction of diet (floodplain soil & concentrate (e.g., grain/supplements) from off Site)	unitless	17	17
Soil Bioavailability	unitless	0.044	0.044
Avian BCF (whole food basis)	unitless	18	18
Poultry egg cooking loss	unitless	6.9	0.014
Child poultry egg consumption rate	g/kg-day	82	83

Table 6-25

Sensitivity Analyses for the Probabilistic Noncancer Model for Children

Commercial Farm Family: Produce Consumption

Variable	Units	Probability bounds: Remove uncertainty	Probability bounds: Remove uncertainty and variability
Soil-to-Exposed Vegetable Transfer Factor	ww plant/dw soil	0.24	0.24
Soil-to-Exposed Fruit Transfer Factor	ww plant/dw soil	0.13	0.13
Soil-to-Root Vegetable Transfer Factor	ww plant/dw soil	88	88
Exposed vegetable cooking loss	unitless	0.46	1.8
Exposed fruit cooking loss	unitless	0.50	3.1
Root vegetable cooking loss	unitless	12	13
Regional adjustment factor for fruit consumption	unitless	2.7	2.7
Regional adjustment factor for vegetable consumption	unitless	3.7	3.7
Child exposed vegetable consumption rate	g/kg-day	2.4	8.9
Child exposed fruit consumption rate	g/kg-day	7.4	12
Child root vegetable consumption rate	g/kg-day	37	56

Notes:
Values are precentages.
Sensitivity analyses are conducted using results assuming a tPCB concentration of 2 mg/kg in soil and all of the animal feed is grown in the floodplain (Fraction = 1).

Table 6-26 Monte Carlo Analog Assumptions and Sources of Uncertainty for Agricultural Scenarios

Input	Commercial Dairy	Backyard Beef	Commercial Poultry - Meat	Commercial Poulty - Egg	Commercial Produce
TF (Soil to Plant Transfer Factor)	?	C	NA		?
D (Diet Composition)	?	?	?	?	NA
BA (Bioavailability)	NA	C	C	C	NA
BCF (Bioconcentration factor)	C	C	?	?	NA
F (Animal Fat Content)	?	?	?	NA	NA
CL (Cooking loss)	NA	?	?	?	?
PCL (Post cooking loss)	NA	?	?	?	?
UE (Uncertainty factor for consumption rate)	NA	NA	NA	NA	NA
CR (Consumption rates)	C	C	C	C	C
AF (Regional adjustment factor)	NA	NA	NA	NA	?
ED (Exposure duration)	?	?	?	?	?

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
NA = not applicable

Table 6-27 Probability Bounds Analysis Assumptions and Sources of Uncertainty for Agricultural Scenarios

Input	Commercial Dairy	Backyard Beef	Commercial Poultry - Meat	Commercial Poulty - Egg	Commercial Produce
TF (Soil to Plant Transfer Factor)	?	C	NA		?
D (Diet Composition)	?	?	?	?	NA
BA (Bioavailability)	NA	?	?	?	NA
BCF (Bioconcentration factor)	C	C	?	?	NA
F (Animal Fat Content)	?	?	?	NA	NA
CL (Cooking loss)	NA	?	?	?	?
PCL (Post cooking loss)	NA	?	?	?	?
UE (Uncertainty factor for consumption rate)	C	C	C	C	C
CR (Consumption rate)	C	C	C	C	C
AF (Regional adjustment factor)	NA	NA	NA	NA	?
ED (Exposure duration)	?	?	?	?	?

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
NA = not applicable

SECTION 6

FIGURES

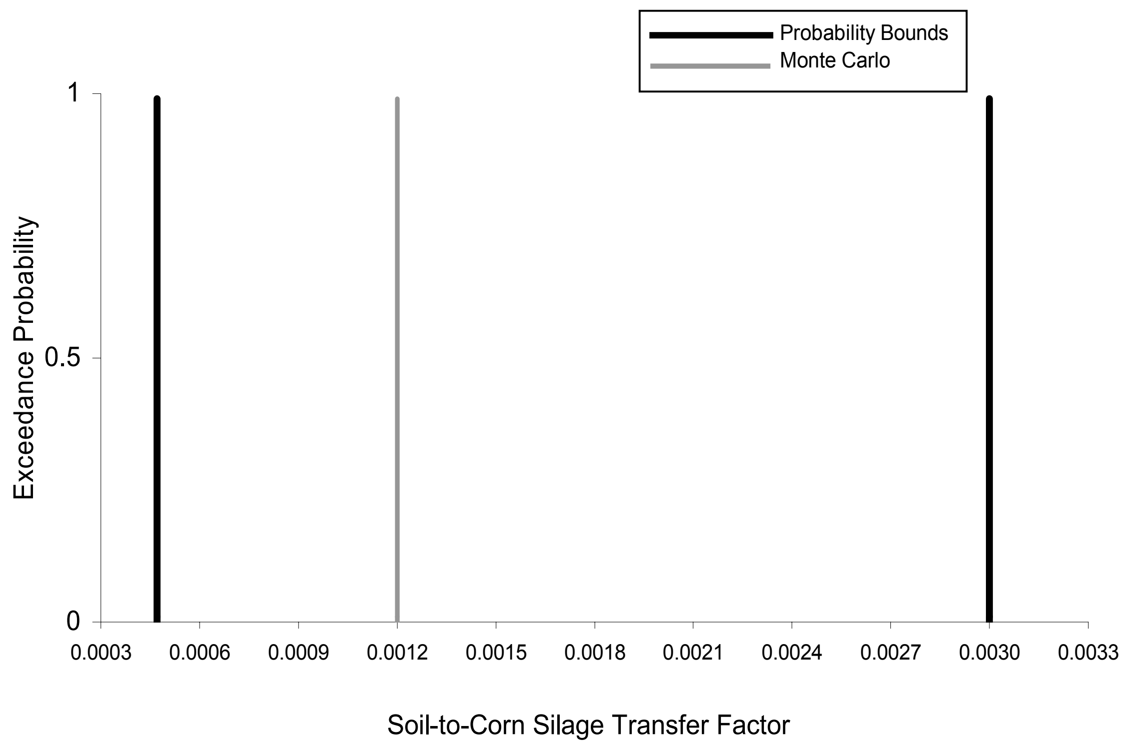

Figure 6-1 Model Inputs for Soil-to-Corn Silage Transfer Factor, Dairy Consumption, Commercial Farm Family

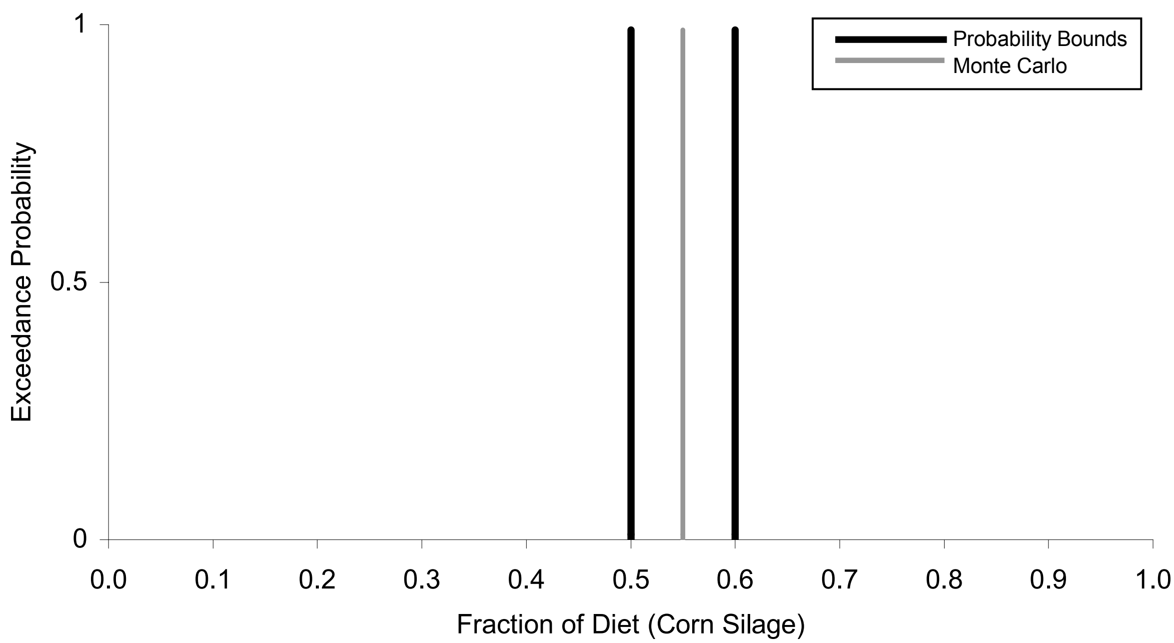

Figure 6-2 Model Inputs for Fraction of Diet (Corn Silage), Dairy Consumption, Commercial Farm Family

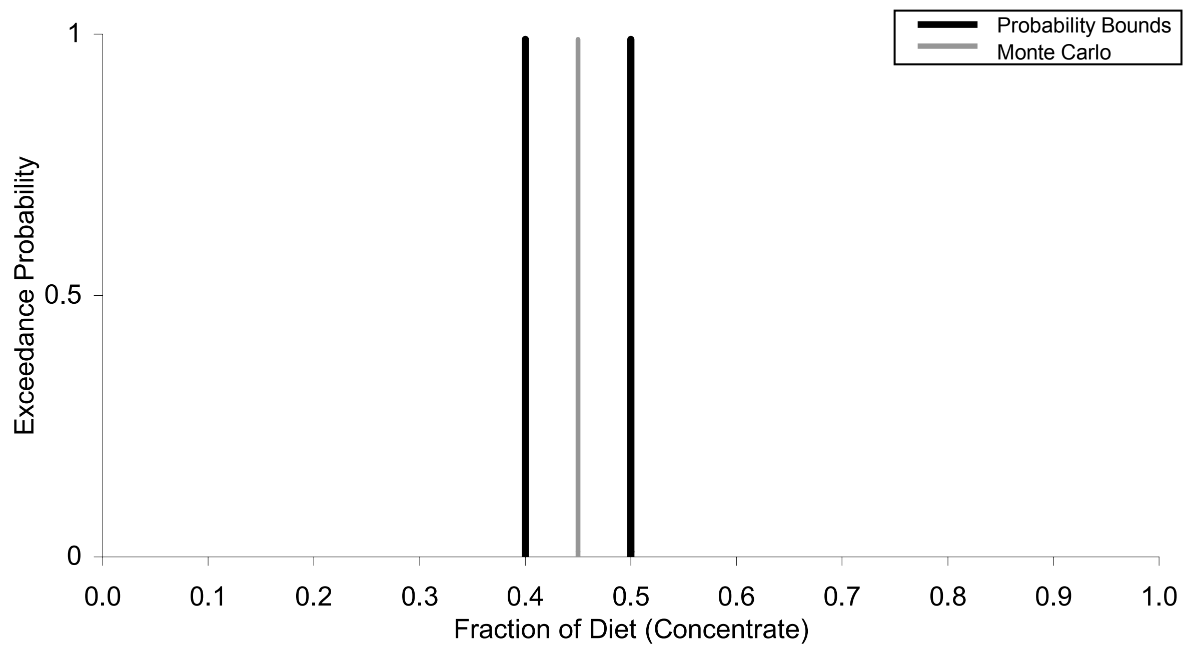

Figure 6-3 Model Inputs for Fraction of Diet (Concentrate), Dairy Consumption, Commercial Farm Family

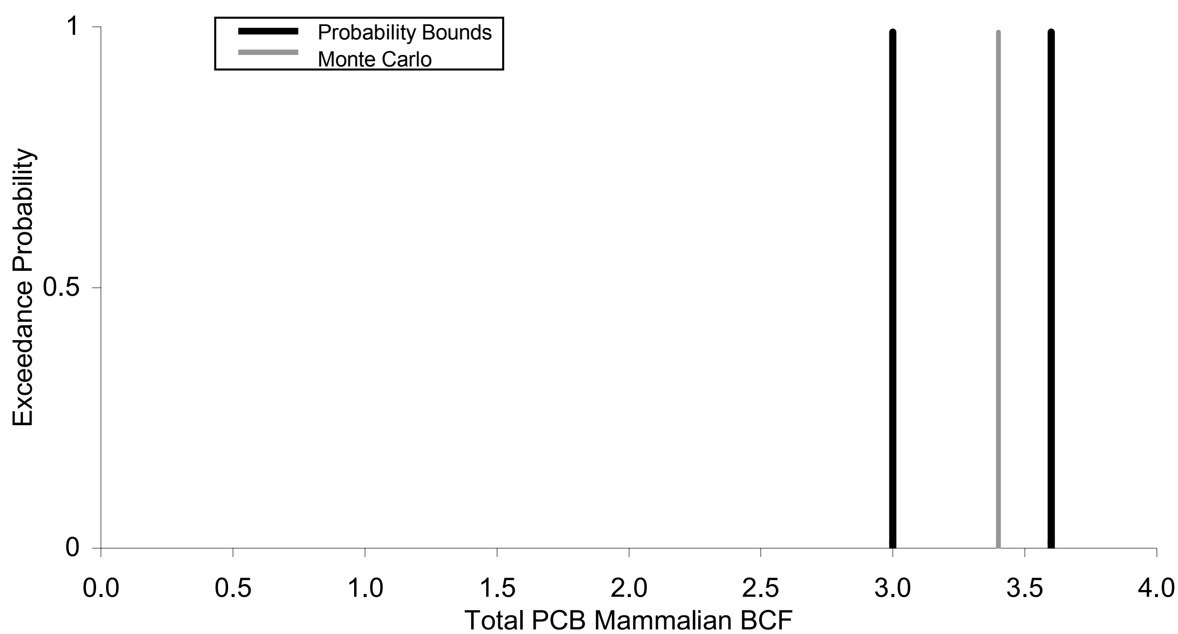

Figure 6-4 Model Inputs for tPCB Mammalian BCF, Dairy Consumption, Commercial Farm Family

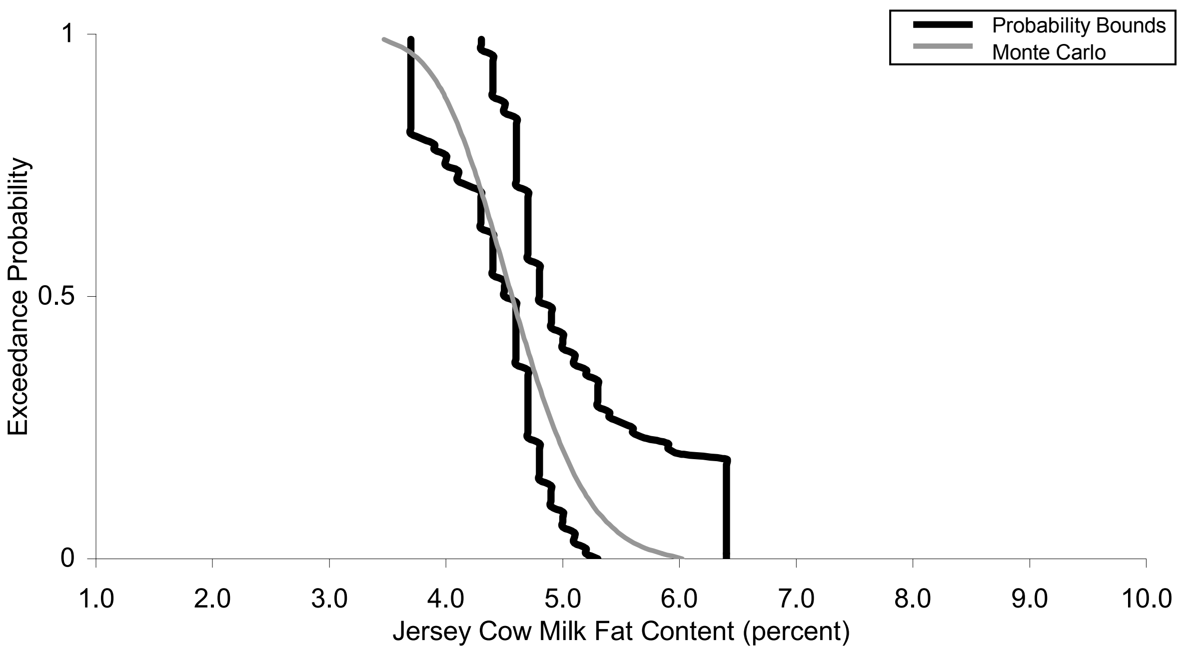

Figure 6-5 Model Inputs for Jersey Cow Milk Fat Content, Dairy Consumption, Commercial Farm Family

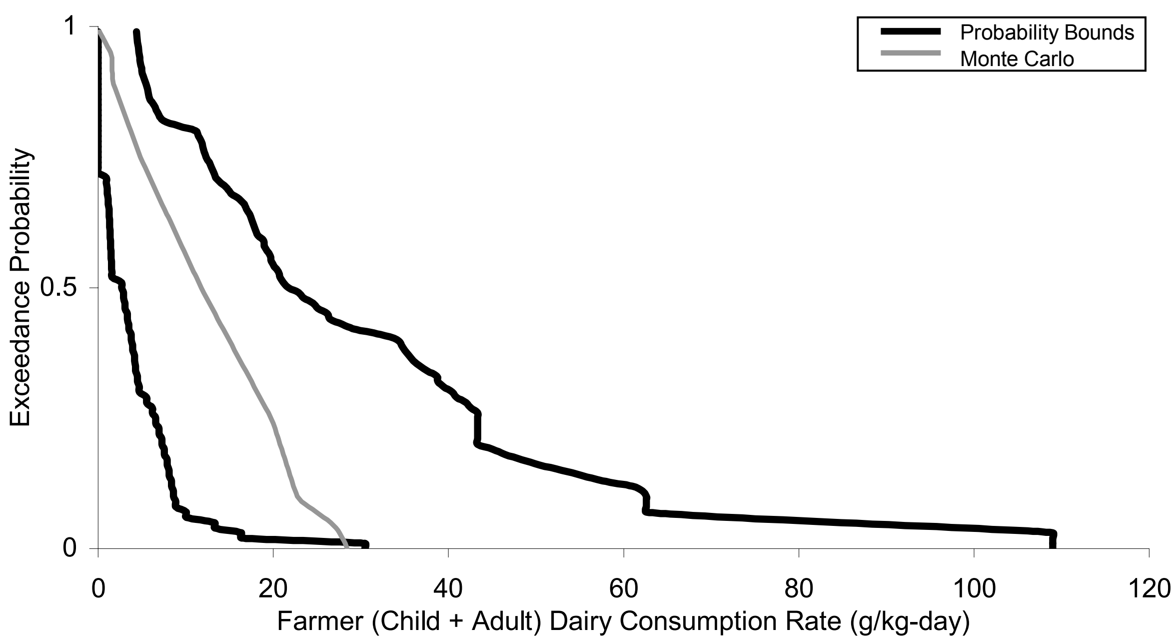

Figure 6-6 Model Inputs for Farmer (Child + Adult) Dairy Consumption Rate, Dairy Consumption, Commercial Farm Family

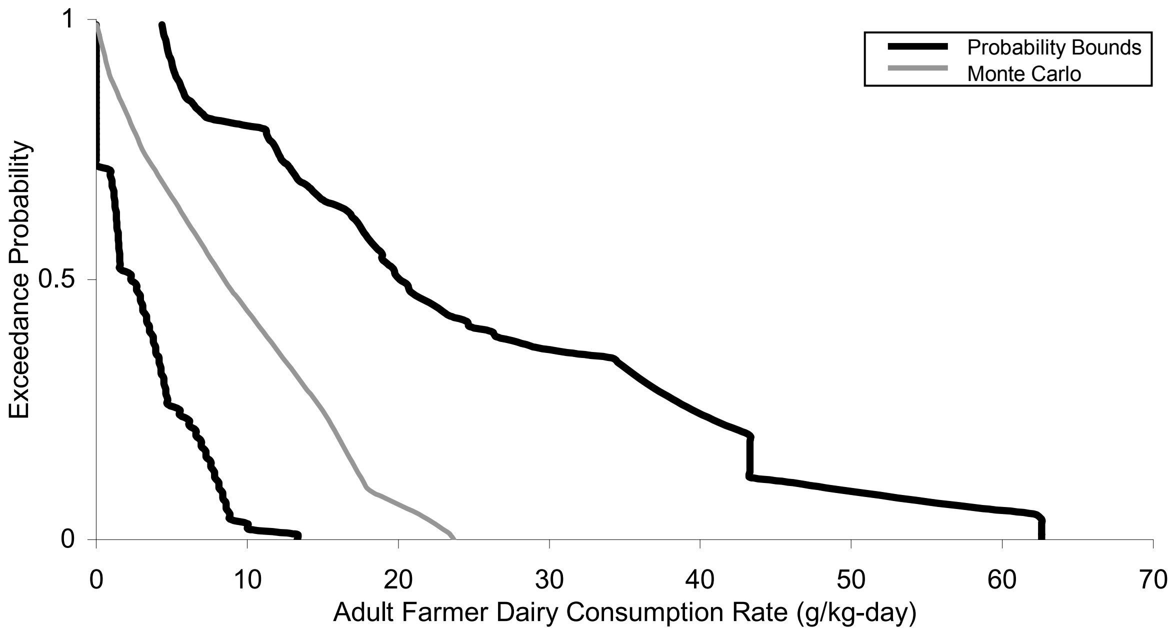

Figure 6-7 Model Inputs for Adult Farmer Dairy Consumption Rate, Dairy Consumption, Commercial Farm Family

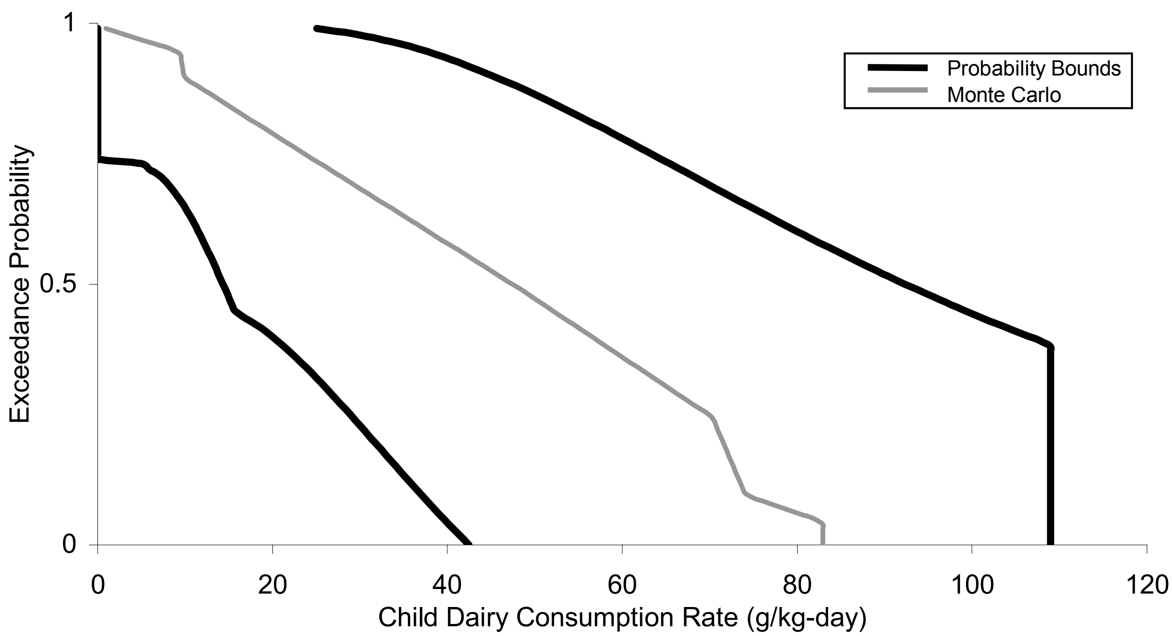

Figure 6-8 Model Inputs for Child Dairy Consumption Rate, Dairy Consumption, Commercial Farm Family

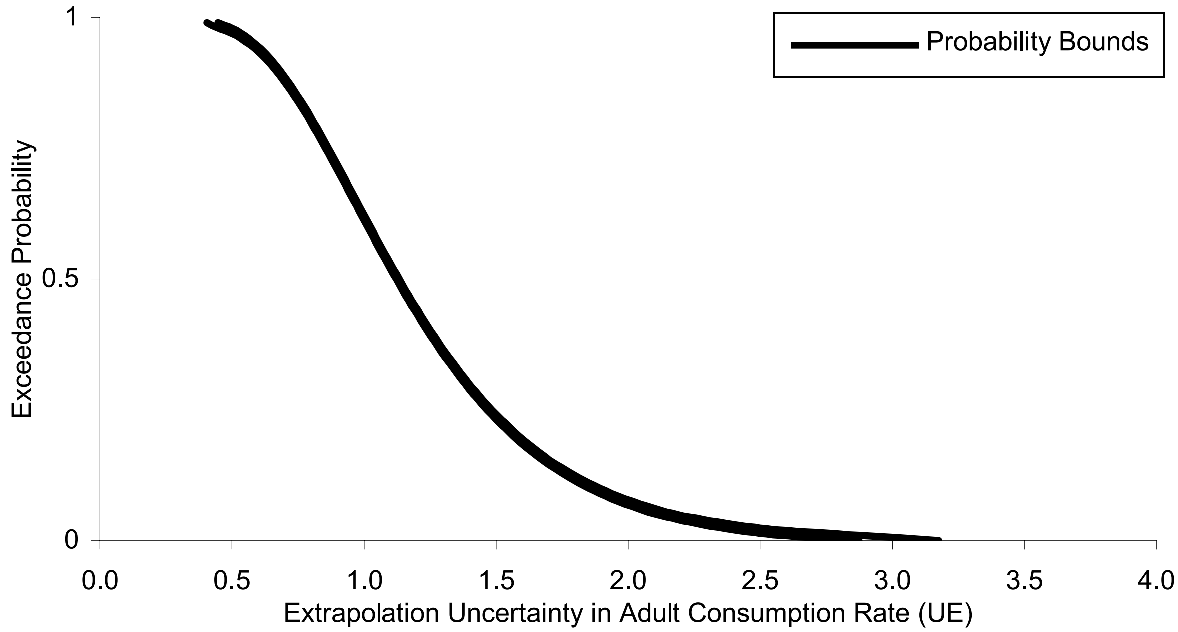

Figure 6-9 Model Input for Extrapolation Uncertainty in Adult Consumption Rate, Dairy Consumption, Commercial Farm Family

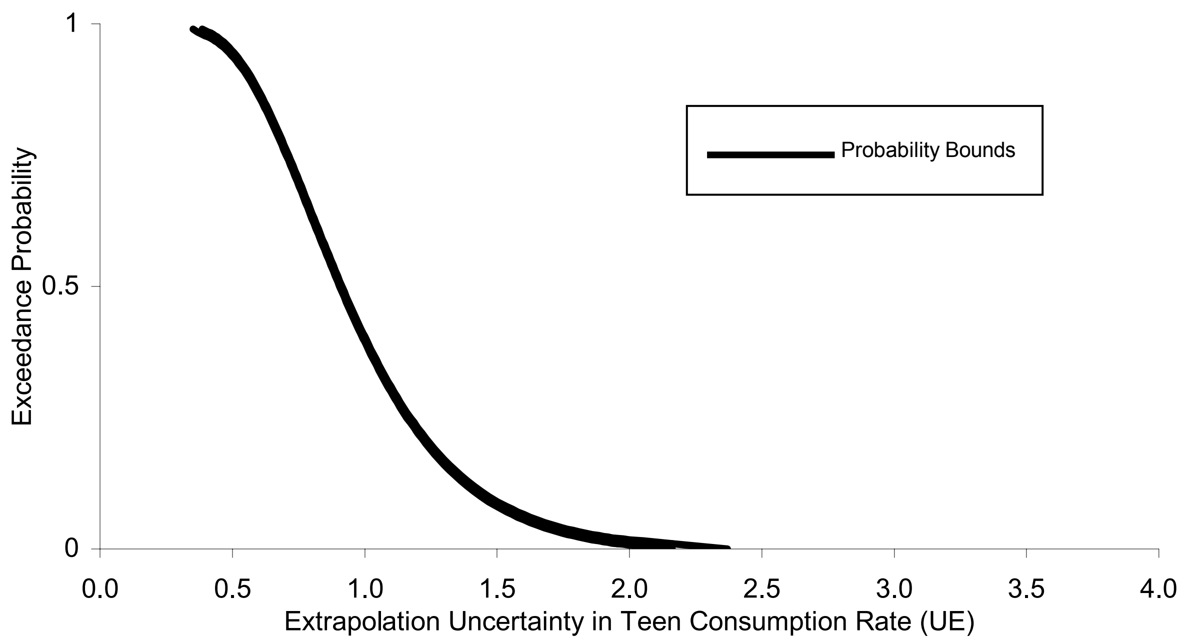

Figure 6-10 Model Input for Extrapolation Uncertainty in Teen Consumption Rate, Dairy Consumption, Commercial Farm Family

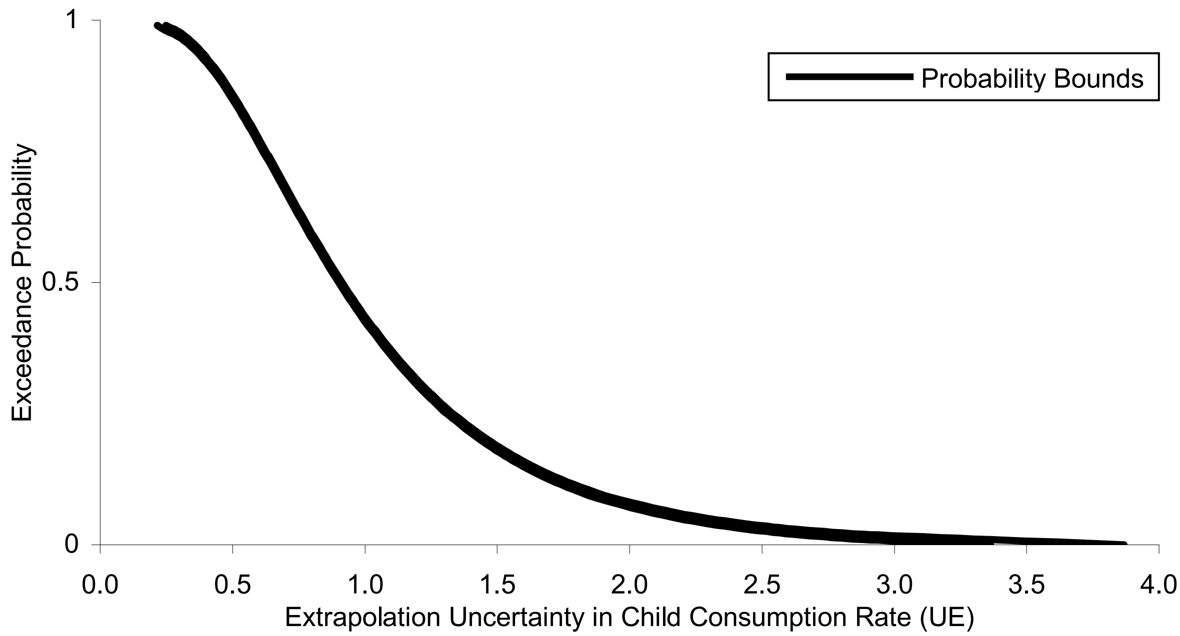

Figure 6-11 Model Input for Extrapolation Uncertainty in Child Consumption Rate, Dairy Consumption, Commercial Farm Family

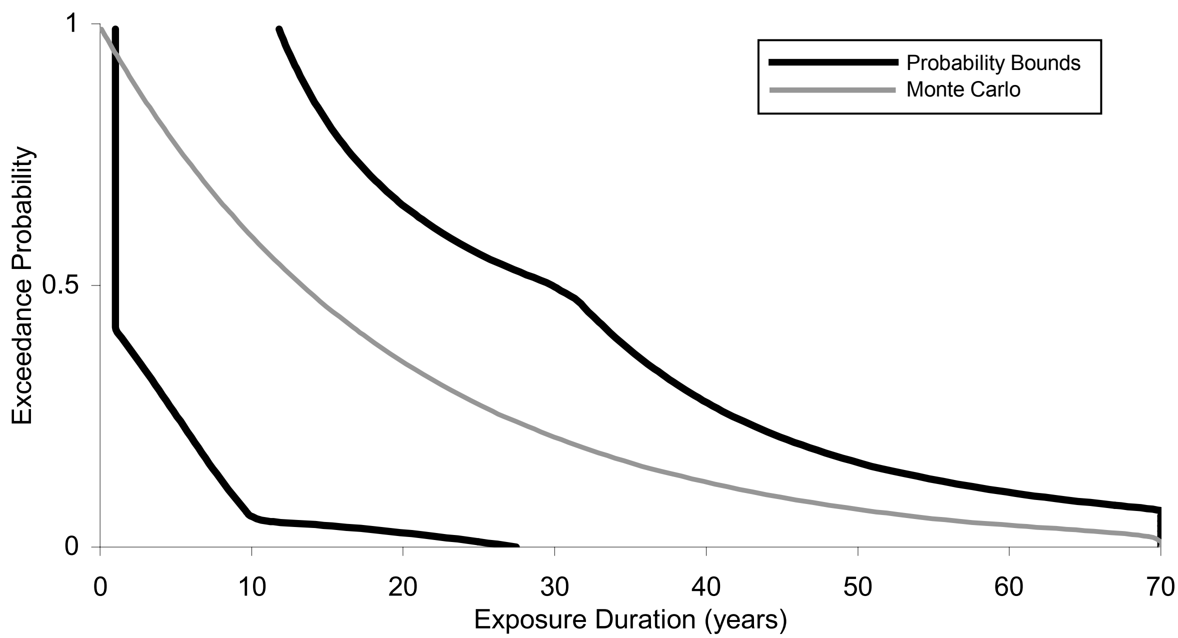

Figure 6-12 Model Inputs for Exposure Duration, Dairy Consumption, Commercial Farm Family

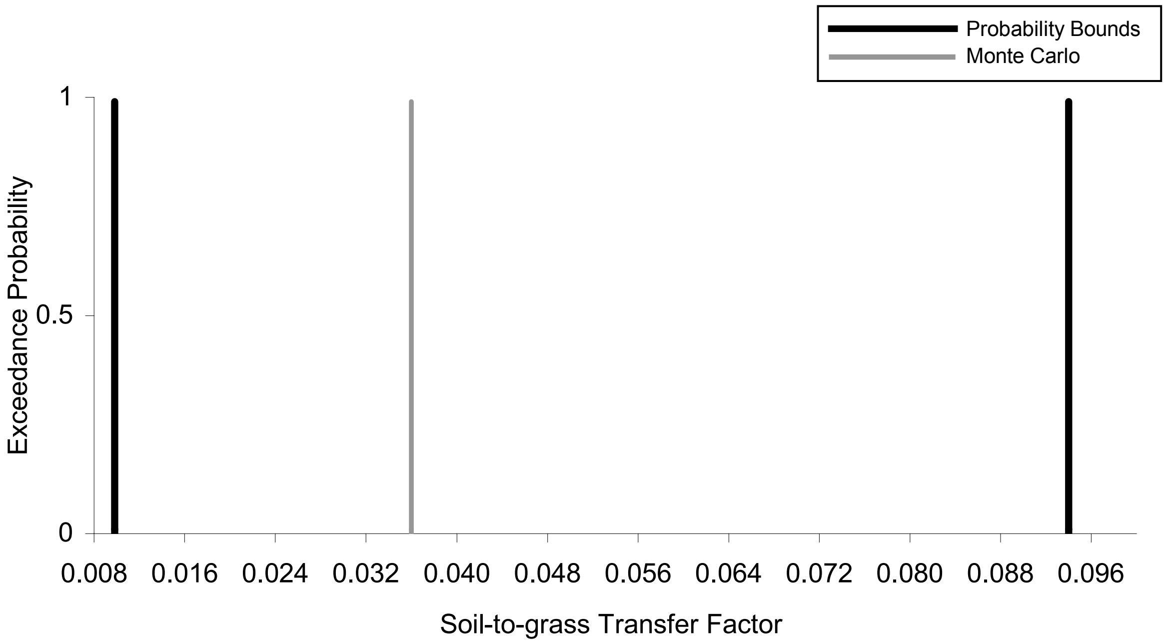

Figure 6-13 Model Inputs for Soil-to-Grass Transfer Factor, Beef Consumption, Backyard Farm Family

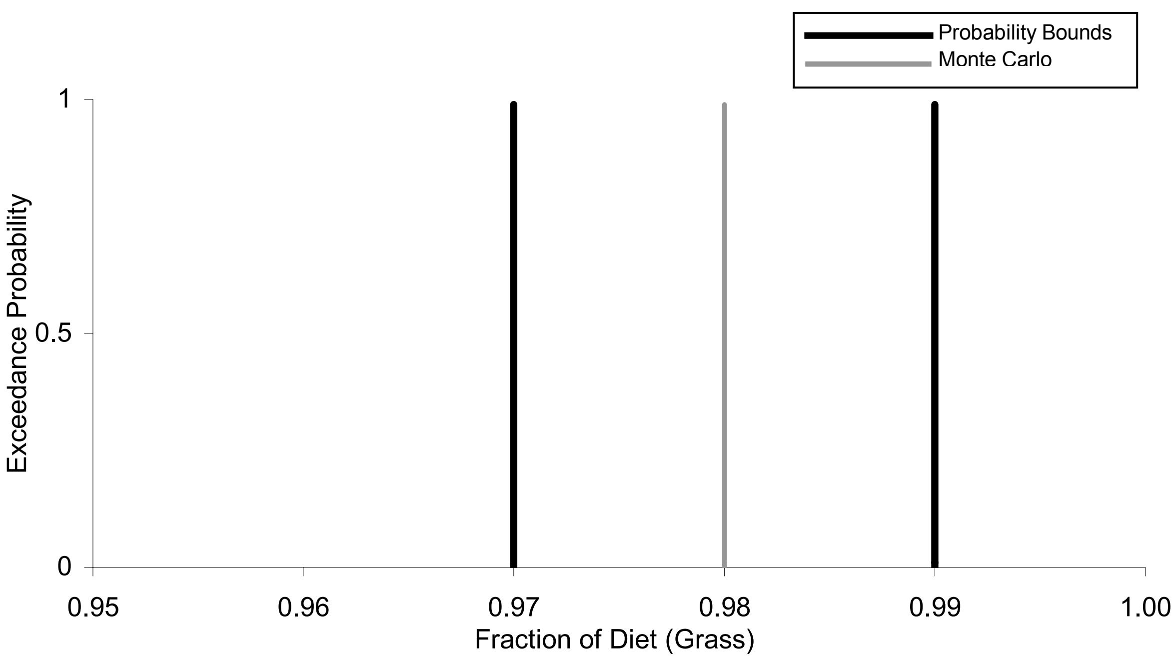

Figure 6-14 Model Inputs for Fraction of Diet (Grass), Beef Consumption, Backyard Farm Family

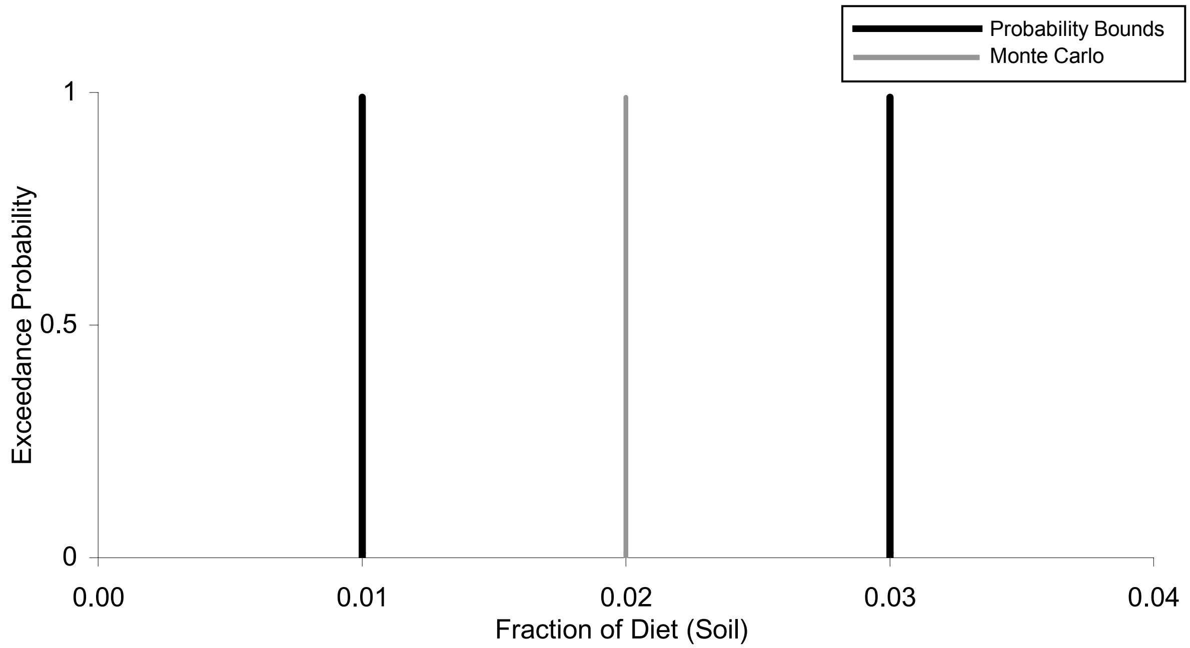

Figure 6-15 Model Inputs for Fraction of Diet (Soil), Beef Consumption, Backyard Farm Family

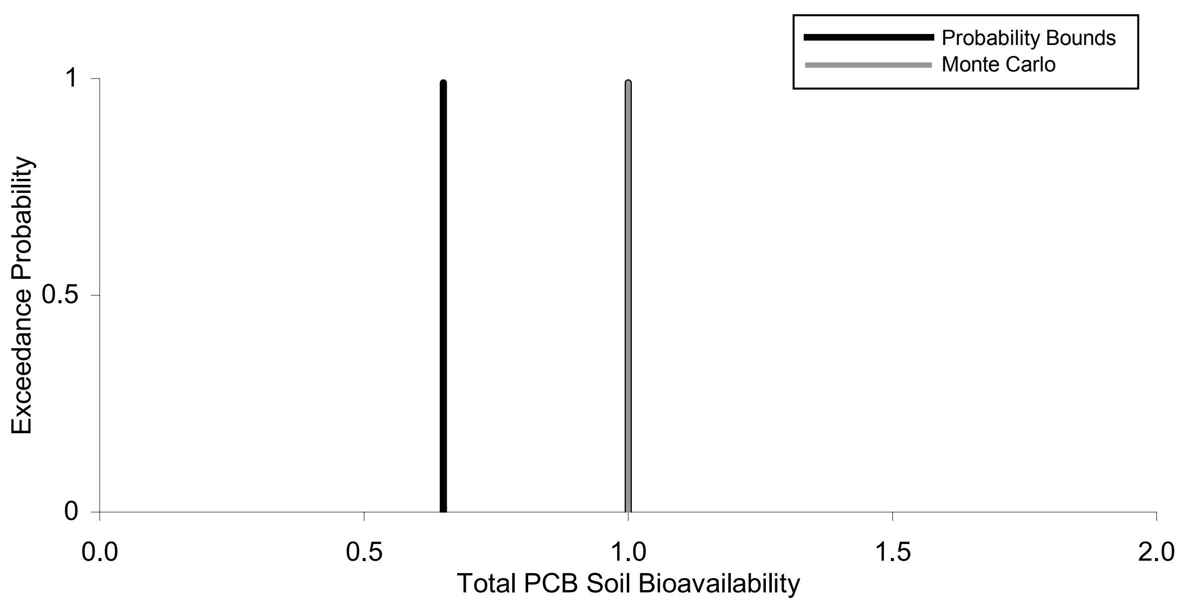

Figure 6-16 Model Inputs for tPCB Soil Bioavailability, Beef Consumption, Backyard Farm Family

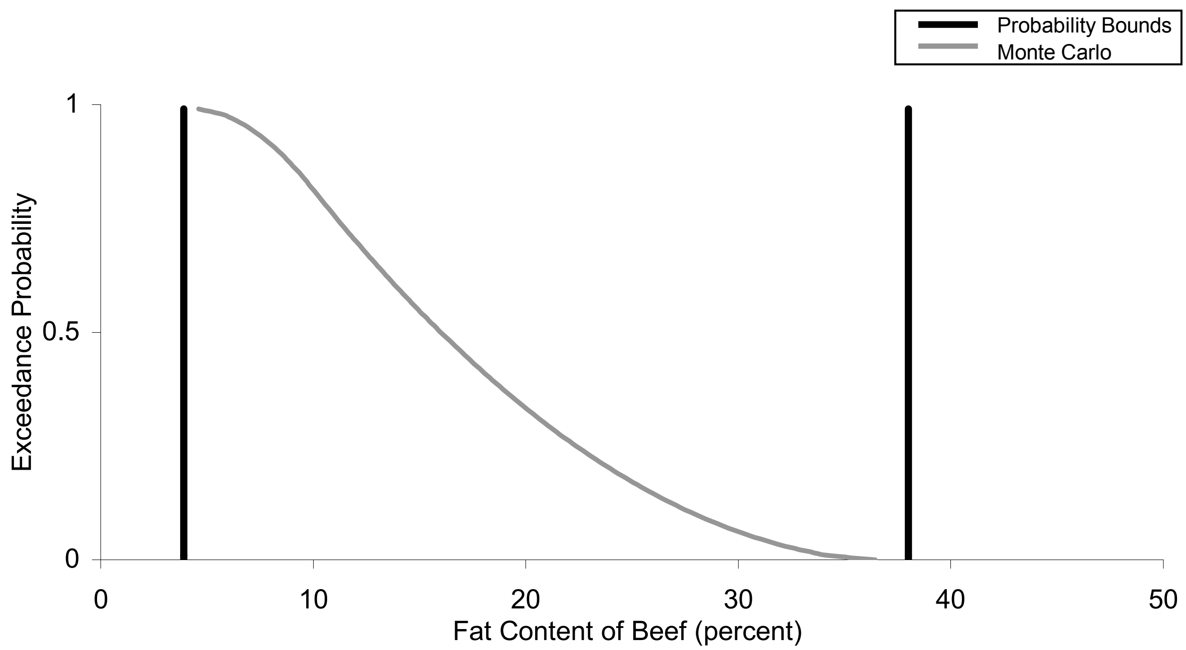

Figure 6-17 Model Inputs for Fat Content of Beef (mg fat/kg beef), Beef Consumption, Backyard Farm Family

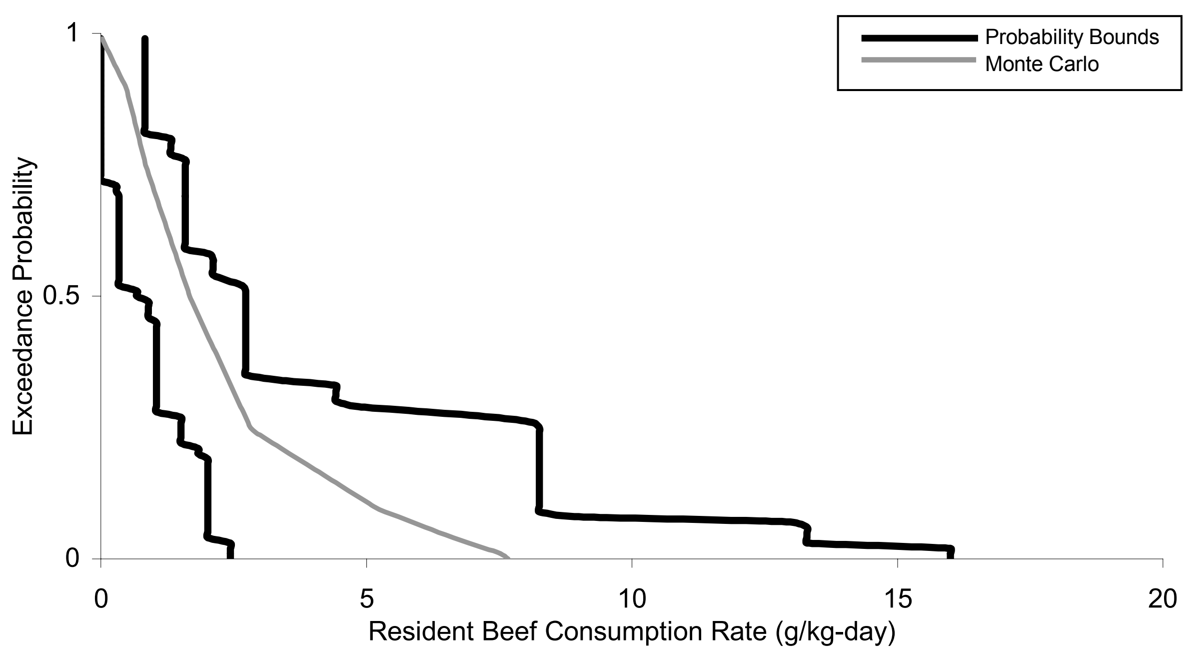

Figure 6-18 Model Inputs for Resident Beef Consumption Rate, Beef Consumption, Backyard Farm Family

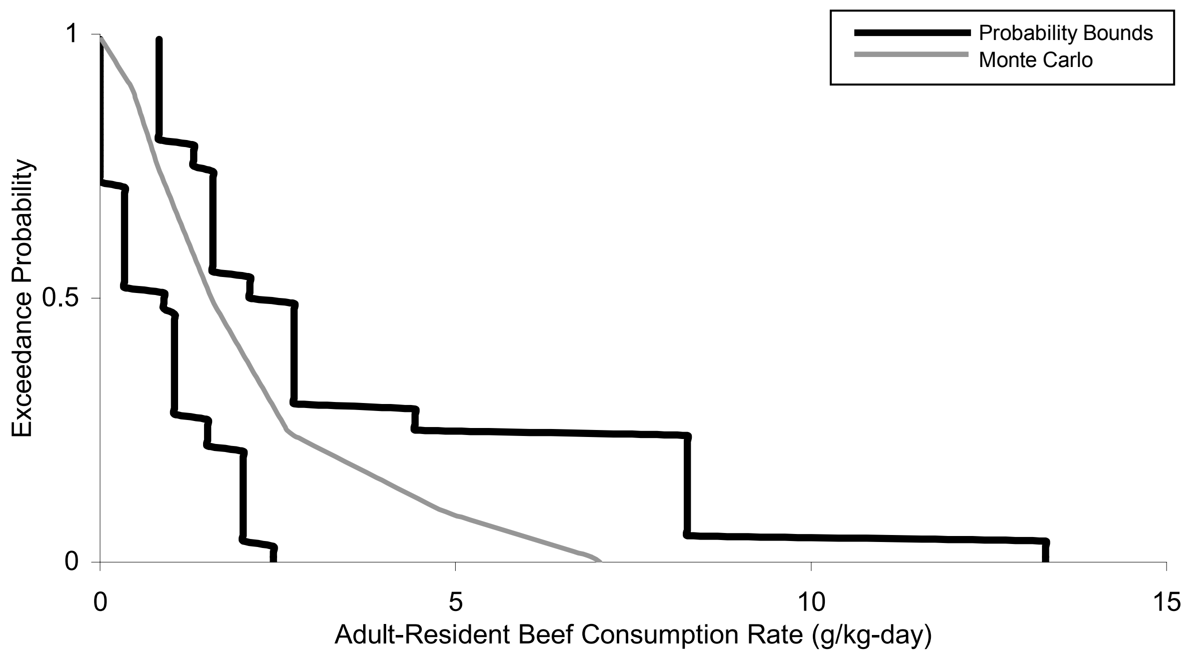

Figure 6-19 Model Inputs for Adult Resident Beef Consumption Rate, Beef Consumption, Backyard Farm Family

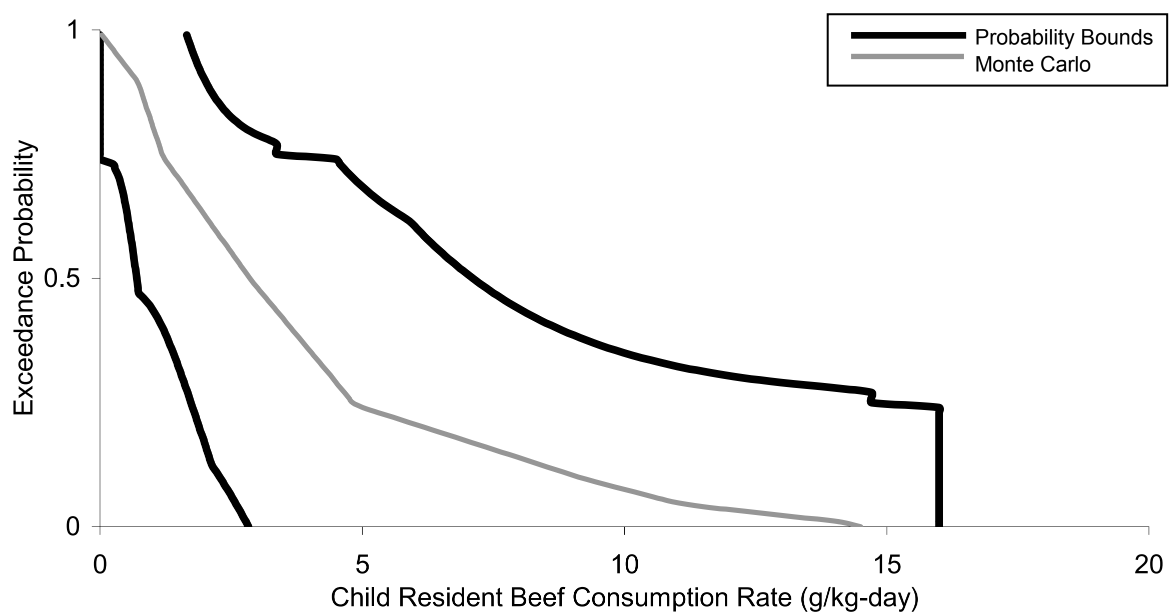

Figure 6-20 Model Inputs for Child Resident Beef Consumption Rate, Beef Consumption, Backyard Farm Family

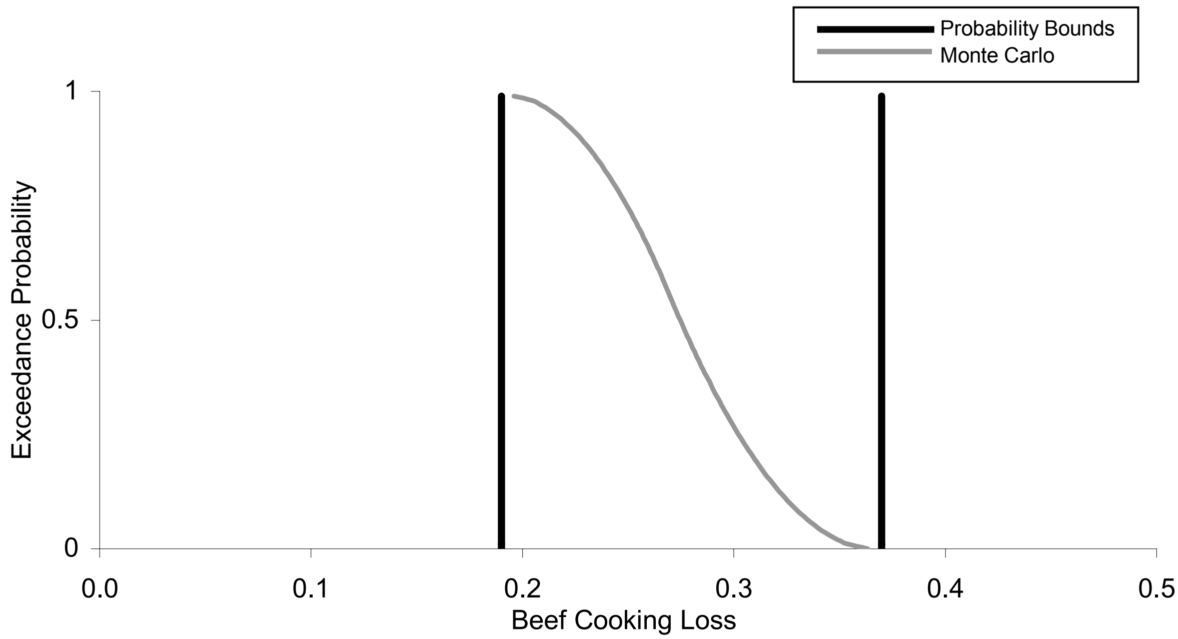

Figure 6-21 Model Inputs for Beef Cooking Loss, Beef Consumption, Backyard Farm Family

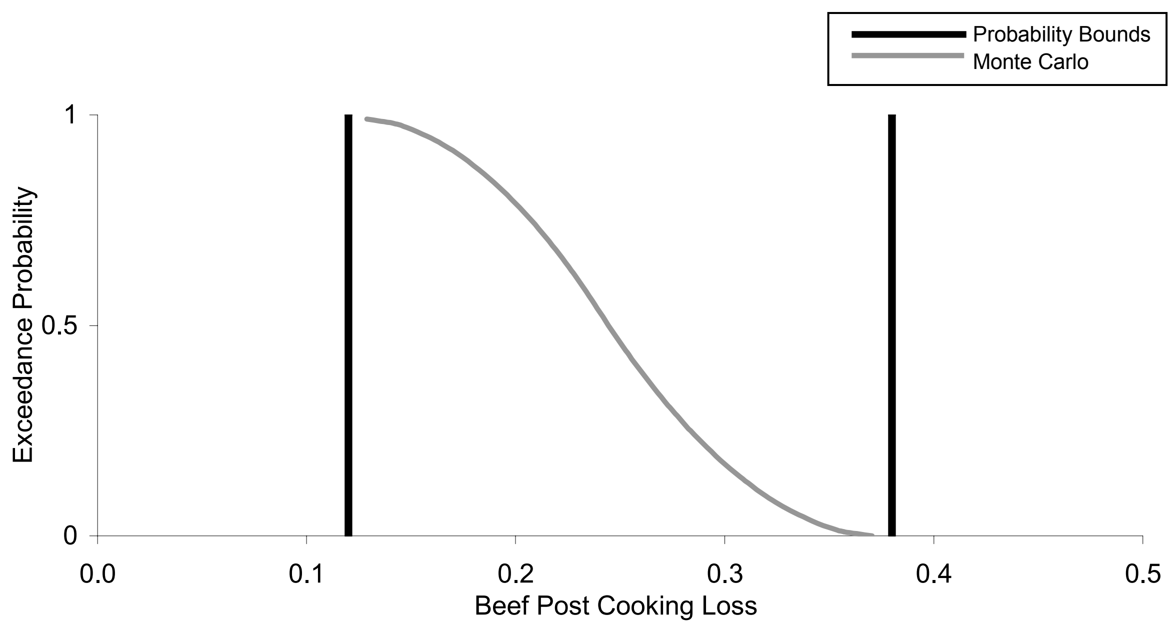

Figure 6-22 Model Inputs for Beef Post Cooking Loss, Beef Consumption, Backyard Farm Family

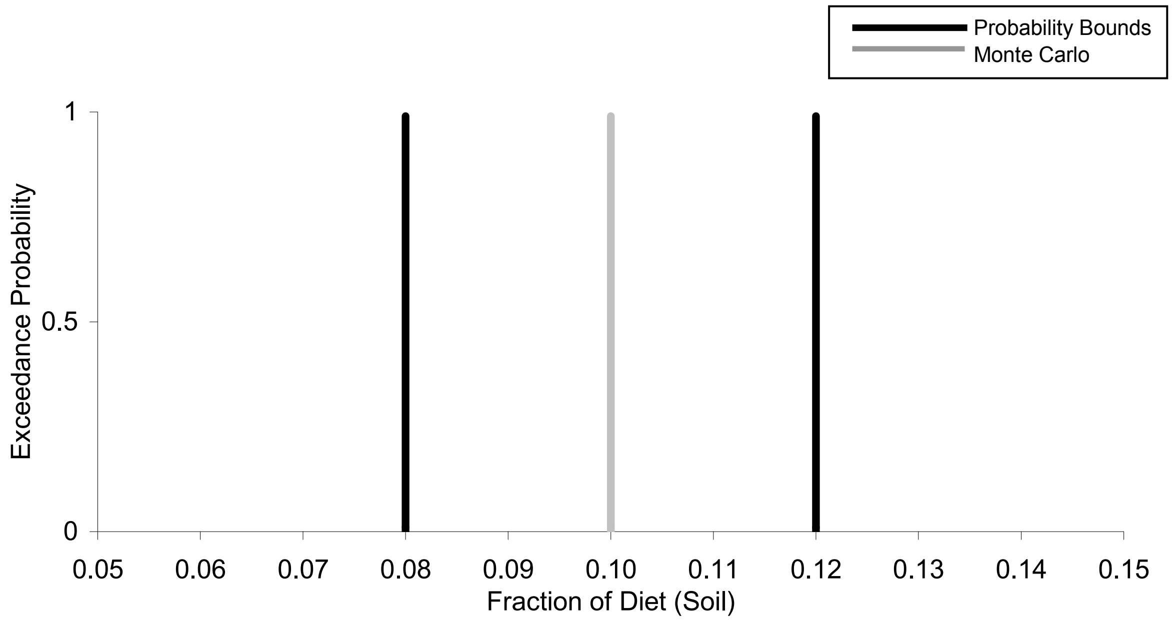

Figure 6-23 Model Inputs for Fraction of Diet (Soil), Poultry Meat Consumption, Commercial Farm Family

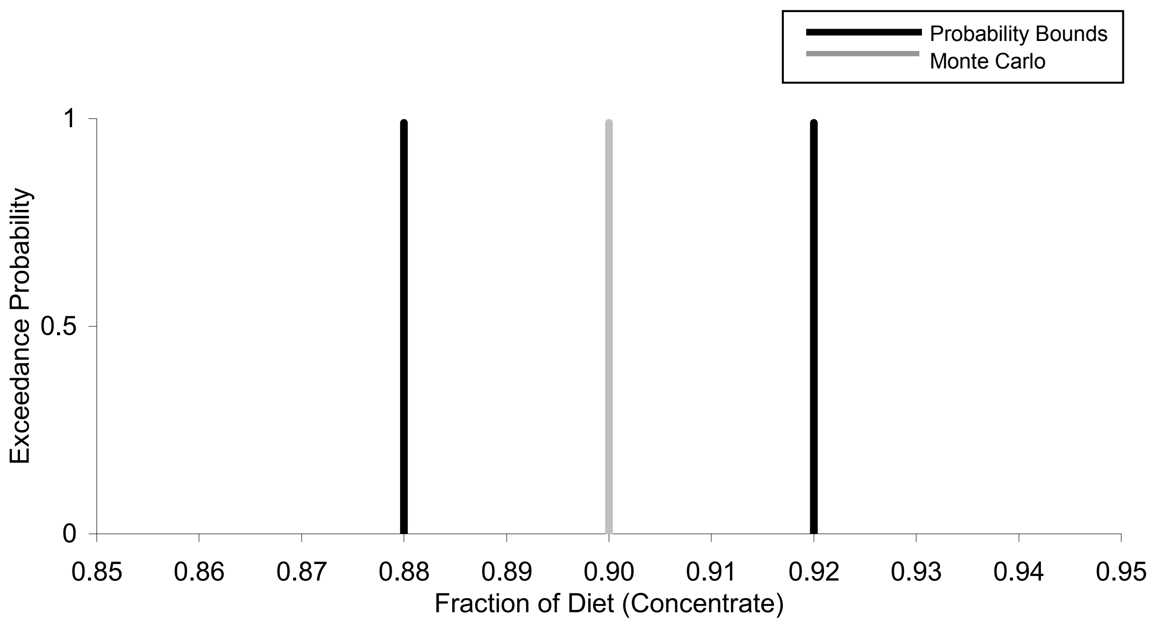

Figure 6-24 Model Inputs for Fraction of Diet (Concentrate), Poultry Meat Consumption, Commercial Farm Family

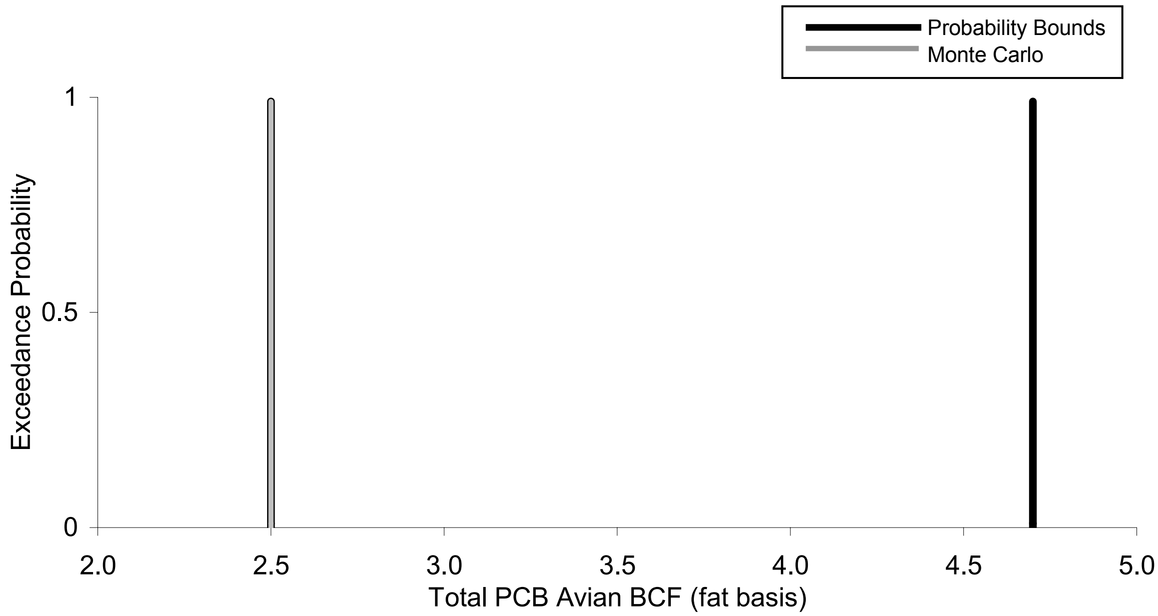

Figure 6-25 Model Inputs for tPCB Avian BCF, Poultry Meat Consumption, Commercial Farm Family

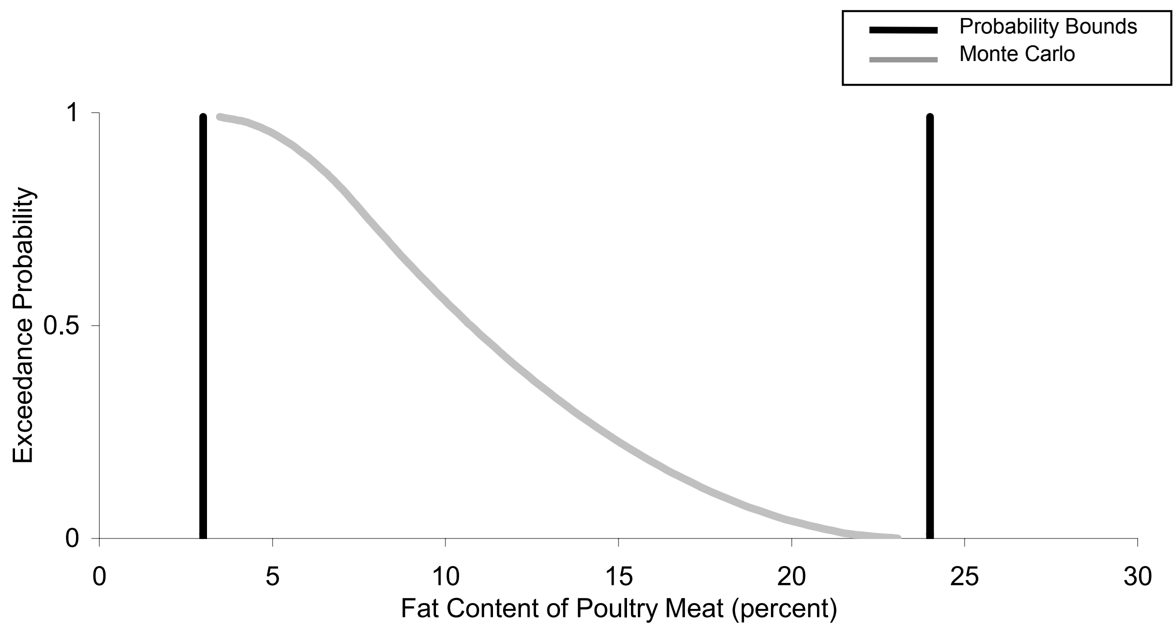

Figure 6-26 Model Inputs for Fat Content of Poultry Meat (mg fat/kg poultry meat), Poultry Meat Consumption, Commercial Farm Family

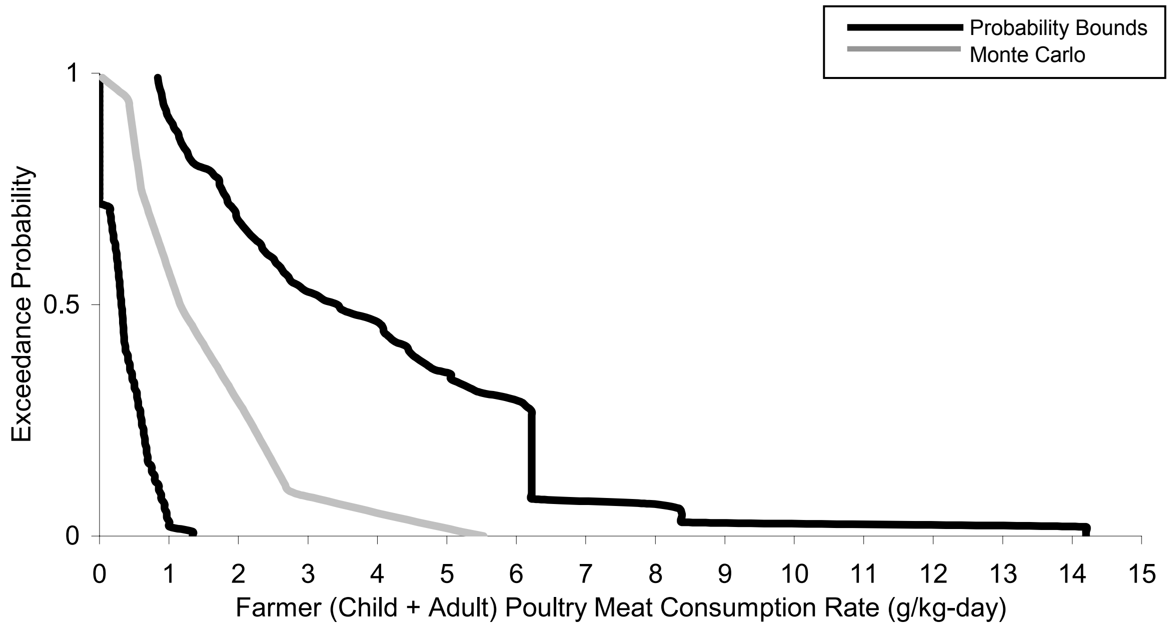

Figure 6-27 Model Inputs for Farmer (Child + Adult) Poultry Meat Consumption Rate, Poultry Meat Consumption, Commercial Farm Family

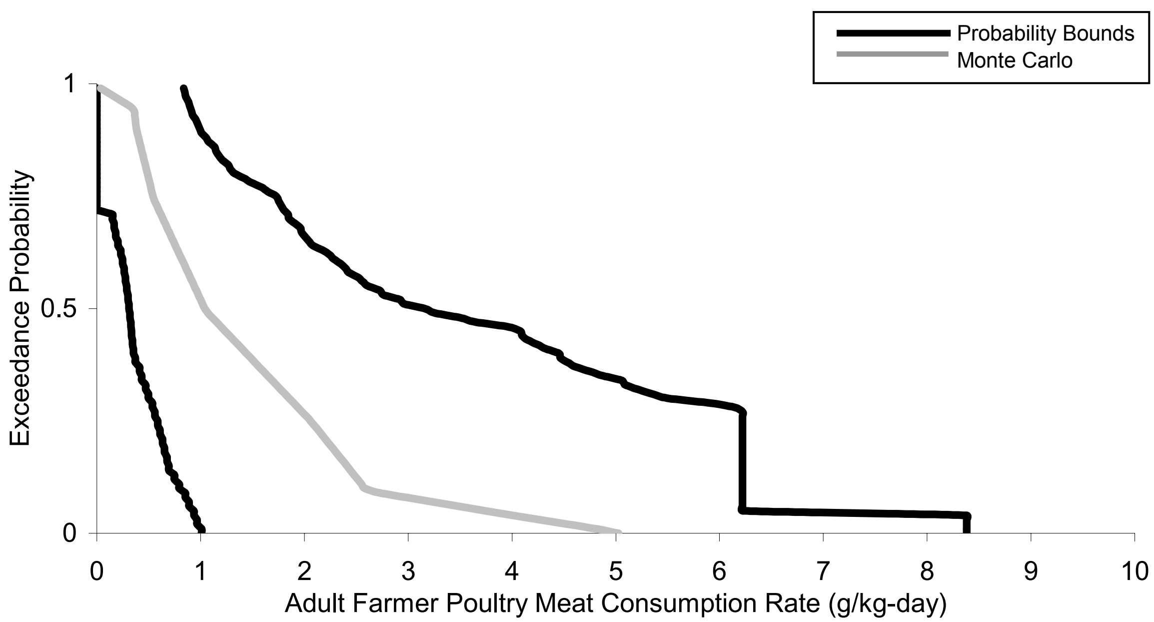

Figure 6-28 Model Inputs for Adult Farmer Poultry Meat Consumption Rate, Poultry Meat Consumption, Commercial Farm Family

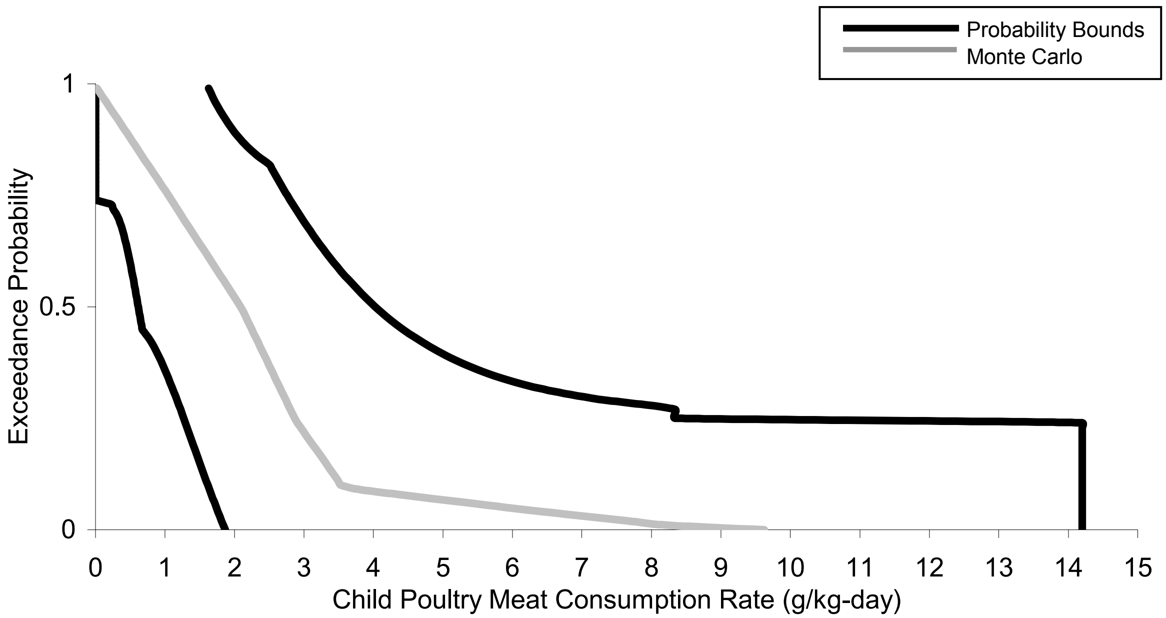

Figure 6-29 Model Inputs for Child Poultry Meat Consumption Rate, Poultry Meat Consumption, Commercial Farm Family

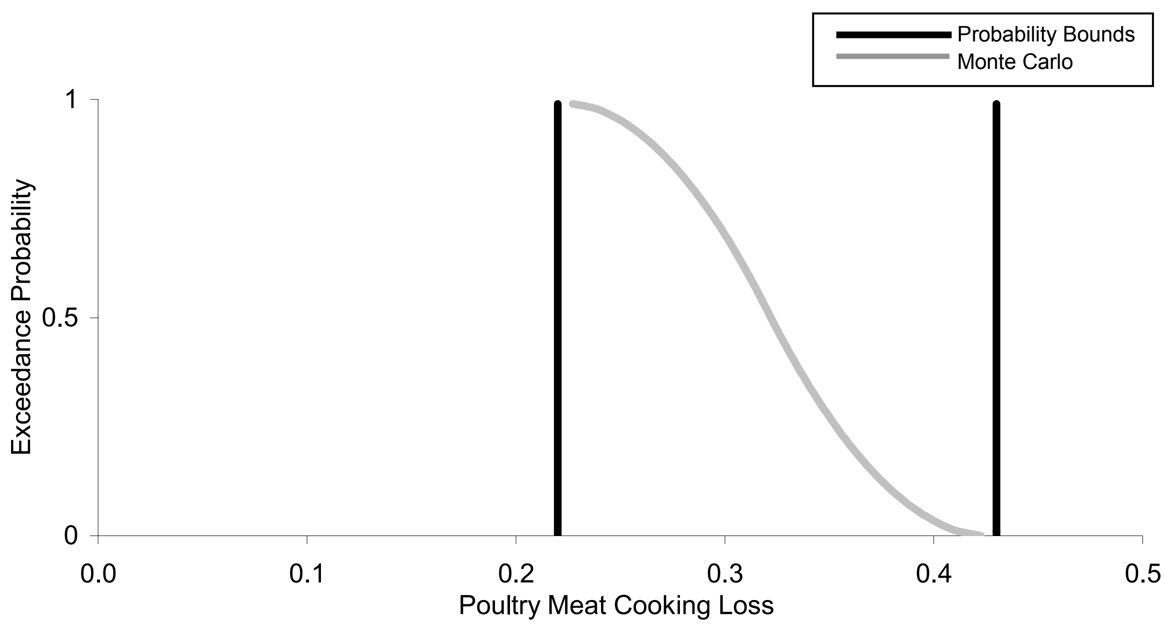

Figure 6-30 Model Inputs for Poultry Meat Cooking Loss, Poultry Meat Consumption, Commercial Farm Family

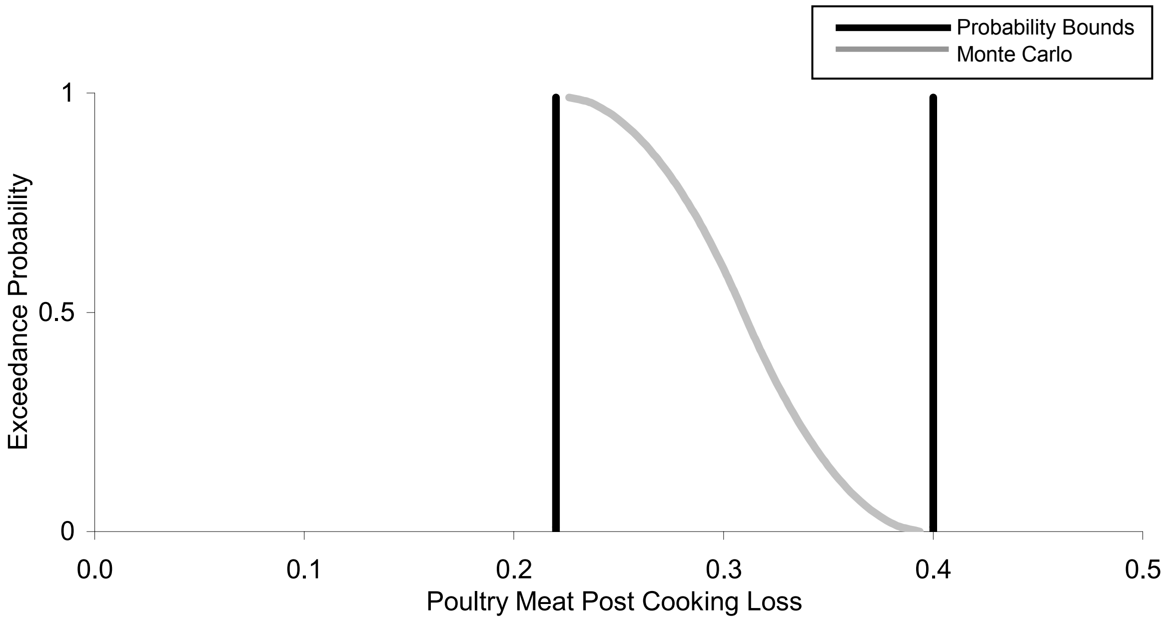

Figure 6-31 Model Inputs for Poultry Meat Post Cooking Loss, Poultry Meat Consumption, Commercial Farm Family

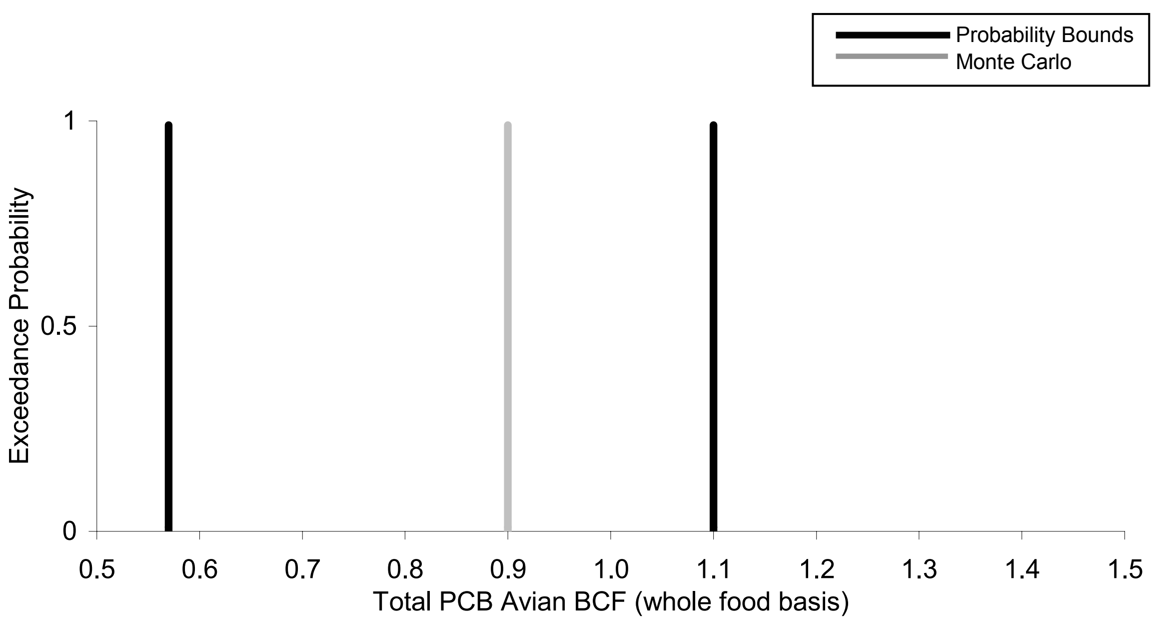

Figure 6-32 Model Inputs for tPCB Avian BCF, Poultry Egg Consumption, Commercial Farm Family

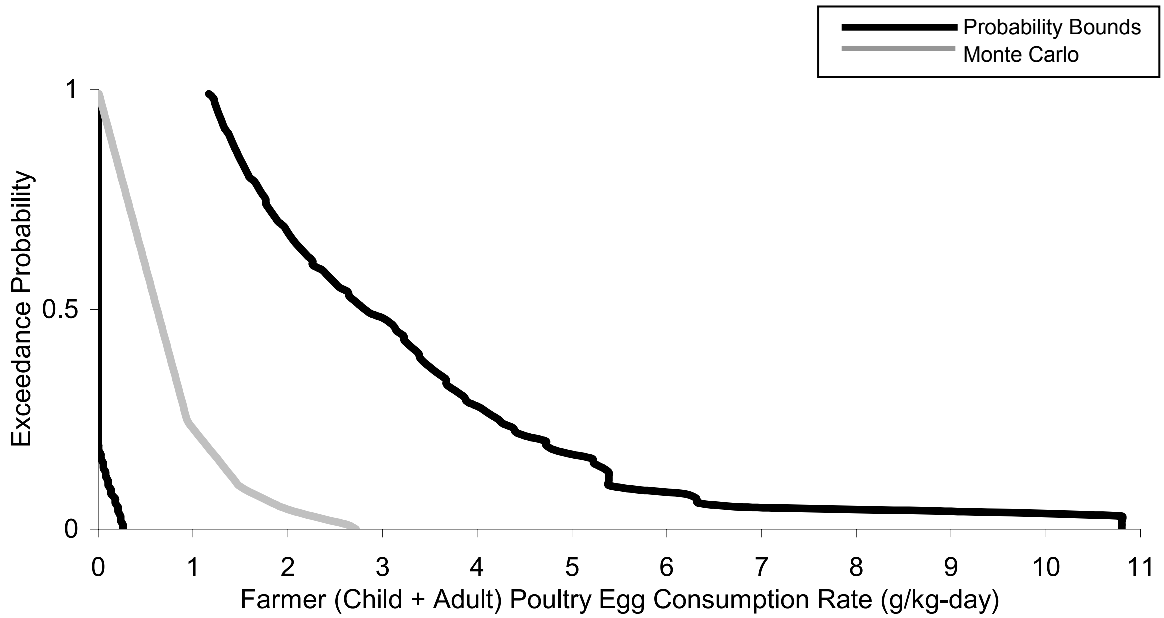

Figure 6-33 Model Inputs for Farmer (Child +Adult) Poultry Egg Consumption Rate, Poultry Egg Consumption, Commercial Farm Family

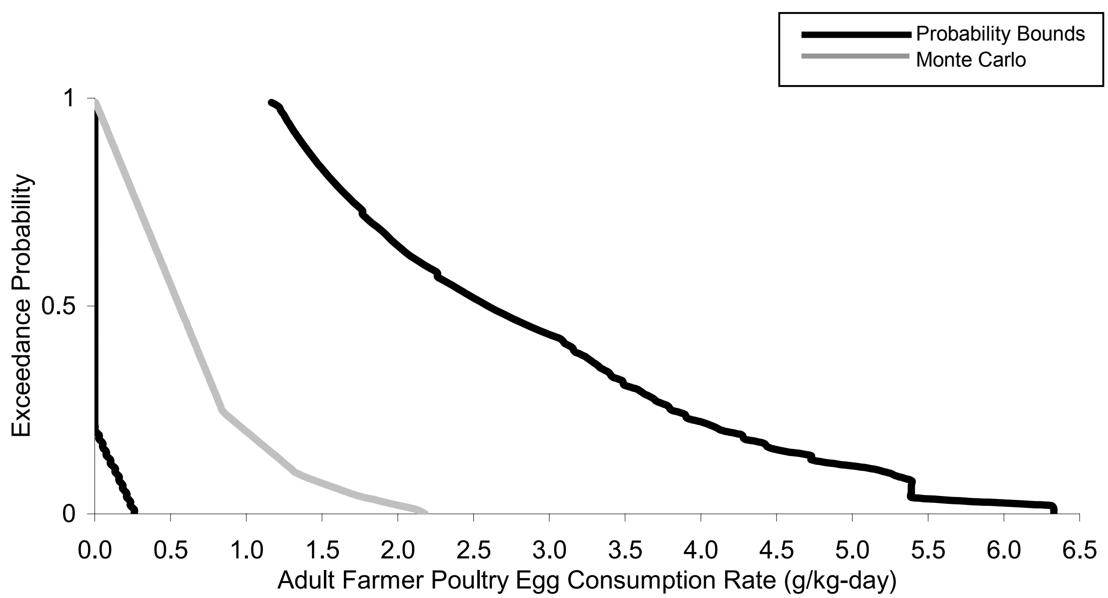

Figure 6-34 Model Inputs for Adult Farmer Poultry Egg Consumption Rate, Poultry Egg Consumption, Commercial Farm Family

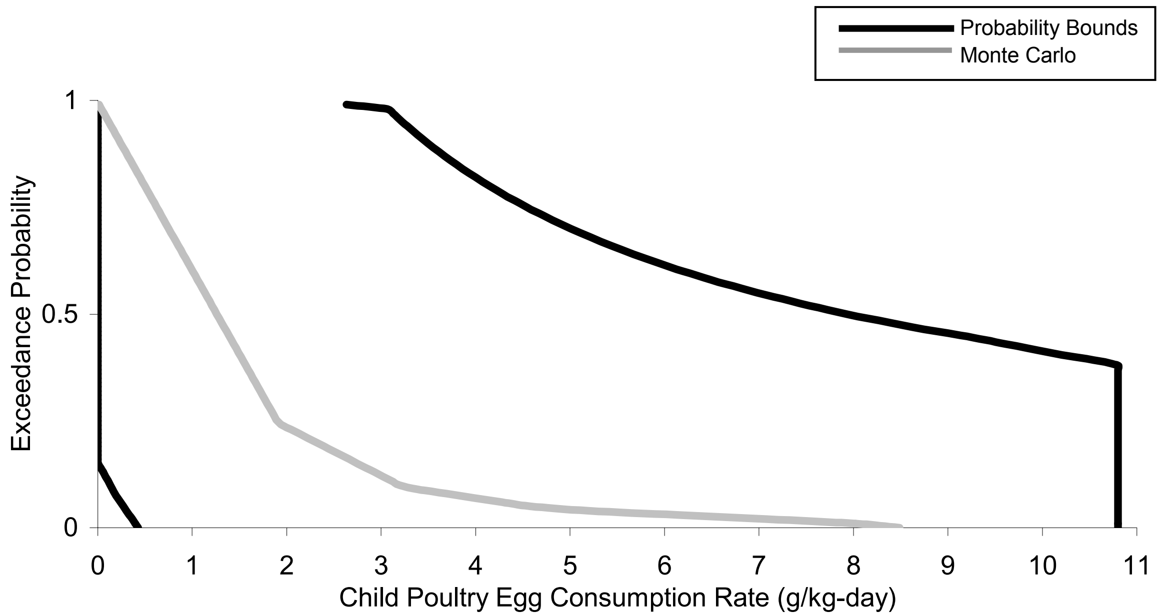

Figure 6-35 Model Inputs for Child Poultry Egg Consumption Rate, Poultry Egg Consumption, Commercial Farm Family

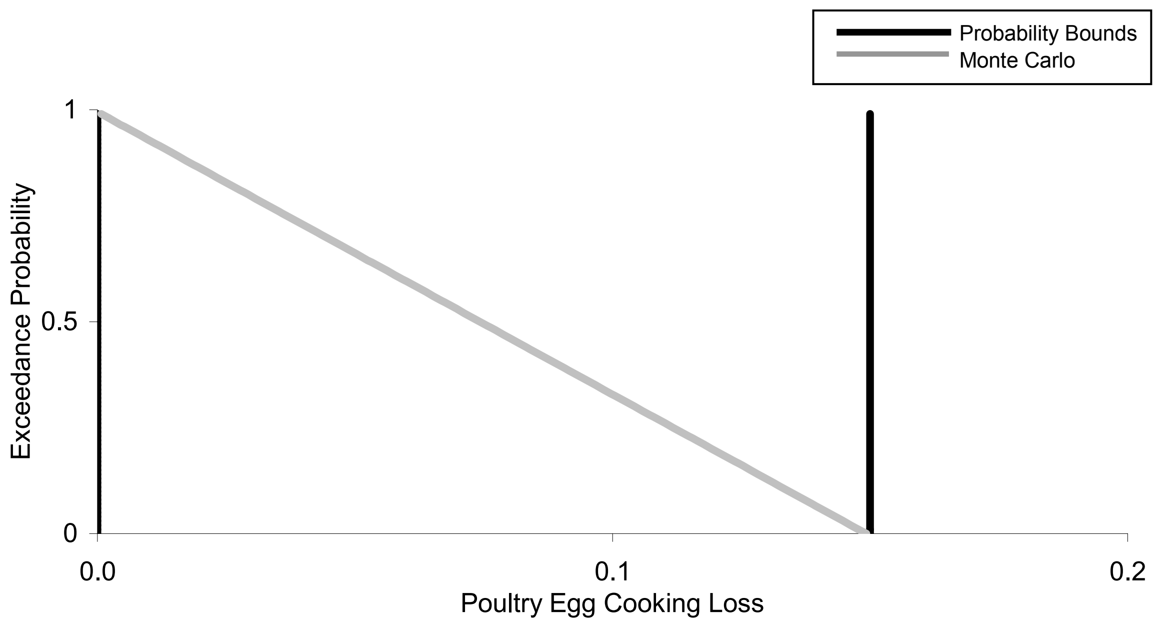

Figure 6-36 Model Inputs for Poultry Egg Cooking Loss, Poultry Egg Consumption, Commercial Farm Family

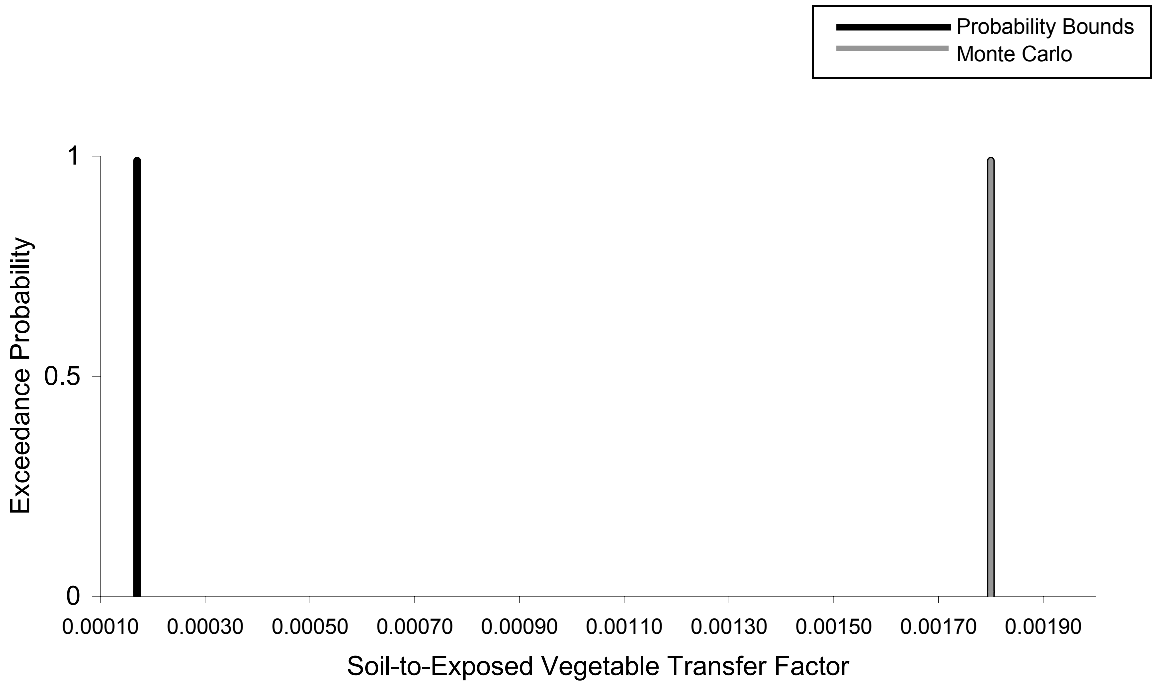

Figure 6-37 Model Inputs for Soil-to-Exposed Vegetable Transfer Factor, Garden Produce Consumption, Commercial Farm Family

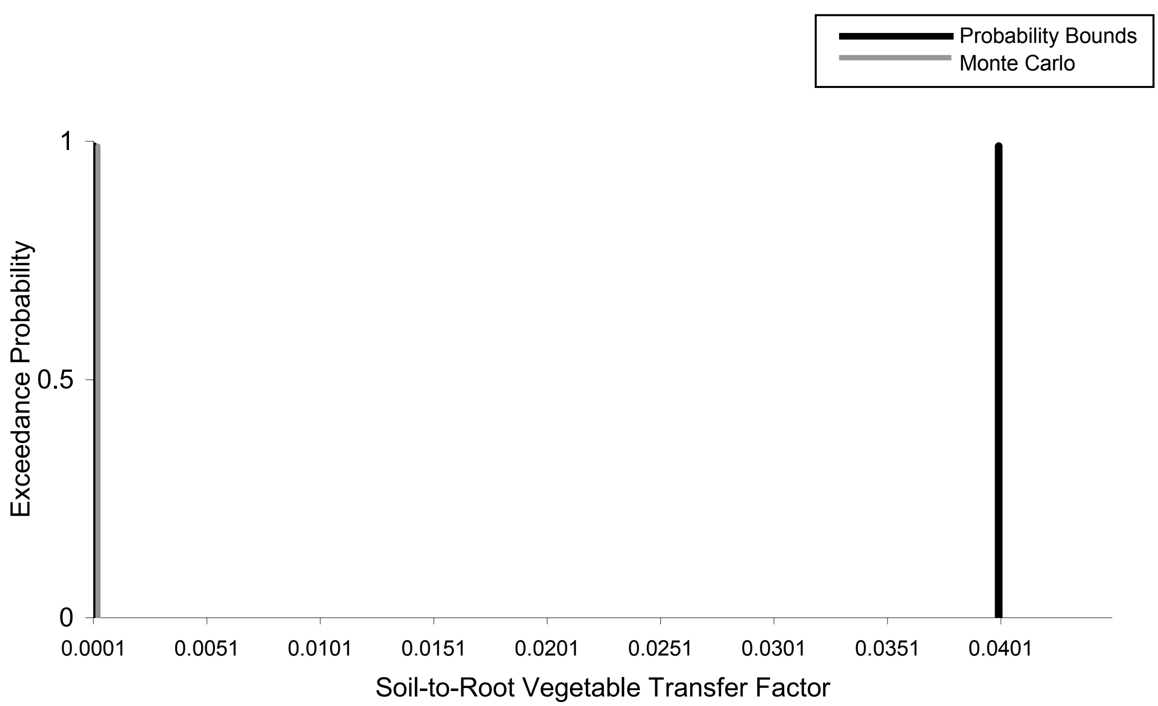

Figure 6-38 Model Inputs for Soil-to-Root Vegetable Transfer Factor, Garden Produce Consumption, Commercial Farm Family

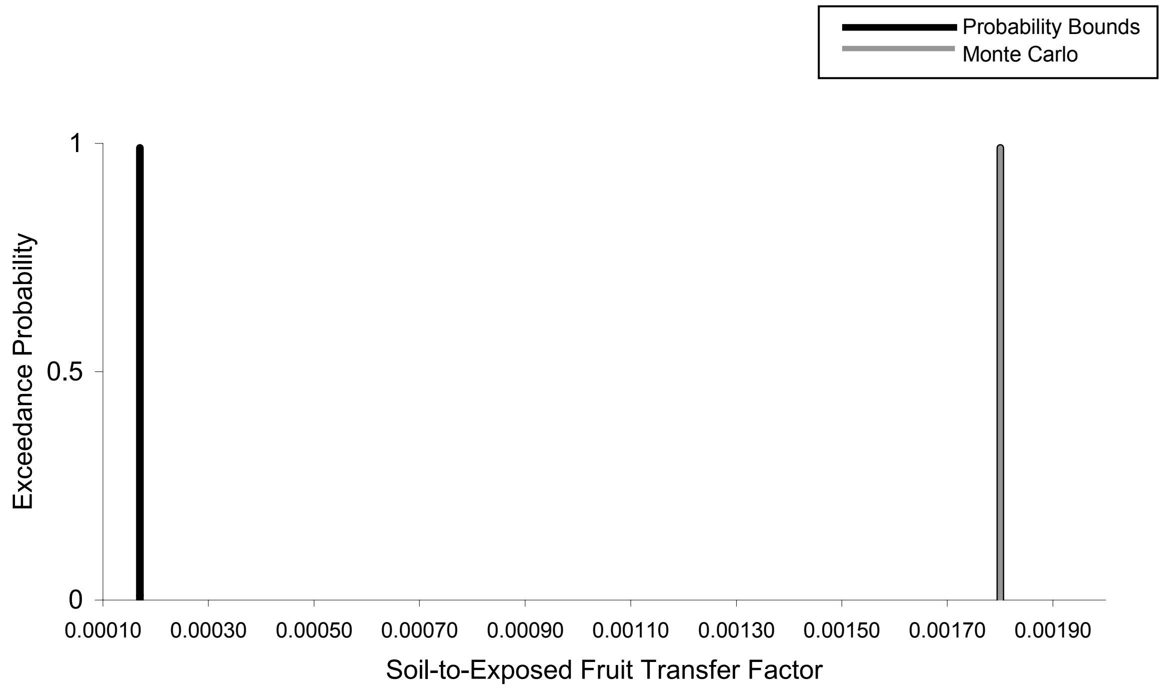

Figure 6-39 Model Inputs for Soil-to-Exposed Fruit Transfer Factor, Garden Produce Consumption, Commercial Farm Family

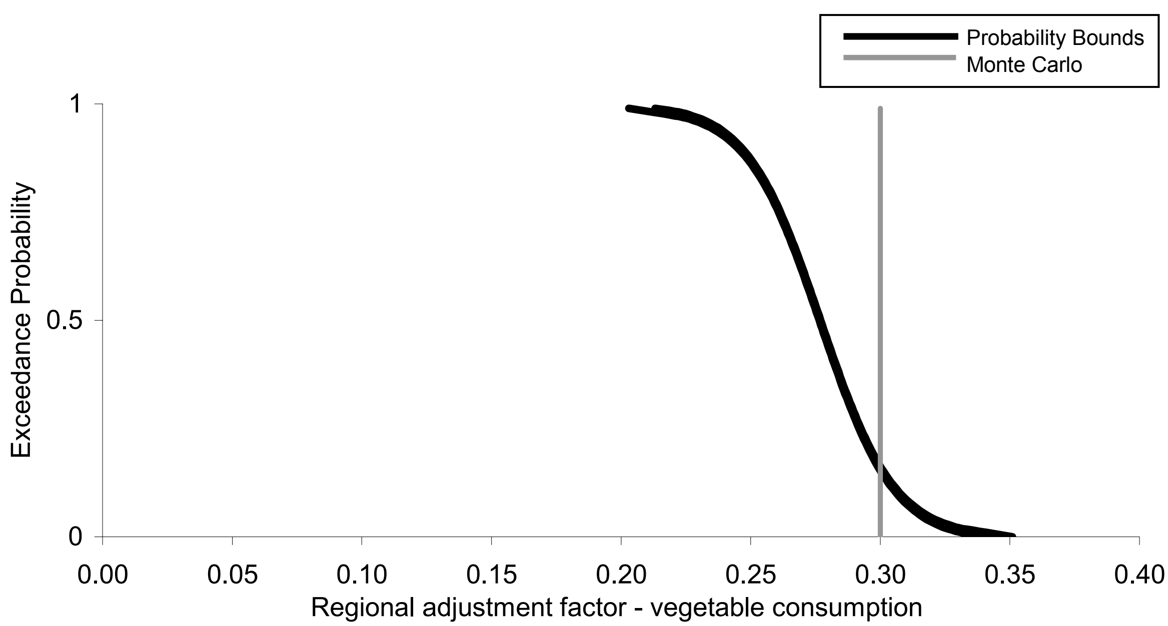

Figure 6-40 Model Inputs for Regional Adjustment Factor – Vegetable Consumption, Garden Produce Consumption, Commercial Farm Family

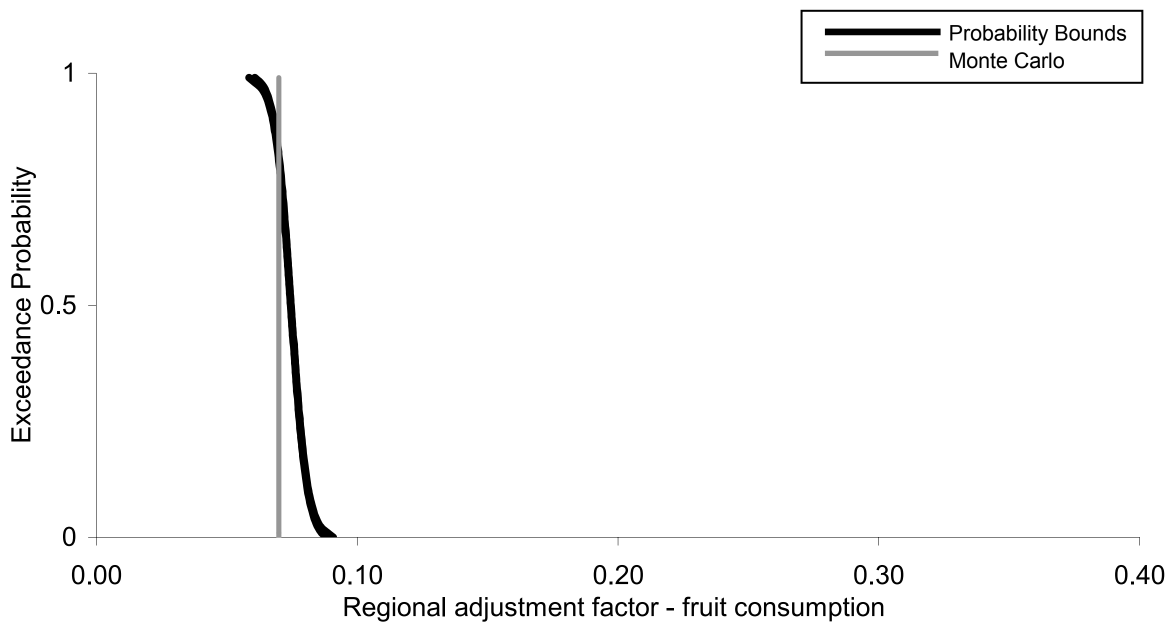

Figure 6-41 Model Inputs for Regional Adjustment Factor – Fruit Consumption, Garden Produce Consumption, Commercial Farm Family

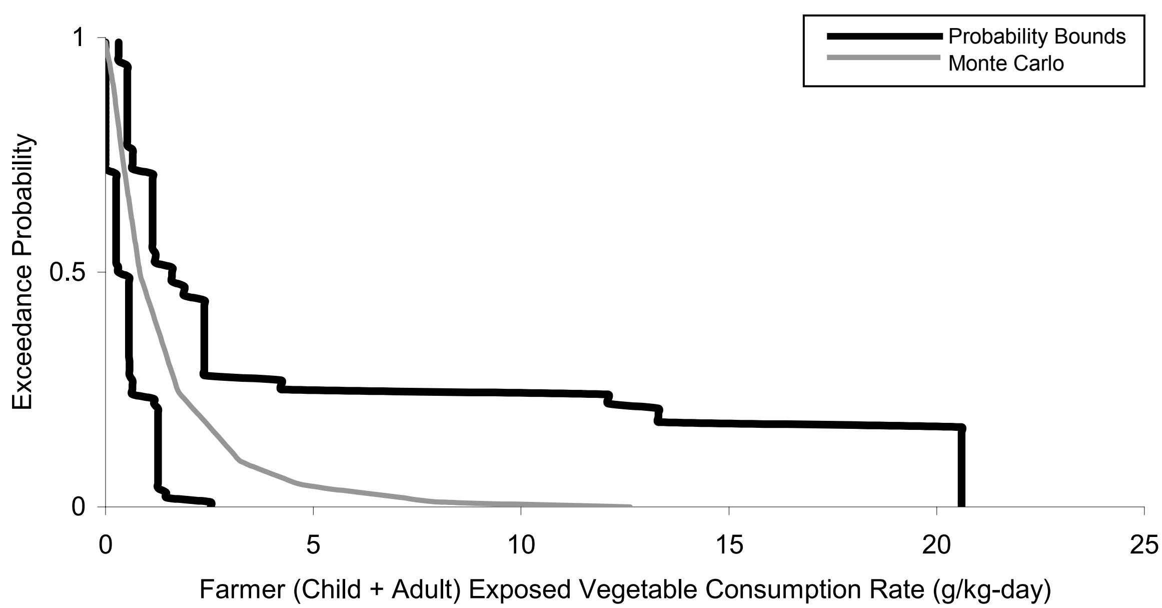

Figure 6-42 Model Inputs for Farmer (Child + Adult) – Exposed Vegetable Consumption Rate, Garden Produce Consumption, Commercial Farm Family

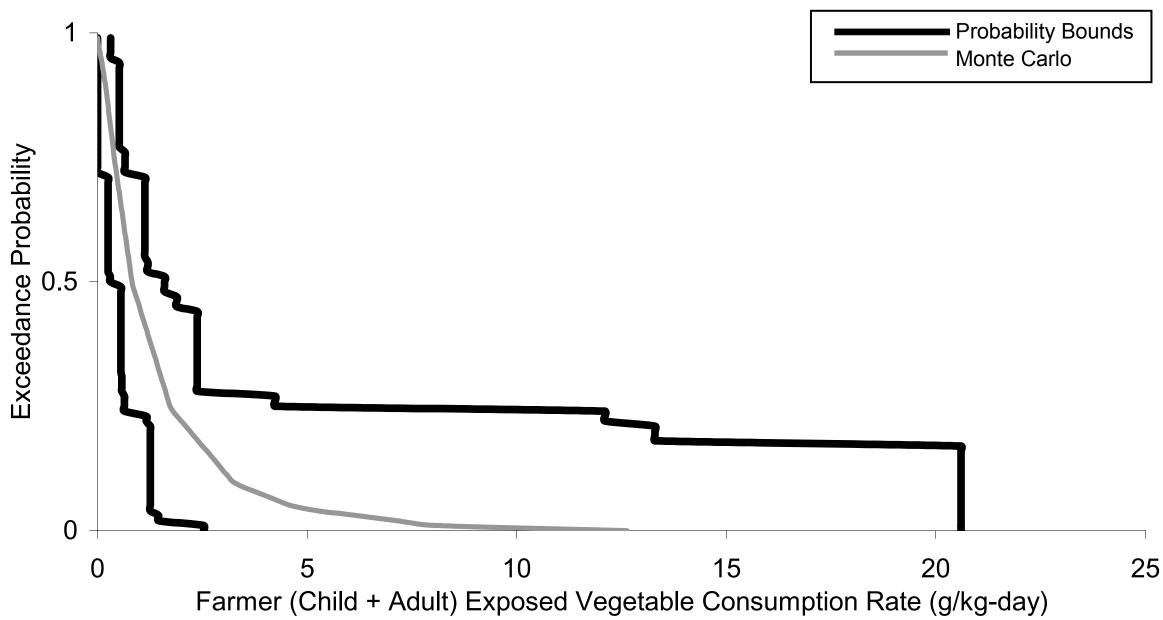

Figure 6-43 Model Inputs for Farmer (Child + Adult) Exposed Vegetable Consumption Rate, Garden Produce Consumption, Commercial Farm Family

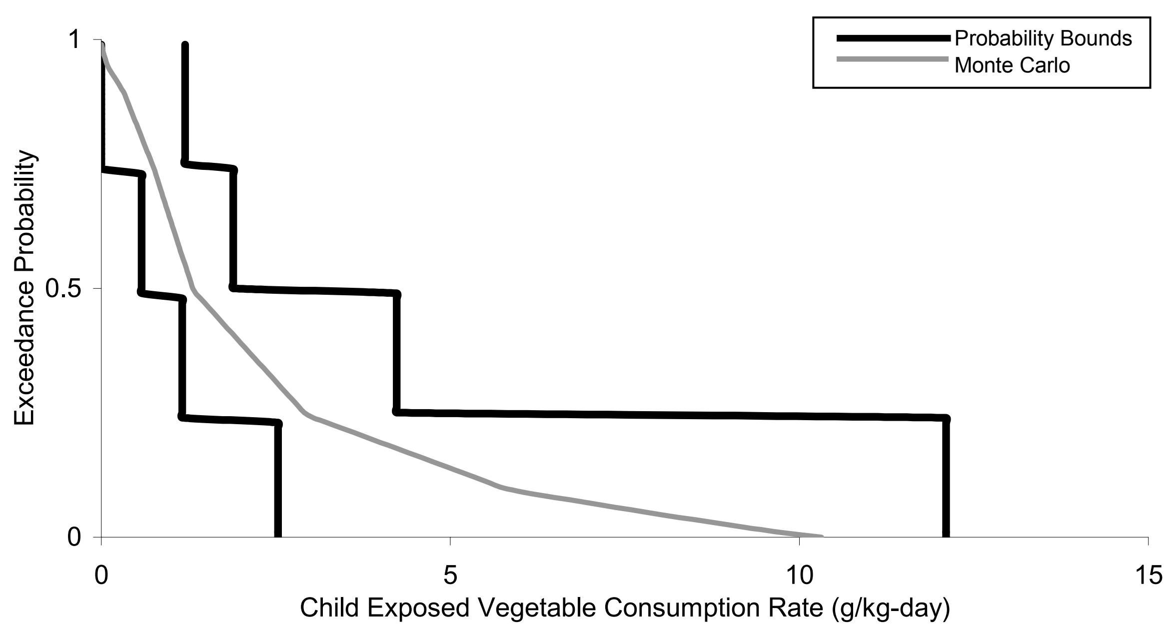

Figure 6-44 Model Inputs for Child Exposed Vegetable Consumption Rate, Garden Produce Consumption, Commercial Farm Family

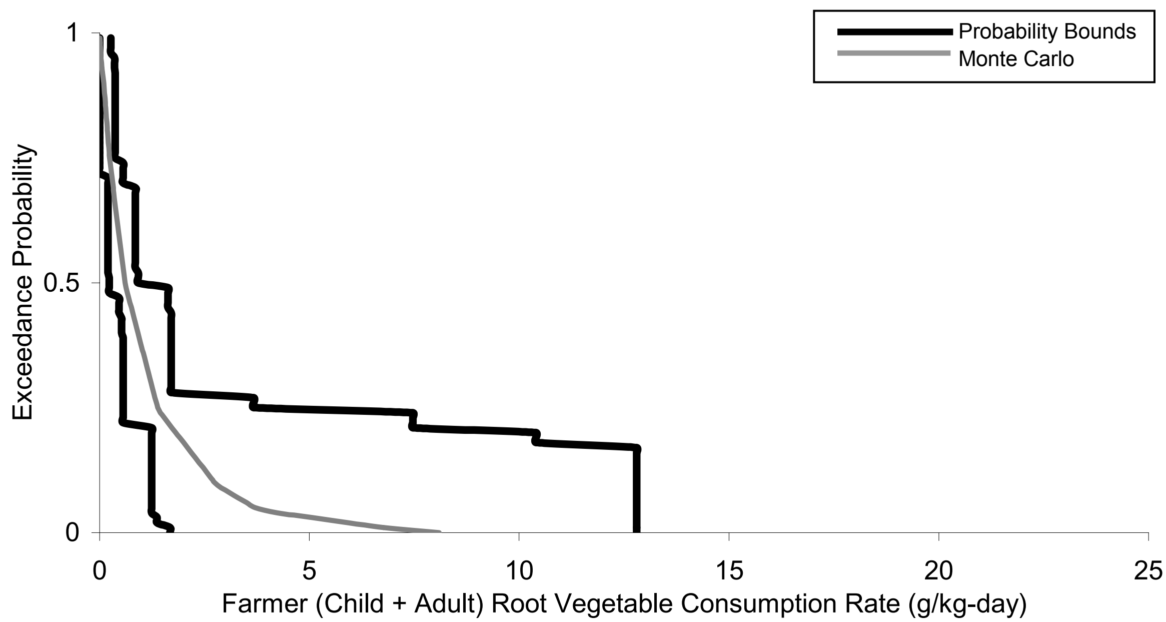

Figure 6-45 Model Inputs for Farmer (Child + Adult) Root Vegetable Consumption Rate, Garden Produce Consumption, Commercial Farm Family

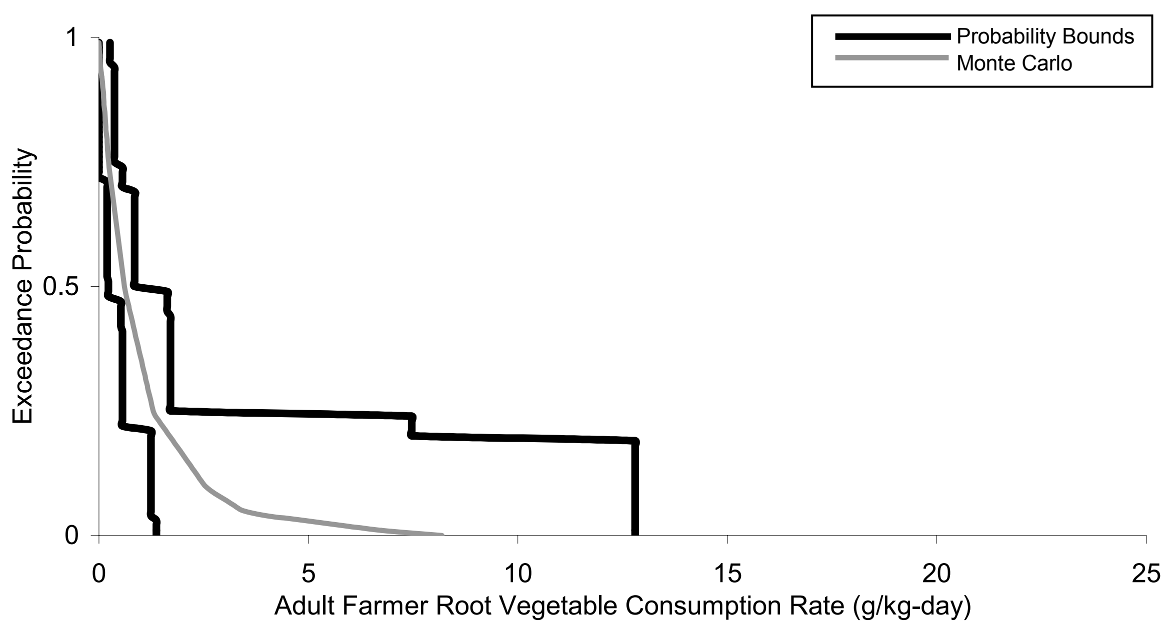

Figure 6-46 Model Inputs for Adult Farmer Root Vegetable Consumption Rate, Garden Produce Consumption, Commercial Farm Family

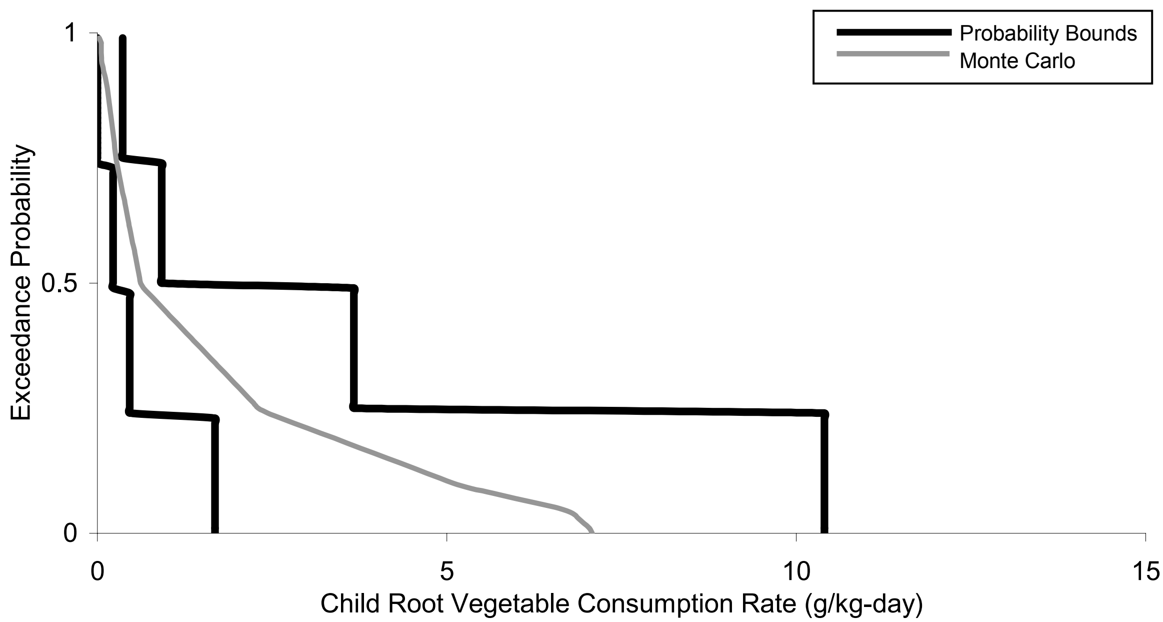

Figure 6-47 Model Inputs for Child Root Vegetable Consumption Rate, Garden Produce Consumption, Commercial Farm Family

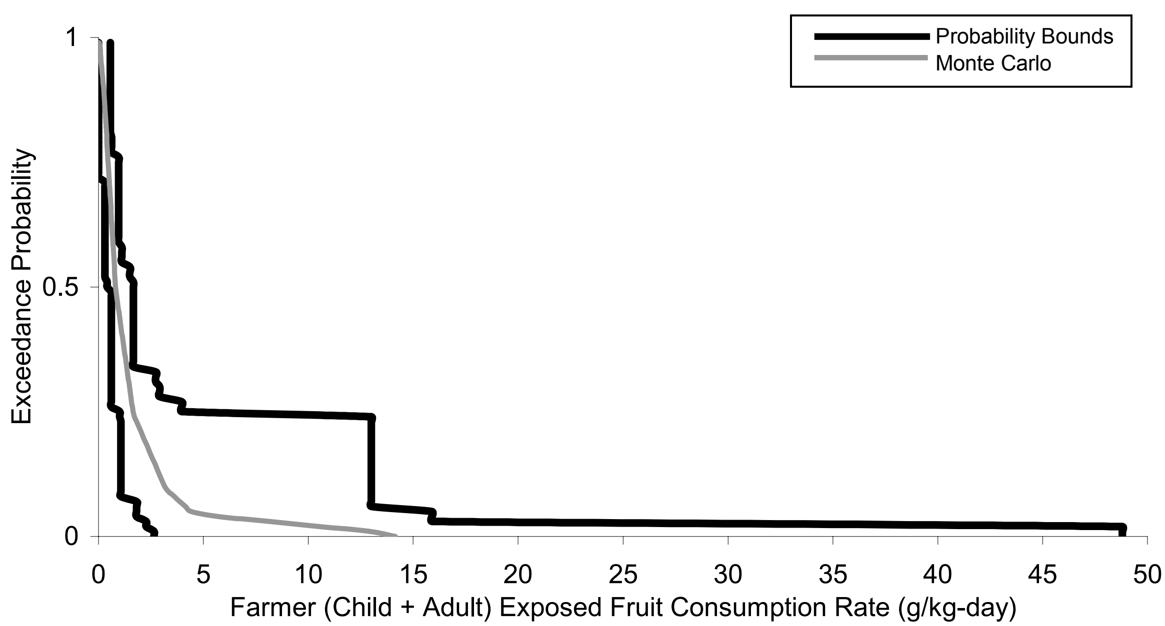

Figure 6-48 Model Inputs for Farmer (Child + Adult) Exposed Fruit Consumption Rate, Garden Produce Consumption, Commercial Farm Family

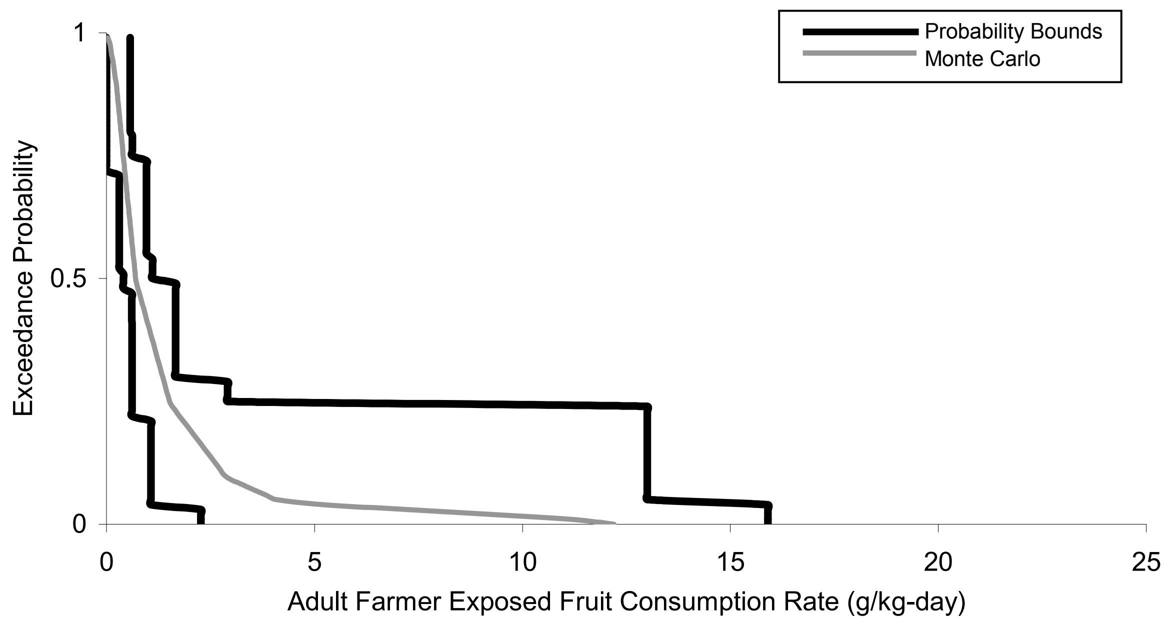

Figure 6-49 Model Inputs for Adult Farmer Exposed Fruit Consumption Rate, Garden Produce Consumption, Commercial Farm Family

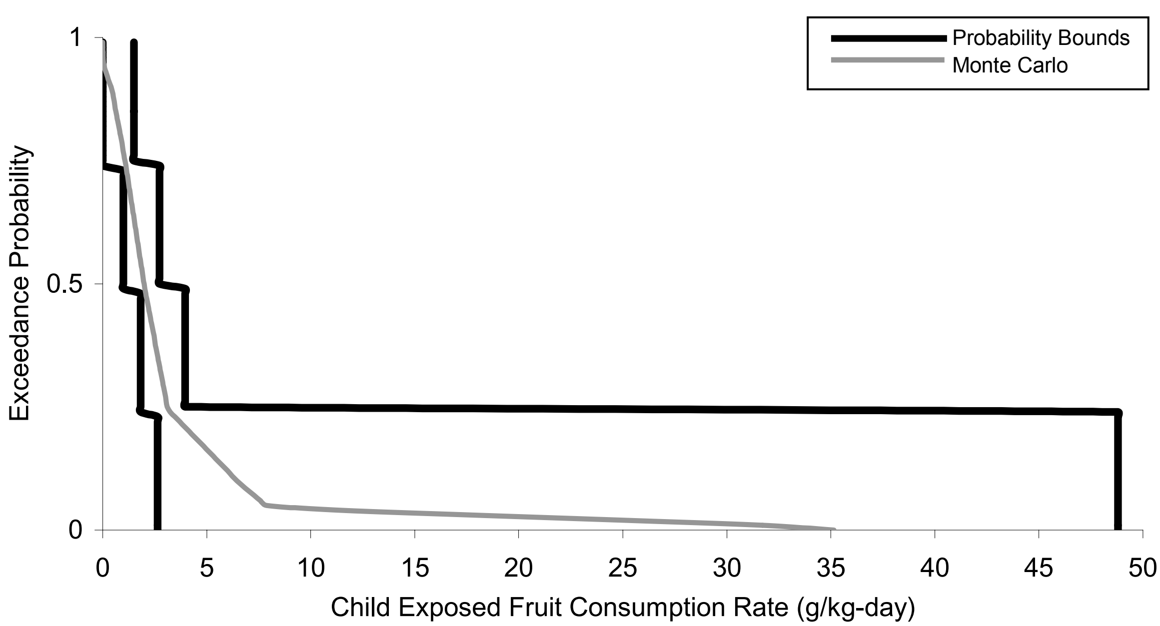

Figure 6-50 Model Inputs for Child Exposed Fruit Consumption Rate, Garden Produce Consumption, Commercial Farm Family

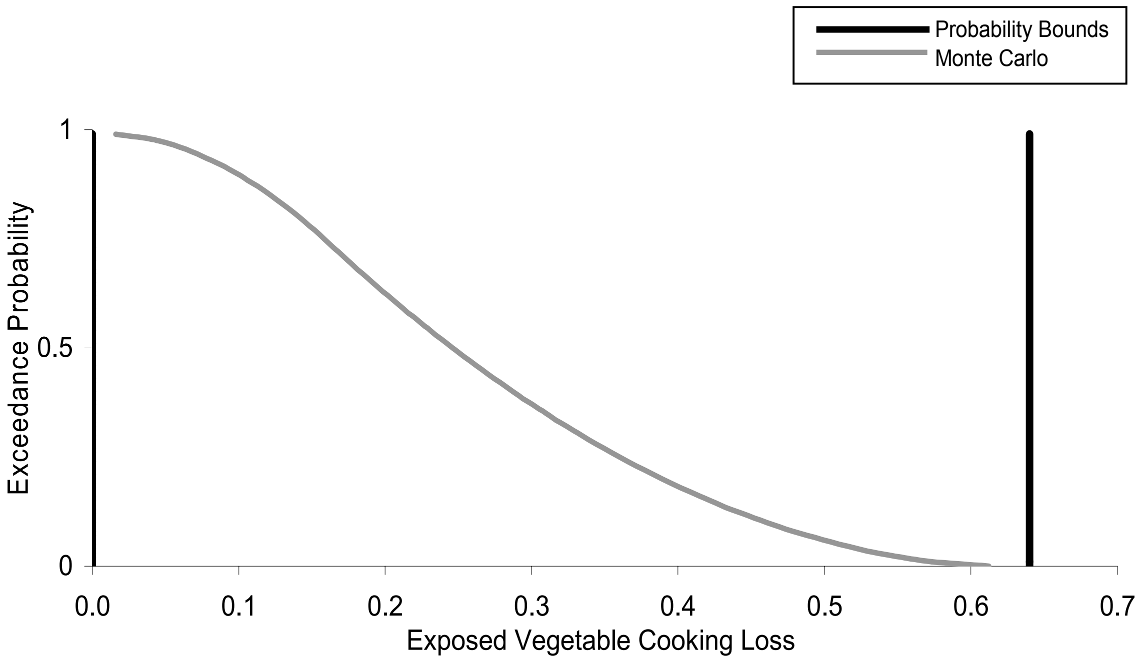

Figure 6-51 Model Inputs for Exposed Vegetable Cooking Loss, Garden Produce Consumption, Commercial Farm Family

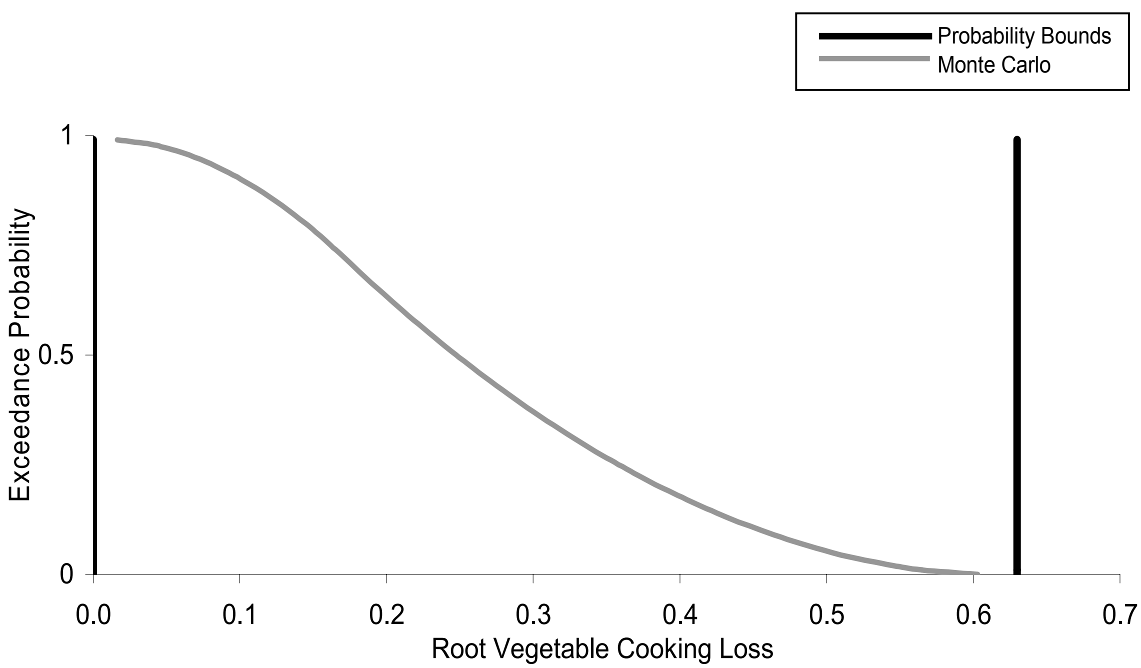

Figure 6-52 Model Inputs for Root Vegetable Cooking Loss, Garden Produce Consumption, Commercial Farm Family

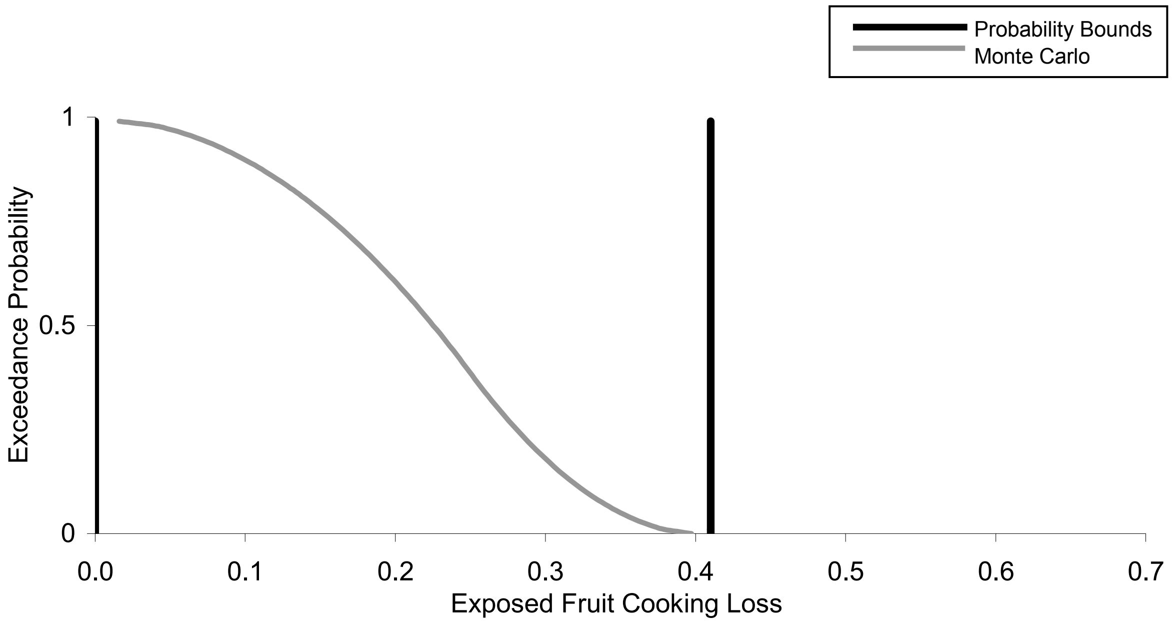

Figure 6-53 Model Inputs for Exposed Fruit Cooking Loss, Garden Produce Consumption, Commercial Farm Family

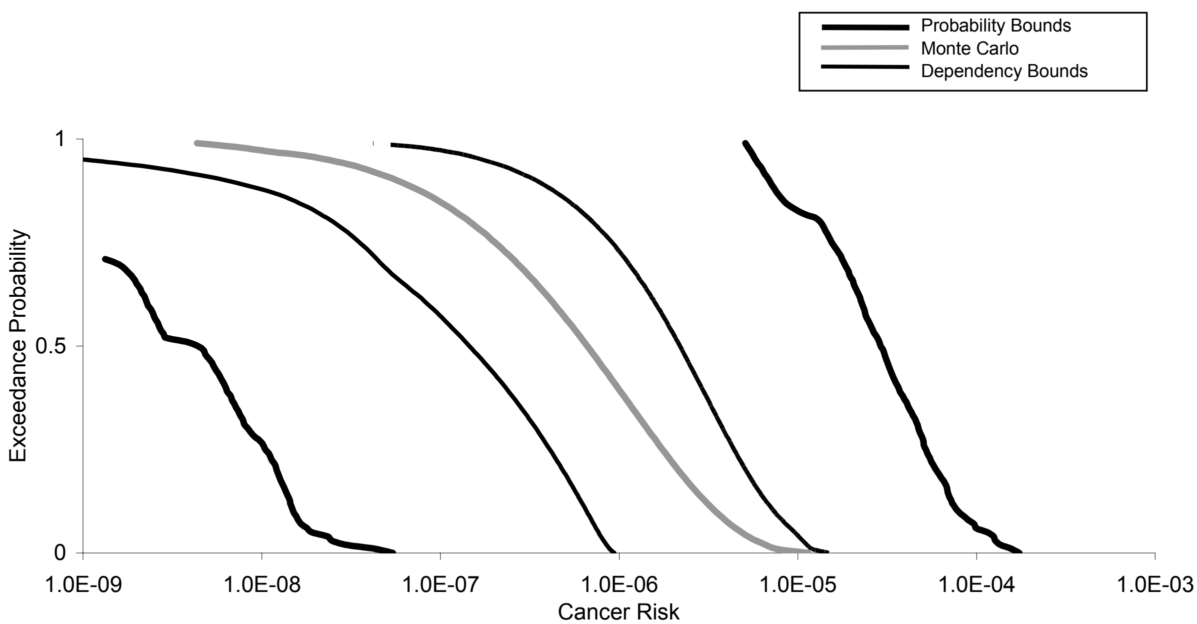

Figure 6-54 Cancer Risk, Dairy Consumption, Commercial Farm Family

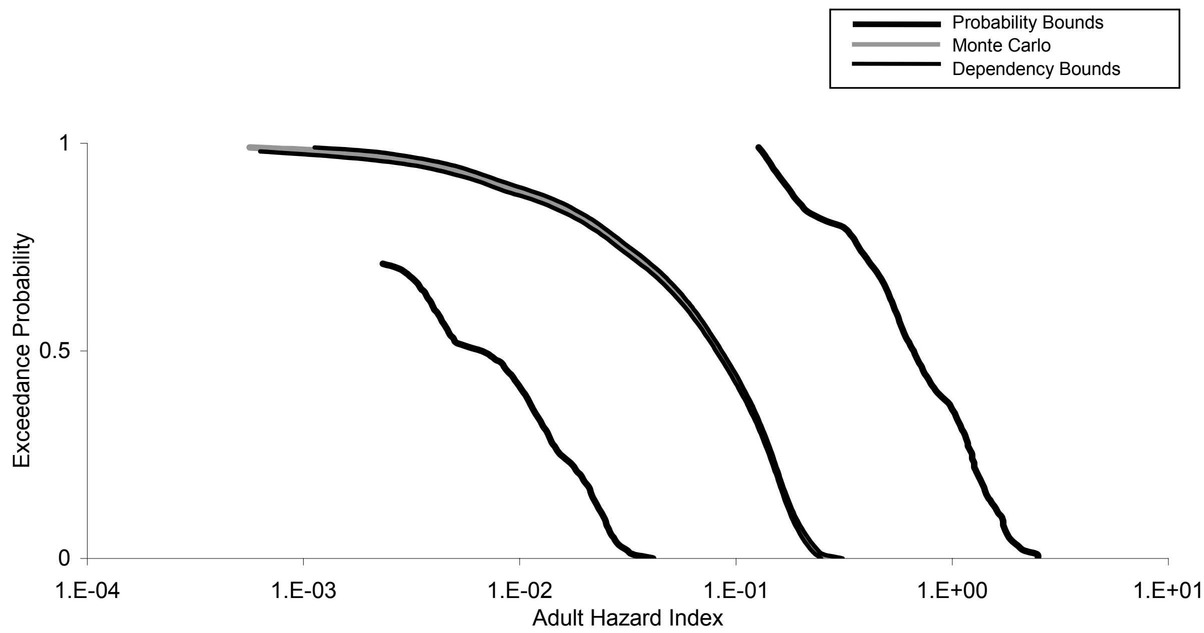

Figure 6-55 Adult Hazard Risk, Dairy Consumption, Commercial Farm Family

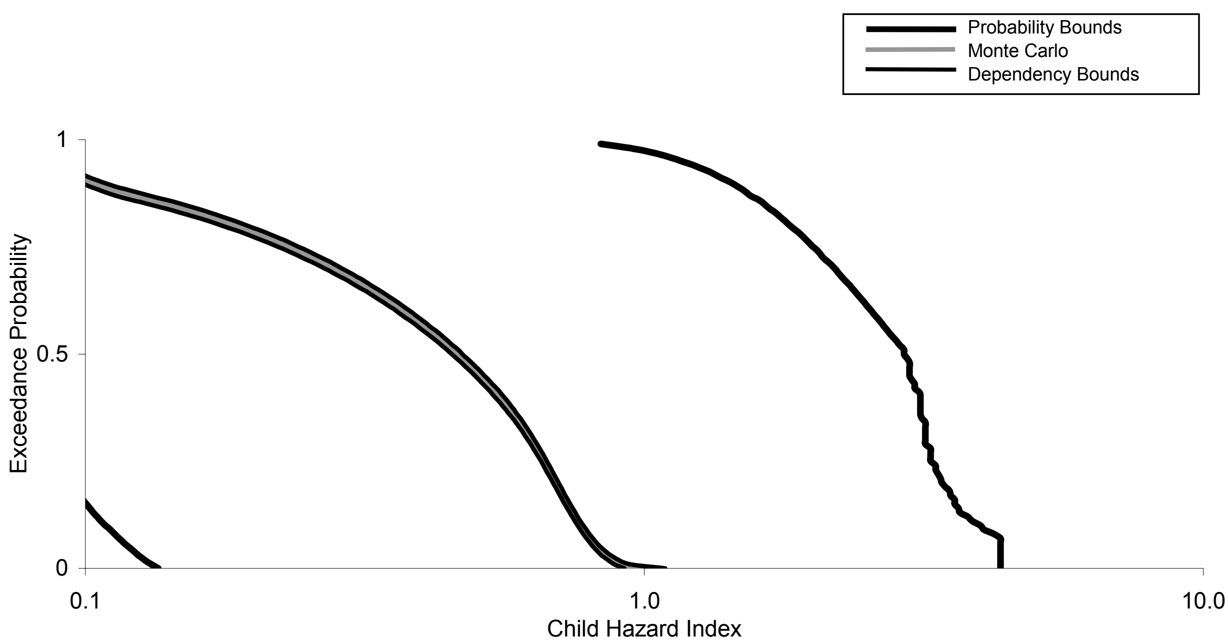

Figure 6-56 Child Hazard Risk, Dairy Consumption, Commercial Farm Family

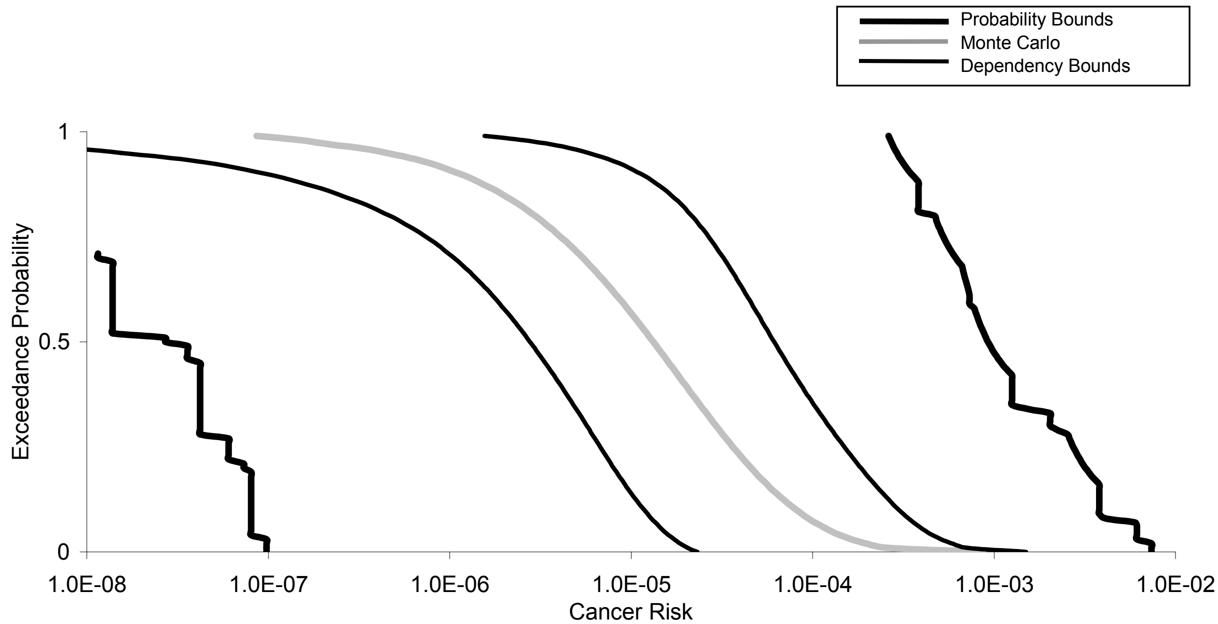

Figure 6-57 Cancer Risk, Beef Consumption, Backyard Farm Family

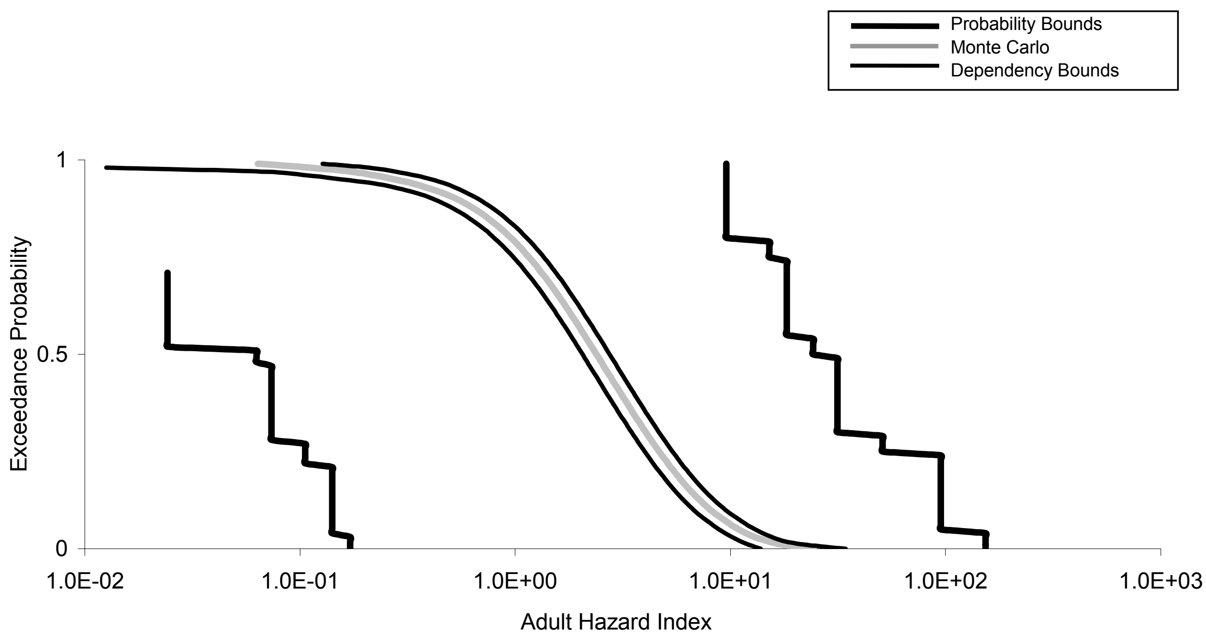

Figure 6-58 Adult Hazard Risk, Beef Consumption, Backyard Farm Family

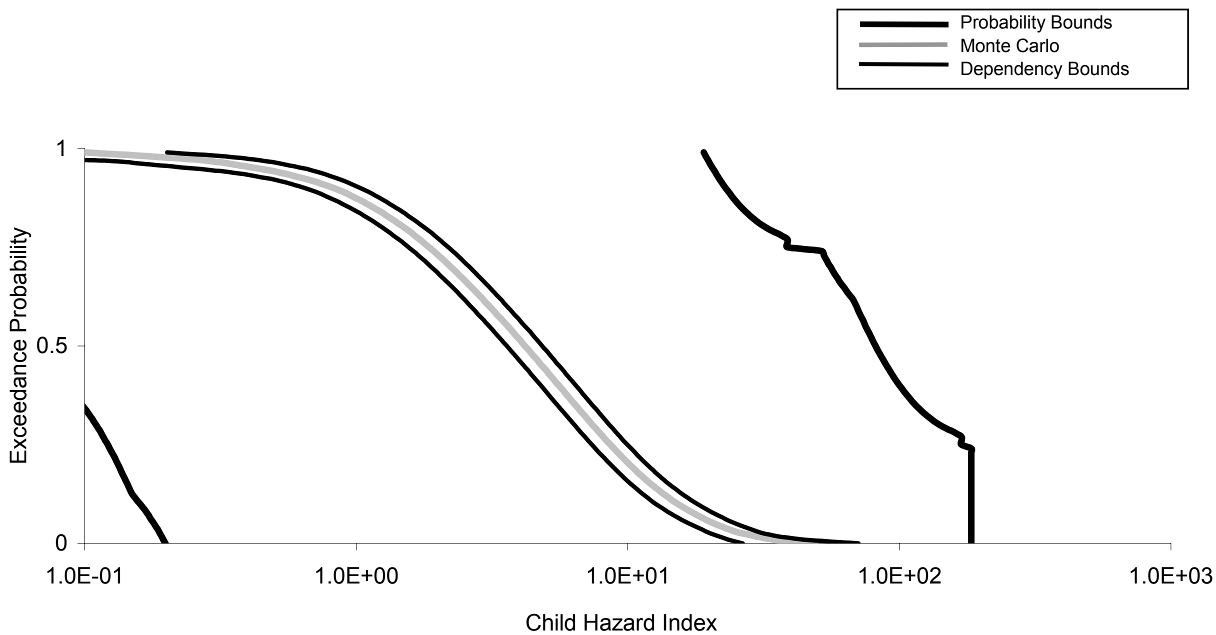

Figure 6-59 Child Hazard Risk, Beef Consumption, Backyard Farm Family

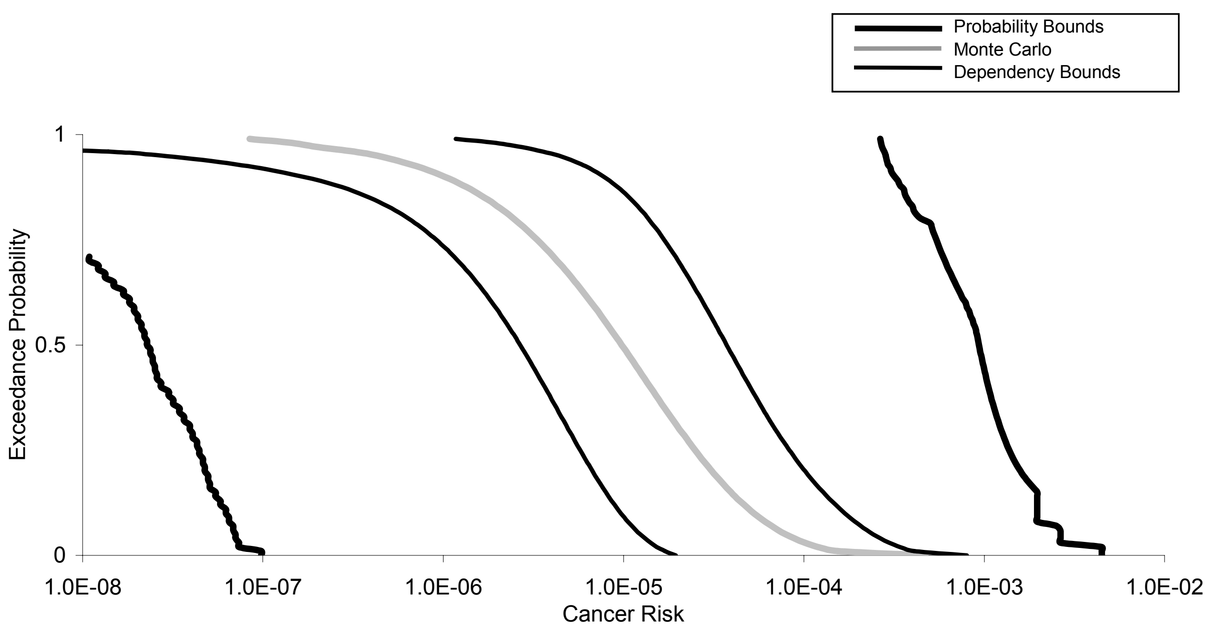

Figure 6-60 Cancer Risk, Poultry Meat Consumption, Commercial Farm Family

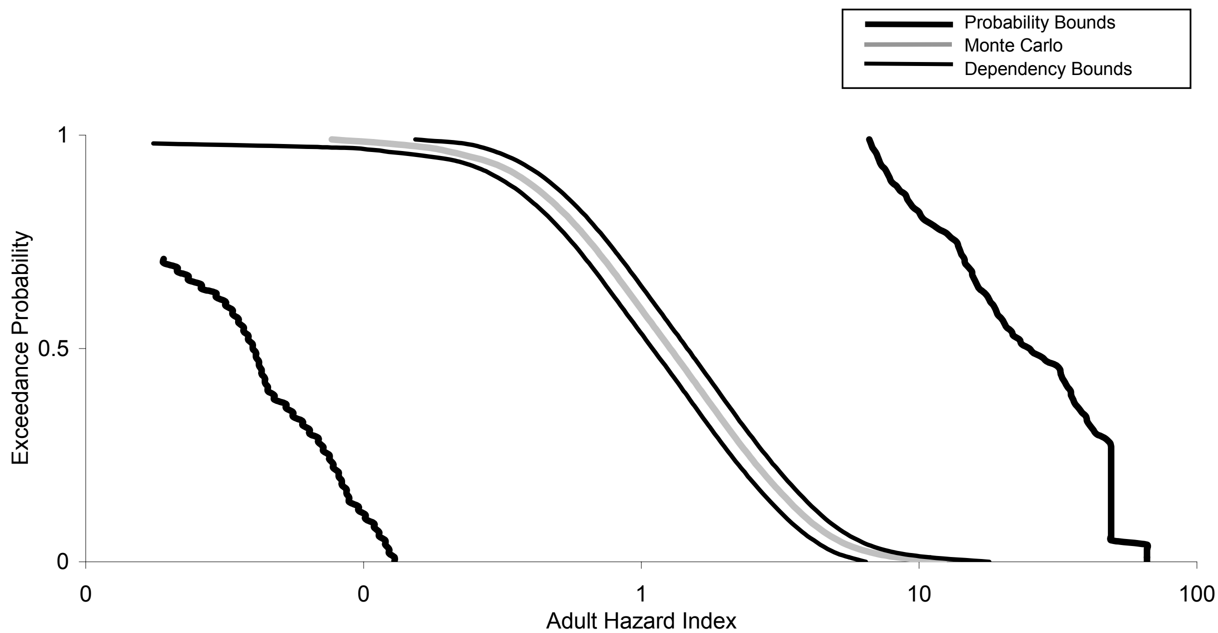

Figure 6-61 Adult Hazard Risk, Poultry Meat Consumption, Commercial Farm Family

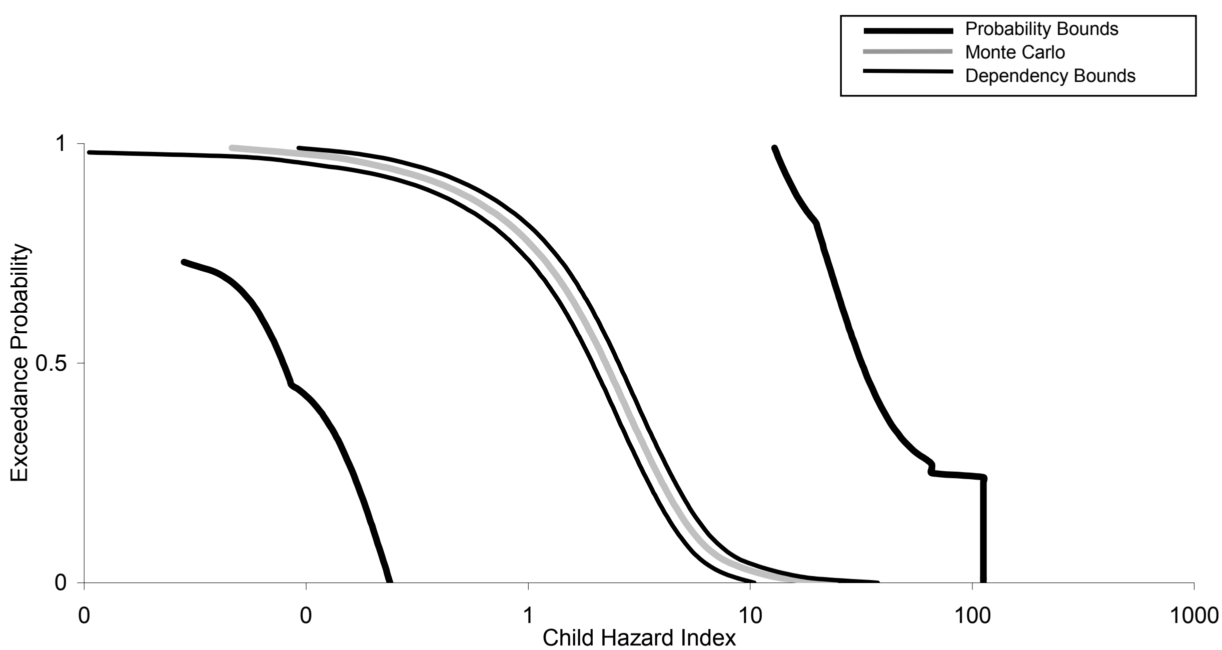

Figure 6-62 Child Hazard Risk, Poultry Meat Consumption, Commercial Farm Family

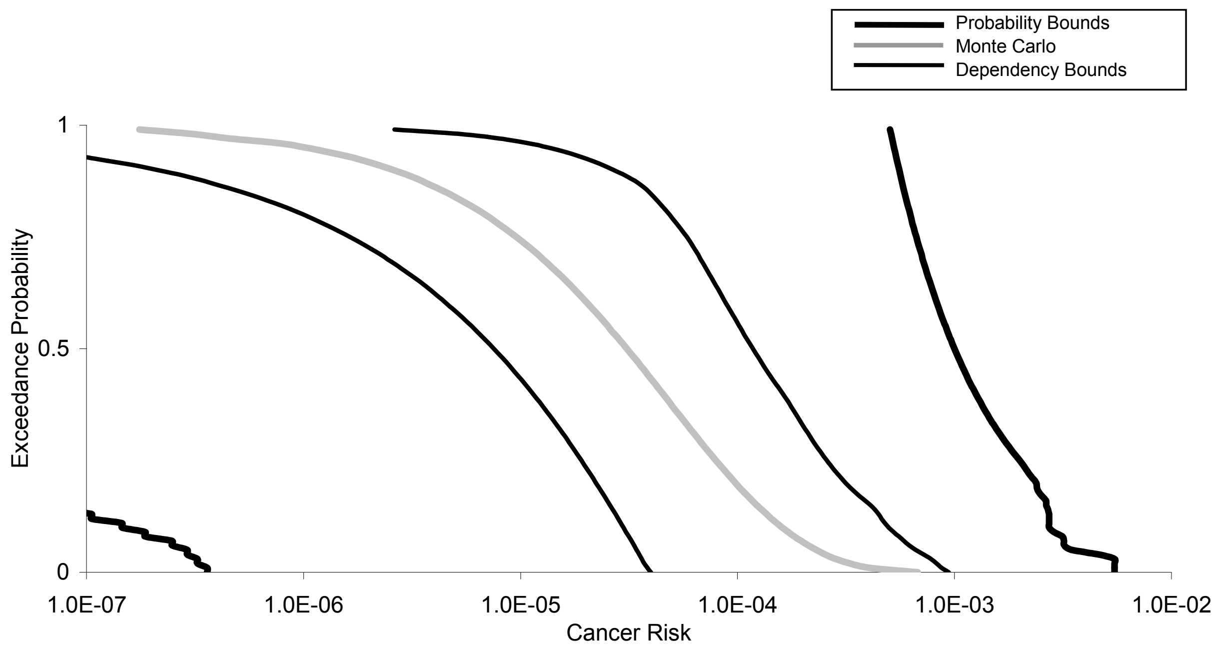

Figure 6-63 Cancer Risk, Poultry Egg Consumption, Commercial Farm Family

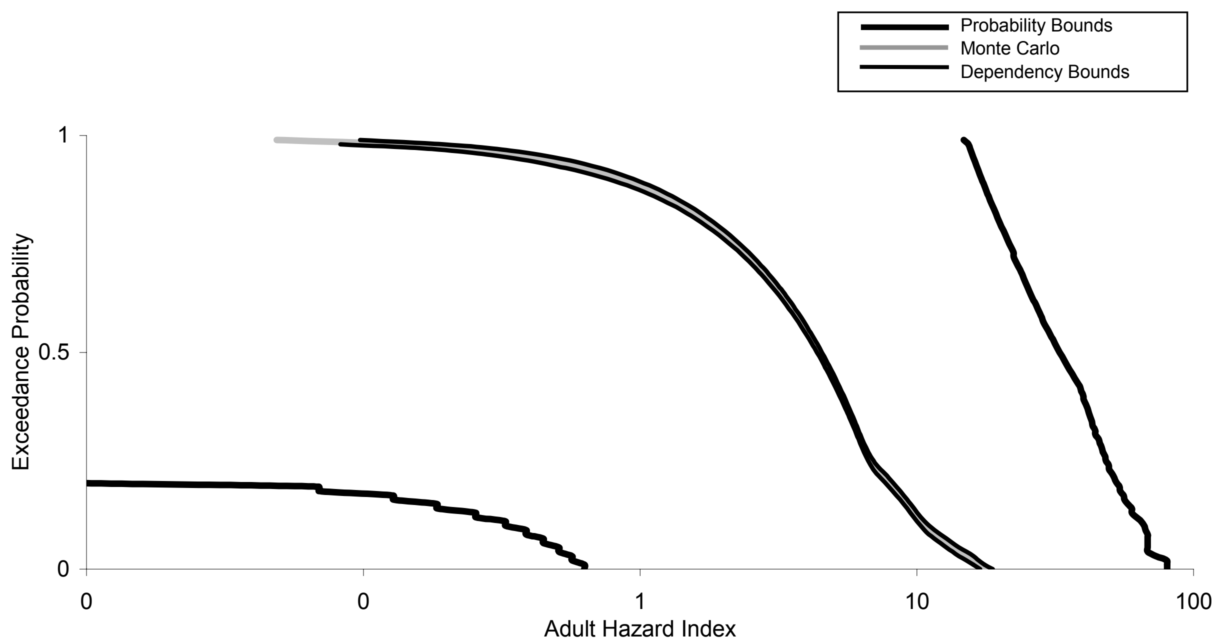

Figure 6-64 Adult Hazard Risk, Poultry Egg Consumption, Commercial Farm Family

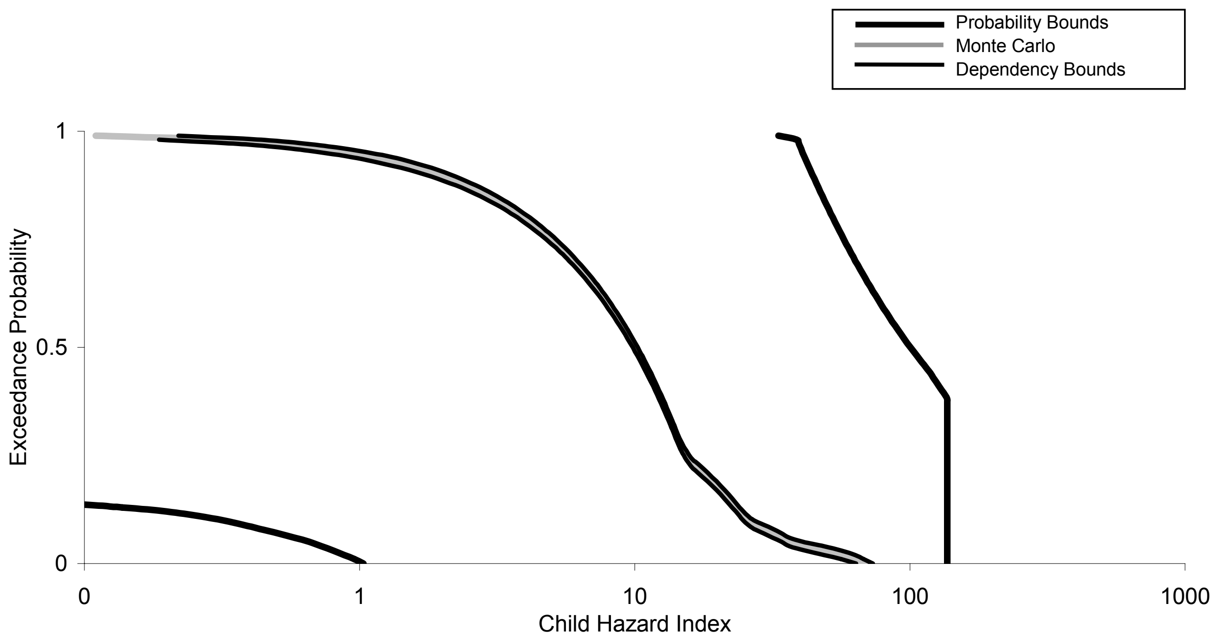

Figure 6-65 Child Hazard Risk, Poultry Egg Consumption, Commercial Farm Family

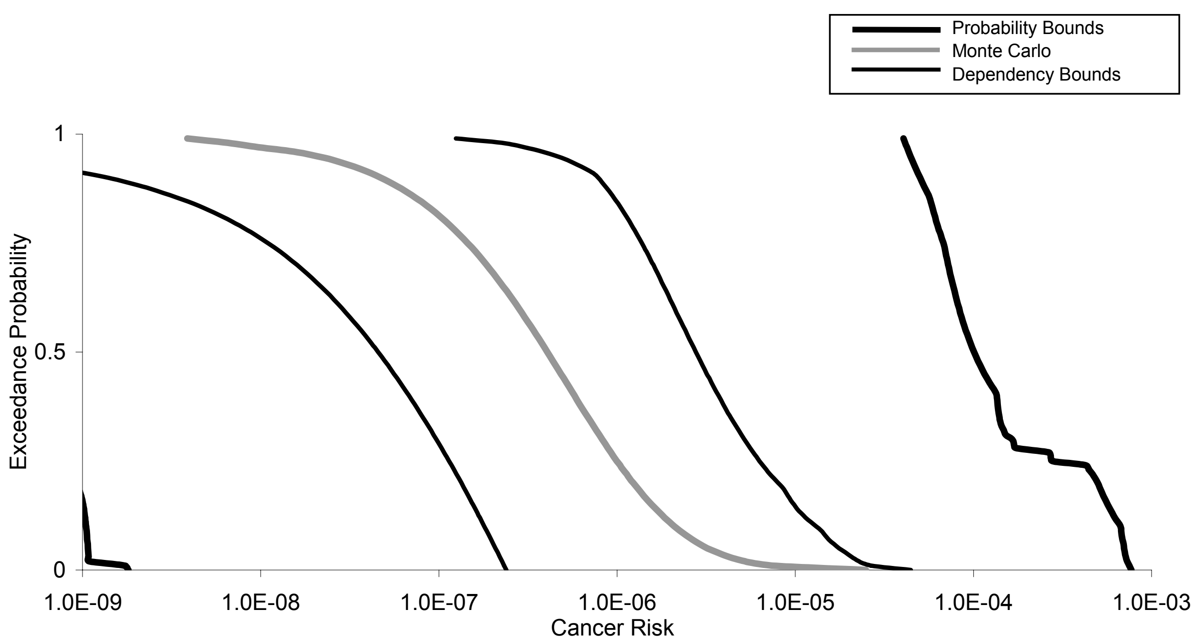

Figure 6-66 Cancer Risk, Garden Produce Consumption, Commercial Farm Family

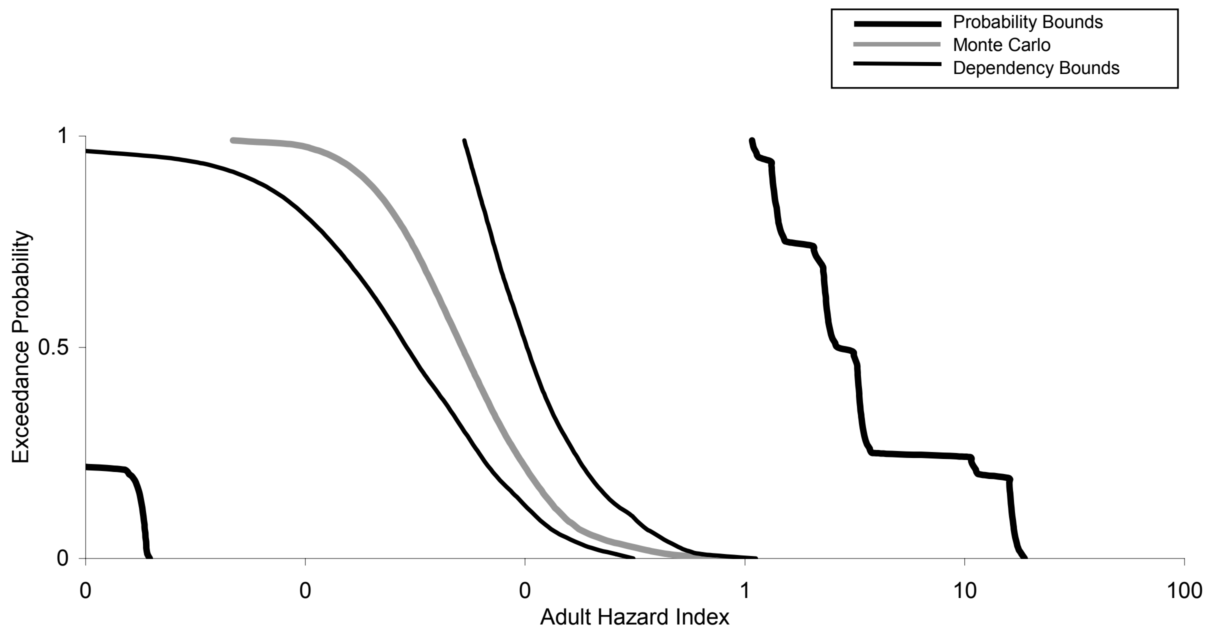

Figure 6-67 Adult Hazard Risk, Garden Produce Consumption, Commercial Farm Family

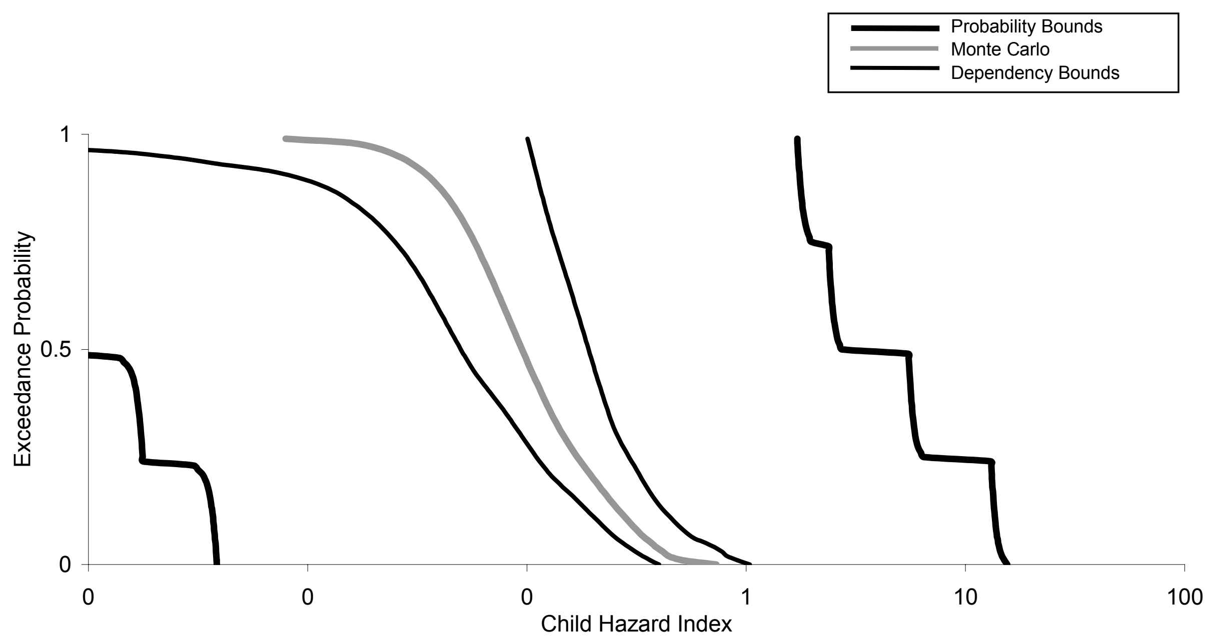

Figure 6-68 Child Hazard Risk, Garden Produce Consumption, Commercial Farm Family

SECTION 6

EXHIBITS

EXHIBIT 6-1

EXAMPLE OF RISK CALC CODE FOR MONTE CARLO ANALOG ANALYSIS MASTER SCRIPT, TOTAL PCBs

EXHIBIT 6-1
EXAMPLE OF RISK CALC CODE FOR MONTE CARLO ANALOG ANALYSIS
MASTER SCRIPT, Total PCBs

//In the following code, annotations explaining various program elements are shown after two forward slashes (//)

```
// PARCEL - SPECIFIC INPUTS

_clear

// Scenario [specify commercial or backyard scenario with a “1” and set the
other variable to zero]
Scomm=1
Sbkyd=0

// Soil EPCs for total PCBs (tPCBs)

// Pasture
   EPC.pasture.soil.PCB.1=0.5 mg kg{-1}
   EPC.pasture.soil.PCB.2=2.0 mg kg{-1}
   EPC.pasture.soil.PCB.3=10 mg kg{-1}
   EPC.pasture.soil.PCB.4=25mg kg{-1}

// Cornfield
   EPC.cornfield.soil.PCB.1=0.5 mg kg{-1}
   EPC.cornfield.soil.PCB.2=2.0 mg kg{-1}
   EPC.cornfield.soil.PCB.3=10 mg kg{-1}
   EPC.cornfield.soil.PCB.4=25 mg kg{-1}

// Hayfield
   EPC.hayfield.soil.PCB.1=0.5 mg kg{-1}
   EPC.hayfield.soil.PCB.2=2.0 mg kg{-1}
   EPC.hayfield.soil.PCB.3=10 mg kg{-1}
   EPC.hayfield.soil.PCB.4=25 mg kg{-1}

// Grainfield
   EPC.grainfield.soil.PCB.1=0.5 mg kg{-1}
   EPC.grainfield.soil.PCB.2=2.0 mg kg{-1}
   EPC.grainfield.soil.PCB.3=10 mg kg{-1}
   EPC.grainfield.soil.PCB.4=25 mg kg{-1}

// Garden
   EPC.garden.soil.PCB.1=0.5 mg kg{-1}
   EPC.garden.soil.PCB.2=2.0 mg kg{-1}
   EPC.garden.soil.PCB.3=10 mg kg{-1}
   EPC.garden.soil.PCB.4=25 mg kg{-1}

// Fraction of farm area that is in the floodplain

// Pasture
   FS.pasture.1=0.25
   FS.pasture.2=0.50
   FS.pasture.3=0.75
```

```
   FS.pasture.4=1.00

// Cornfield
   FS.cornfield.1=0.25
   FS.cornfield.2=0.50
   FS.cornfield.3=0.75
   FS.cornfield.4=1.00

// Hayfield
   FS.hayfield.1=0.25
   FS.hayfield.2=0.50
   FS.hayfield.3=0.75
   FS.hayfield.4=1.00

// Grainfield
   FS.grainfield.1=0.25
   FS.grainfield.2=0.50
   FS.grainfield.3=0.75
   FS.grainfield.4=1.00

// Garden
   FS.garden.1=0.25
   FS.garden.2=0.50
   FS.garden.3=0.75
   FS.garden.4=1.00


// OTHER INPUTS

// Soil-to-Plant Modeling

// Soil-to-Corn Transfer Factor (dw plant/dw soil)
   TF.cornsilage.PCB=0.0012
// Soil-to-Grass Transfer Factor (dw plant/dw soil)
   TF.grass.PCB=0.036
// Soil-to-Hay Transfer Factor (dw plant/dw soil)
   TF.hay.PCB=0.036
// Soil-to-Exposed Vegetable Transfer Factor (ww plant/dw soil)
   TF.expveg.PCB=0.0018
// Soil-to-Exposed Fruit Transfer Factor (ww plant/dw soil)
   TF.fruit.PCB=0.0018
 // Soil-to-Root Vegetable Transfer Factor (ww plant/dw soil)
   TF.rtveg.PCB=0.00030
// Grainfield-to-Concentrate Transfer Factor (ww plant/dw soil)
   TF.concentrate.PCB=0.0

// Animal Intake [varies by scenario; values shown correspond to "commercial
dairy" scenario]

// Animal Diet Composition (unitless)
// fraction of diet = soil
   D.soil =0
// fraction of diet = corn silage grown on farm
   D.cornsilage=0.55
// fraction of diet = hay or other grass-based feed grown on farm
   D.hay=0
// fraction of diet = pasture grass on farm
```

```
   D.grass=0
// fraction of diet = concentrate (e.g., grain/supplements) from off Site
   D.concentrate=0.45

// Soil Bioavailability (unitless)
   BA.soil.PCB=1

// Bioconcentration Factors (unitless)

// Mammalian BCFs (fat basis)
   BCF.mammal.PCB=3.4
// Avian BCFs (fat basis)
   BCF.poultry.meat.PCB=2.5
// Avian BCFs (whole food basis)
   BCF.poultry.egg.PCB=0.9

// Fat Concentration (mg fat/mg whole food)

// dairy-milk: jersey cows
   F.dairy.jersey=lognormal(0.046,0.0052)
// beef
   F.beef=triangular(0.039,0.099,0.38)
// poultry meat
   F.poultry.meat=triangular(0.03,0.074,0.24)

// Cooking loss

// dairy
   CL.dairy=0
// beef
   CL.beef=triangular(0.19,0.27,0.37)
// poultry meat
   CL.poultry.meat=triangular(0.22,0.32,0.43)
// poultry egg
   CL.poultry.egg=uniform(0,0.15)
// garden produce
   CL.expveg=triangular(0,0.16,0.64)
   CL.fruit=triangular(0,0.25,0.41)
   CL.rtveg=triangular(0,0.17,0.63)

// Post-cooking loss

//dairy
   PCL.dairy=0
// beef
   PCL.beef=triangular(0.12,0.24,0.38)
// poultry meat
   PCL.poultry.meat=triangular(0.22,0.31,0.40)
// poultry egg
   PCL.poultry.egg=0
// garden produce
   PCL.expveg=0
   PCL.fruit=0
   PCL.rtveg=0

// Human Exposure
```

```
// Fraction of PCBs, dioxins, and furans absorbed in GI tract (unitless) [Set to
1 for all foods based on the assumption that absorption in humans is the same as
absorption in animals in studies used to develop RfD and CSF]
// dairy-milk
   ABS.dairy=1
// beef
   ABS.beef=1
// poultry meat
   ABS.poultry.meat=1
// poultry egg
   ABS.poultry.egg=1
// garden produce
   ABS.garden=1

// Food consumption rates (body weight-normalized)

// unit correction factor (kg whole food/g whole food)
   UCF =0.001 kg g{-1}

// uncertainty factor associated with extrapolating consumption rates (UE) [UE
is not used in this analysis]
//   UE.child=1
//   UE.teen=1
//   UE.adult=1

// regional adjustment factor for garden produce consumption (unitless)
   AF.fruit=0.07
   AF.veg=0.3

// dairy-milk
// adult resident
   CR.adult.resident.dairy=@(0,0) (0.856,0.1) (3.13,0.25) (8.58,0.5) (15.1,0.75)
(18.0,0.9) (21.7,0.95) (23.7,0.99) (23.7,1)@ g kg{-1} day{-1}
// adult farmer
   CR.adult.farmer.dairy=@(0,0) (0.856,0.1) (3.13,0.25) (8.58,0.5) (15.1,0.75)
(18.0,0.9) (21.7,0.95) (23.7,0.99) (23.7,1)@ g kg{-1} day{-1}
// child
   CR.child.dairy=@(0,0) (9.35,0.05) (9.95,0.1) (24.1, 0.25) (47.9,0.5)
(70.3,0.75) (74.1,0.9) (82.9,0.95) (82.9,1)@ g kg{-1} day{-1}
//cancer
  CR.resident.dairy=@(0,0) (1.59, 0.05) (1.64,0.1) (4.93, 0.25) (11.9,0.5)
(19.9,0.75) (22.8,0.9) (27.0,0.95) (28.4,0.99) (28.4,1)@ g kg{-1} day{-1}
  CR.farmer.dairy=@(0,0) (1.59, 0.05) (1.64,0.1) (4.93, 0.25) (11.9,0.5)
(19.9,0.75) (22.8,0.9) (27.0,0.95) (28.4,0.99) (28.4,1)@ g kg{-1} day{-1}

// beef
// adult resident
   CR.adult.resident.beef=@(0,0) (0.459,0.1) (0.823, 0.25) (1.58,0.5)(2.65,0.75)
(4.84,0.9) (6.06,0.95) (7.03,0.99) (7.03,1)@ g kg{-1} day{-1}
// adult farmer
   CR.adult.farmer.beef=@(0,0) (0.459,0.1) (0.823, 0.25) (1.58,0.5) (2.65,0.75)
(4.84,0.9) (6.06,0.95) (7.03,0.99) (7.03,1)@ g kg{-1} day{-1}
// child
   CR.child.beef=@(0,0) (0.725,0.1) (1.20, 0.25) (2.89,0.5) (4.86,0.75)
(9.27,0.9) (11.1,0.95) (14.5,0.99) (14.5,1)@ g kg{-1} day{-1}
//cancer
```

```
   CR.resident.beef=@(0,0) (0.482,0.1) (0.856, 0.25) (1.69,0.5) (2.84,0.75)
(5.22,0.9) (6.49,0.95) (7.67,0.99) (7.67,1)@ g kg{-1} day{-1}
   CR.farmer.beef=@(0,0) (0.482,0.1) (0.856, 0.25) (1.69,0.5) (2.84,0.75)
(5.22,0.9) (6.49,0.95) (7.67,0.99) (7.67,1)@ g kg{-1} day{-1}

// poultry meat
// adult resident
   CR.adult.resident.poultry.meat=@(0,0) (0.356, 0.05) (0.386,0.1) (0.547, 0.25)
(1.05,0.5) (2.08,0.75) (2.60,0.9) (3.87,0.95) (4.94,0.99) (5.11,1)@ g kg{-1}
day{-1}
// adult farmer
   CR.adult.farmer.poultry.meat=@(0,0) (0.356, 0.05) (0.386,0.1) (0.547, 0.25)
(1.05,0.5) (2.08,0.75) (2.60,0.9) (3.87,0.95) (4.94,0.99) (5.11,1)@ g kg{-1}
day{-1}
// child
   CR.child.poultry.meat=@(0,0) (1.07, 0.25) (2.11,0.5) (2.88,0.75) (3.56,0.9)
(6.15,0.95) (8.55,0.99) (10.7,1)@ g kg{-1} day{-1}
//cancer
   CR.resident.poultry.meat=@(0,0) (0.415, 0.05) (0.458,0.1) (0.605, 0.25)
(1.17,0.5) (2.18,0.75) (2.73,0.9) (4.13,0.95) (5.35,0.99) (5.71,1)@ g kg{-1}
day{-1}
   CR.farmer.poultry.meat=@(0,0) (0.415, 0.05) (0.458,0.1) (0.605, 0.25)
(1.17,0.5) (2.18,0.75) (2.73,0.9) (4.13,0.95) (5.35,0.99) (5.71,1)@ g kg{-1}
day{-1}

// poultry egg
// adult resident
   CR.adult.resident.poultry.egg=@(0,0) (0.846,0.75) (1.34,0.9) (1.72,0.95)
(2.18,0.99) (2.18,1)@ g kg{-1} day{-1}
// adult farmer
   CR.adult.farmer.poultry.egg=@(0,0) (0.846,0.75) (1.34,0.9) (1.72,0.95)
(2.18,0.99) (2.18,1)@ g kg{-1} day{-1}
// child
   CR.child.poultry.egg=@(0,0) (1.91,0.75) (3.24,0.9) (4.73,0.95) (8.49,0.99)
(8.49,1)@ g kg{-1} day{-1}
//cancer
   CR.resident.poultry.egg=@(0,0) (0.94,0.75) (1.50,0.9) (1.98,0.95) (2.72,0.99)
(2.72,1)@ g kg{-1} day{-1}
   CR.farmer.poultry.egg=@(0,0) (0.94,0.75) (1.50,0.9) (1.98,0.95) (2.72,0.99)
(2.72,1)@ g kg{-1} day{-1}

// exposed vegetables
// adult resident
   CR.adult.resident.expveg=@(0,0)(0.00417,0.01) (0.0961, 0.05) (0.180,0.1)
(0.375, 0.25) (0.784,0.5) (1.64,0.75) (3.02,0.9) (4.46,0.95) (8.44,0.99)
(17.3,1)@ g kg{-1} day{-1}
 // adult farmer
   CR.adult.farmer.expveg=@(0,0)(0.00417,0.01) (0.0961, 0.05) (0.180,0.1)
(0.375, 0.25) (0.784,0.5) (1.64,0.75) (3.02,0.9) (4.46,0.95) (8.44,0.99)
(17.3,1)@ g kg{-1} day{-1}
// child
   CR.child.expveg=@(0,0)(0.00760,0.01) (0.0907, 0.05) (0.318,0.1) (0.742, 0.25)
(1.32,0.5) (2.94,0.75) (5.84,0.9) (8.02,0.95) (9.93,0.99) (10.7,1)@ g kg{-1}
day{-1}
// cancer
```

```
   CR.resident.expveg=@(0,0)(0.00446,0.01) (0.0956, 0.05) (0.192,0.1) (0.406,
0.25) (0.830,0.5) (1.75,0.75) (3.26,0.9) (4.77,0.95) (8.56,0.99) (16.7,1)@ g
kg{-1} day{-1}
   CR.farmer.expveg=@(0,0)(0.00446,0.01) (0.0956, 0.05) (0.192,0.1) (0.406,
0.25) (0.830,0.5) (1.75,0.75) (3.26,0.9) (4.77,0.95) (8.56,0.99) (16.7,1)@ g
kg{-1} day{-1}

// exposed fruit
// adult resident
   CR.adult.resident.fruit=@(0,0)(0.0663,0.01) (0.149, 0.05) (0.237,0.1) (0.409,
0.25) (0.707,0.5) (1.53,0.75) (2.88,0.9) (4.22,0.95) (12.2,0.99) (12.2,1)@ g
kg{-1} day{-1}
// adult farmer
   CR.adult.farmer.fruit=@(0,0)(0.0663,0.01) (0.149, 0.05) (0.237,0.1) (0.409,
0.25) (0.707,0.5) (1.53,0.75) (2.88,0.9) (4.22,0.95) (12.2,0.99) (12.2,1)@ g
kg{-1} day{-1}
// child [There was no home produced data and no per capita data available to
extrapolate a consumption rate for the 1-2 age group, therefore, the CR for the
1-2 age group was extrapolated based on the relative body weight of 3-5 and 1-2
year olds.]
   CR.child.fruit=@(0,0)(0,0.01) (0.0285, 0.05) (0.435,0.1) (1.10, 0.25)
(2.01,0.5) (3.13,0.75) (6.57,0.9) (8.02,0.95) (35.1,0.99) (35.2,1)@ g kg{-1}
day{-1}
//cancer
   CR.resident.fruit=@(0,0)(0.0606,0.01) (0.139, 0.05) (0.254,0.1) (0.468, 0.25)
(0.818,0.5) (1.66,0.75) (3.20,0.9) (4.55,0.95) (14.1,0.99) (14.2,1)@ g kg{-1}
day{-1}
   CR.farmer.fruit=@(0,0)(0.0606,0.01) (0.139, 0.05) (0.254,0.1) (0.468, 0.25)
(0.818,0.5) (1.66,0.75) (3.20,0.9) (4.55,0.95) (14.1,0.99) (14.2,1)@ g kg{-1}
day{-1}

// root vegetables
// adult resident
   CR.adult.resident.rtveg=@(0,0)(0.00657,0.01) (0.0347, 0.05) (0.0999,0.1)
(0.238, 0.25) (0.617,0.5) (1.31,0.75) (2.57,0.9) (3.53,0.95) (7.20,0.99)
(9.18,1)@ g kg{-1} day{-1}
// adult farmer
   CR.adult.farmer.rtveg=@(0,0)(0.00657,0.01) (0.0347, 0.05) (0.0999,0.1)
(0.238, 0.25) (0.617,0.5) (1.31,0.75) (2.57,0.9) (3.53,0.95) (7.20,0.99)
(9.18,1)@ g kg{-1} day{-1}
// child
   CR.child.rtveg=@(0,0)(0.0553,0.01) (0.0577, 0.05) (0.138,0.1) (0.271, 0.25)
(0.625,0.5) (2.34,0.75) (5.19,0.9) (6.76,0.95) (7.08,0.99) (7.08,1)@ g kg{-1}
day{-1}
//cancer
   CR.resident.rtveg=@(0,0)(0.0107,0.01) (0.0366, 0.05) (0.103,0.1) (0.241,
0.25) (0.618,0.5) (1.40,0.75) (2.79,0.9) (3.81,0.95) (7.19,0.99) (9.00,1)@ g
kg{-1} day{-1}
   CR.farmer.rtveg=@(0,0)(0.0107,0.01) (0.0366, 0.05) (0.103,0.1) (0.241, 0.25)
(0.618,0.5) (1.40,0.75) (2.79,0.9) (3.81,0.95) (7.19,0.99) (9.00,1)@ g kg{-1}
day{-1}

// Fraction ingested from the floodplain (unitless) [The fact that agriculture
areas might not all be located entirely within the floodplain is addressed with
FS, which represents different assumed fractions within the floodplain]

// dairy-milk
```

```
   FI.dairy=1
// beef
   FI.beef=1
// poultry meat
   FI.poultry.meat=1
// poultry egg
   FI.poultry.egg=1
// garden produce
   FI.garden=1

// Exposure Frequency [consumption rates are annualized; therefore, EF equal 365
day per year minus 2-week vacation]

// child
   EF.child=350 day year{-1}
// adult resident
   EF.adult.resident=350 day year{-1}
// adult farmer
   EF.adult.farmer=350 day year{-1}

// Exposure Duration

//calculate confidence intervals around mean and std dev for p-box
// xbar is average from MADPH, 2001
//xbar=14.75
//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=14.75
//s2 = ss^2 i.e. the variance
//s2= (14.75) * (14.75)
//n=1882
// 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))
// calculate confidence intervals around variance(Sokal and Rolf, Section 7.7)
//slcl=14.3
//sucl=15.2

// exposure duration for resident or farmer cancer risk [varies by scenario;
mean= 19.5 for commercial scenarios and 15 for backyard scenarios]
   ED.cancer=minI(exponential(19.5 year),70 year)

// Body Weight (not needed; all food consumption rates are normalized to body
weight of interviewees)

// Averaging Time, Cancer
   ATc=25550 day
// conversion factor, years to days for non-cancer equations
   ATcf=365 day year {-1}

// Toxicity Information
   CSF.PCB=2 mg{-1} kg day
   RfD.PCB=0.00002 mg kg{-1} day{-1}
```

```
// RISK CALCULATION

_for j:=1 to 4 do begin // Fraction of Pasture, Cornfield, Hayfield, or Garden
on the Site (unitless)
_for i:=1 to 4 do begin // Total PCB Concentration Pasture, Cornfield, Hayfield,
or Garden (mg/kg, dw)

// Animal product concentrations

// cow and poultry intake equations [reflects time on pasture given regional
climate and farming practices]

// cow intake [assumes dependence among intake items]
   Intake.cow= EPC.pasture.soil.PCB.i |*| FS.pasture.j |*| (BA.soil.PCB |*|
D.soil |+| TF.grass.PCB |*| D.grass) |+| EPC.cornfield.soil.PCB.i |*|
FS.cornfield.j |*| TF.cornsilage.PCB |*| D.cornsilage |+|
EPC.hayfield.soil.PCB.i |*| FS.hayfield.j |*| TF.hay.PCB |*| D.hay |+|
EPC.grainfield.soil.PCB.i |*| FS.grainfield.j |*| TF.concentrate.PCB |*|
D.concentrate
// poultry intake (assumes dependence among intake items)
   Intake.poultry= EPC.pasture.soil.PCB.i |*| FS.pasture.j |*| (BA.soil.PCB |*|
D.soil |+| TF.grass.PCB |*| D.grass) |+| EPC.grainfield.soil.PCB.i |*|
FS.grainfield.j |*| TF.concentrate.PCB |*| D.concentrate

// food concentration: dairy
   Cfood.dairy.i.j= BCF.mammal.PCB |*| F.dairy.jersey |*| Intake.cow
// food concentration: beef
   Cfood.beef.i.j= BCF.mammal.PCB |*| F.beef |*| Intake.cow
// food concentration: poultry meat
   Cfood.poultry.meat.i.j= BCF.poultry.meat.PCB |*| F.poultry.meat |*|
Intake.poultry
// food concentration: poultry egg
   Cfood.poultry.egg.i.j= BCF.poultry.egg.PCB |*| Intake.poultry

// dairy-milk
// child non-cancer
   ADD.child.dairy=Cfood.dairy.i.j |*| CR.child.dairy |*| UCF |*| ABS.dairy |*|
FI.dairy |*| (1 |-| PCL.dairy) |*| (1 |-| CL.dairy) |*| EF.child
   HI.dairy.child.i.j= (ADD.child.dairy |/| ATcf) |/| RfD.PCB
 // adult resident non-cancer
   ADD.adult.resident.dairy=Sbkyd |*| Cfood.dairy.i.j |*|
CR.adult.resident.dairy |*| UCF |*| ABS.dairy |*| FI.dairy |*| (1 |-| PCL.dairy)
|*| (1 |-| CL.dairy) |*| EF.adult.resident
   HI.dairy.adult.resident.i.j= (ADD.adult.resident.dairy |/| ATcf) |/| RfD.PCB
// adult farmer non-cancer
   ADD.adult.farmer.dairy=Scomm |*| Cfood.dairy.i.j |*| CR.adult.farmer.dairy
|*| UCF |*| ABS.dairy |*| FI.dairy |*| (1 |-| PCL.dairy) |*| (1 |-| CL.dairy)
|*| EF.adult.farmer
   HI.dairy.adult.farmer.i.j= (ADD.adult.farmer.dairy |/| ATcf) |/| RfD.PCB
// child and adult resident combined cancer risk
   ADD.resident.dairy=Sbkyd |*| Cfood.dairy.i.j |*| UCF |*| ABS.dairy |*|
FI.dairy |*| (1 |-| PCL.dairy) |*| (1 |-| CL.dairy) |*| EF.adult.resident |*|
CR.resident.dairy |*| ED.cancer
   CancerRisk.dairy.resident.i.j= (ADD.resident.dairy |/| ATc)|*| CSF.PCB
// child and adult farmer combined cancer risk
```

```
   ADD.farmer.dairy=Scomm |*| Cfood.dairy.i.j |*| UCF |*| ABS.dairy |*| FI.dairy
|*| (1 |-| PCL.dairy) |*| (1 |-| CL.dairy) |*| EF.adult.farmer |*|
CR.farmer.dairy |*| ED.cancer
   CancerRisk.dairy.farmer.i.j= (ADD.farmer.dairy |/| ATc)|*| CSF.PCB

// beef
// child non-cancer
   ADD.child.beef=Cfood.beef.i.j |*| CR.child.beef |*| UCF |*| ABS.beef |*|
FI.beef |*| (1 |-| PCL.beef) |*| (1 |-| CL.beef) |*| EF.child
   HI.beef.child.i.j= (ADD.child.beef |/| ATcf) |/| RfD.PCB
// adult resident non-cancer
   ADD.adult.resident.beef=Sbkyd |*| Cfood.beef.i.j |*| CR.adult.resident.beef
|*| UCF |*| ABS.beef |*| FI.beef |*| (1 |-| PCL.beef) |*| (1 |-| CL.beef) |*|
EF.adult.resident
   HI.beef.adult.resident.i.j= (ADD.adult.resident.beef |/| ATcf) |/| RfD.PCB
// adult farmer non-cancer
   ADD.adult.farmer.beef=Scomm |*| Cfood.beef.i.j |*| CR.adult.farmer.beef |*|
UCF |*| ABS.beef |*| FI.beef |*| (1 |-| PCL.beef) |*| (1 |-| CL.beef) |*|
EF.adult.farmer
   HI.beef.adult.farmer.i.j= (ADD.adult.farmer.beef |/| ATcf) |/| RfD.PCB
// child and adult resident combined cancer risk
   ADD.resident.beef=Sbkyd |*| Cfood.beef.i.j |*| UCF |*| ABS.beef |*| FI.beef
|*| (1 |-| PCL.beef) |*| (1 |-| CL.beef) |*| EF.adult.resident |*|
CR.resident.beef |*| ED.cancer
   CancerRisk.beef.resident.i.j= (ADD.resident.beef |/| ATc)|*| CSF.PCB
// child and adult farmer combined cancer risk
   ADD.farmer.beef=Scomm |*| Cfood.beef.i.j |*| UCF |*| ABS.beef |*| FI.beef |*|
(1 |-| PCL.beef) |*| (1 |-| CL.beef) |*| EF.adult.farmer |*| CR.farmer.beef |*|
ED.cancer
   CancerRisk.beef.farmer.i.j= (ADD.farmer.beef |/| ATc)|*| CSF.PCB

// poultry meat
// child non-cancer
   ADD.child.poultry.meat=Cfood.poultry.meat.i.j |*| CR.child.poultry.meat |*|
UCF |*| ABS.poultry.meat |*| FI.poultry.meat |*| (1 |-| PCL.poultry.meat) |*| (1
|-| CL.poultry.meat)|*| EF.child
   HI.poultry.meat.child.i.j= (ADD.child.poultry.meat |/| ATcf) |/| RfD.PCB
// adult resident non-cancer
   ADD.adult.resident.poultry.meat=Sbkyd |*| Cfood.poultry.meat.i.j |*|
CR.adult.resident.poultry.meat |*| UCF |*| ABS.poultry.meat |*| FI.poultry.meat
|*| (1 |-| PCL.poultry.meat) |*| (1 |-| CL.poultry.meat)|*| EF.adult.resident
   HI.poultry.meat.adult.resident.i.j= (ADD.adult.resident.poultry.meat |/|
ATcf) |/| RfD.PCB
// adult farmer non-cancer
   ADD.adult.farmer.poultry.meat=Scomm |*| Cfood.poultry.meat.i.j |*|
CR.adult.farmer.poultry.meat |*| UCF |*| ABS.poultry.meat |*| FI.poultry.meat
|*| (1 |-| PCL.poultry.meat) |*| (1 |-| CL.poultry.meat)|*| EF.adult.farmer
   HI.poultry.meat.adult.farmer.i.j= (ADD.adult.farmer.poultry.meat |/| ATcf)
|/| RfD.PCB
// child and adult resident combined cancer risk
   ADD.resident.poultry.meat=Sbkyd |*| Cfood.poultry.meat.i.j |*| UCF |*|
ABS.poultry.meat |*| FI.poultry.meat |*| (1 |-| PCL.poultry.meat) |*| (1 |-|
CL.poultry.meat)|*| EF.adult.resident |*| CR.resident.poultry.meat |*| ED.cancer
   CancerRisk.poultry.meat.resident.i.j= (ADD.resident.poultry.meat |/| ATc)|*|
CSF.PCB
// child and adult farmer combined cancer risk
```

```
   ADD.farmer.poultry.meat=Scomm |*| Cfood.poultry.meat.i.j |*| UCF |*|
ABS.poultry.meat |*| FI.poultry.meat |*| (1 |-| PCL.poultry.meat) |*| (1 |-|
CL.poultry.meat)|*| EF.adult.farmer |*| CR.farmer.poultry.meat |*| ED.cancer
   CancerRisk.poultry.meat.farmer.i.j= (ADD.farmer.poultry.meat |/| ATc)|*|
CSF.PCB

// poultry egg
// child non-cancer
   ADD.child.poultry.egg=Cfood.poultry.egg.i.j |*| CR.child.poultry.egg |*| UCF
|*| ABS.poultry.egg |*| FI.poultry.egg |*| (1 |-| PCL.poultry.egg) |*| (1 |-|
CL.poultry.egg)|*| EF.child
   HI.poultry.egg.child.i.j= (ADD.child.poultry.egg |/| ATcf) |/| RfD.PCB
// adult resident non-cancer
   ADD.adult.resident.poultry.egg=Sbkyd |*| Cfood.poultry.egg.i.j |*|
CR.adult.resident.poultry.egg |*| UCF |*| ABS.poultry.egg |*| FI.poultry.egg |*|
(1 |-| PCL.poultry.egg) |*| (1 |-| CL.poultry.egg)|*| EF.adult.resident
   HI.poultry.egg.adult.resident.i.j= (ADD.adult.resident.poultry.egg |/| ATcf)
|/| RfD.PCB
// adult farmer non-cancer
   ADD.adult.farmer.poultry.egg=Scomm |*| Cfood.poultry.egg.i.j |*|
CR.adult.farmer.poultry.egg |*| UCF |*| ABS.poultry.egg |*| FI.poultry.egg |*|
(1 |-| PCL.poultry.egg) |*| (1 |-| CL.poultry.egg)|*| EF.adult.farmer
   HI.poultry.egg.adult.farmer.i.j= (ADD.adult.farmer.poultry.egg |/| ATcf) |/|
RfD.PCB
// child and adult resident combined cancer risk
   ADD.resident.poultry.egg=Sbkyd |*| Cfood.poultry.egg.i.j |*| UCF |*|
ABS.poultry.egg |*| FI.poultry.egg |*| (1 |-| PCL.poultry.egg) |*| (1 |-|
CL.poultry.egg)|*| EF.adult.resident |*| CR.resident.poultry.egg |*| ED.cancer
   CancerRisk.poultry.egg.resident.i.j= (ADD.resident.poultry.egg |/| ATc)|*|
CSF.PCB
// child and adult farmer combined cancer risk
   ADD.farmer.poultry.egg=Scomm |*| Cfood.poultry.egg.i.j |*| UCF |*|
ABS.poultry.egg |*| FI.poultry.egg |*| (1 |-| PCL.poultry.egg) |*| (1 |-|
CL.poultry.egg)|*| EF.adult.farmer |*| CR.farmer.poultry.egg |*| ED.cancer
   CancerRisk.poultry.egg.farmer.i.j= (ADD.farmer.poultry.egg |/| ATc)|*|
CSF.PCB

// garden produce (sum of exposed vegetables, root vegetables, exposed fruit)
// reduced version of intermediate calculations not including repeated
parameters
// take out EPC.garden.soil.PCB.i |*| FS.garden.j from Cfood
//exposed vegetables
   Cfood.garden.expveg.i.j= TF.expveg.PCB
// root vegetables
   Cfood.garden.rtveg.i.j= TF.rtveg.PCB
// fruits
   Cfood.garden.fruit.i.j= TF.fruit.PCB
// take out repeated use of UCF |*| ABS.garden |*| FI.garden |*| EF.child from
ADD
// child non-cancer
   ADD.child.expveg =Cfood.garden.expveg.i.j |*| CR.child.expveg |*| (1 |-|
PCL.expveg) |*| (1 |-| CL.expveg)
   ADD.child.rtveg =Cfood.garden.rtveg.i.j |*| CR.child.rtveg |*| (1 |-|
PCL.rtveg) |*| (1 |-| CL.rtveg)
   ADD.child.fruit =Cfood.garden.fruit.i.j |*| CR.child.fruit |*| (1 |-|
PCL.fruit) |*| (1 |-| CL.fruit)
```

```
   HI.garden.child.i.j = EPC.garden.soil.PCB.i |*| FS.garden.j |*| UCF |*|
ABS.garden |*| FI.garden |*| EF.child |*| ((ADD.child.expveg |+|
ADD.child.rtveg) |*| AF.veg |+| (ADD.child.fruit |*| AF.fruit)) |/| ATcf |/|
RfD.PCB
//adult resident non-cancer
   ADD.adult.resident.expveg =Cfood.garden.expveg.i.j |*|
CR.adult.resident.expveg |*| (1 |-| PCL.expveg) |*| (1 |-| CL.expveg)
   ADD.adult.resident.rtveg =Cfood.garden.rtveg.i.j |*| CR.adult.resident.rtveg
|*| (1 |-| PCL.rtveg) |*| (1 |-| CL.rtveg)
   ADD.adult.resident.fruit =Cfood.garden.fruit.i.j |*| CR.adult.resident.fruit
|*| (1 |-| PCL.fruit) |*| (1 |-| CL.fruit)
   HI.garden.adult.resident.i.j = Sbkyd |*| EPC.garden.soil.PCB.i |*|
FS.garden.j |*| UCF |*| ABS.garden |*| FI.garden |*| EF.adult.resident |*|
((ADD.adult.resident.expveg |+| ADD.adult.resident.rtveg) |*| AF.veg |+|
(ADD.adult.resident.fruit |*| AF.fruit)) |/| ATcf |/| RfD.PCB
// adult farmer non-cancer
   ADD.adult.farmer.expveg =Cfood.garden.expveg.i.j |*| CR.adult.farmer.expveg
|*| (1 |-| PCL.expveg) |*| (1 |-| CL.expveg)
   ADD.adult.farmer.rtveg =Cfood.garden.rtveg.i.j |*| CR.adult.farmer.rtveg |*|
(1 |-| PCL.rtveg) |*| (1 |-| CL.rtveg)
   ADD.adult.farmer.fruit =Cfood.garden.fruit.i.j |*| CR.adult.farmer.fruit |*|
(1 |-| PCL.fruit) |*| (1 |-| CL.fruit)
   HI.garden.adult.farmer.i.j = Scomm |*|  EPC.garden.soil.PCB.i |*| FS.garden.j
|*| UCF |*| ABS.garden |*| FI.garden |*| EF.adult.farmer |*|
((ADD.adult.farmer.expveg |+| ADD.adult.farmer.rtveg) |*| AF.veg |+|
(ADD.adult.farmer.fruit |*| AF.fruit)) |/| ATcf |/| RfD.PCB
// child and adult resident combined cancer risk
   ADD.resident.expveg= Cfood.garden.expveg.i.j |*| CR.resident.expveg |*|(1 |-|
PCL.expveg) |*| (1 |-| CL.expveg)
   ADD.resident.rtveg= Cfood.garden.rtveg.i.j |*| CR.resident.rtveg |*| (1 |-|
PCL.rtveg) |*| (1 |-| CL.rtveg)
   ADD.resident.fruit= Cfood.garden.fruit.i.j |*| CR.resident.fruit |*| (1 |-|
PCL.fruit) |*| (1 |-| CL.fruit)
   CancerRisk.garden.resident.i.j =Sbkyd |*| EPC.garden.soil.PCB.i |*|
FS.garden.j |*| UCF |*| ABS.garden |*| FI.garden |*| EF.adult.resident |*|
ED.cancer |*| ((ADD.resident.expveg |+| ADD.resident.rtveg) |*| AF.veg |+|
(ADD.resident.fruit |*| AF.fruit)) |/| ATc |*| CSF.PCB
// child and adult farmer combined cancer risk
   ADD.farmer.expveg= Cfood.garden.expveg.i.j |*| CR.farmer.expveg |*| (1 |-|
PCL.expveg) |*| (1 |-| CL.expveg)
   ADD.farmer.rtveg= Cfood.garden.rtveg.i.j |*| CR.farmer.rtveg |*| (1 |-|
PCL.rtveg) |*| (1 |-| CL.rtveg)
   ADD.farmer.fruit= Cfood.garden.fruit.i.j |*| CR.farmer.fruit |*| (1 |-|
PCL.fruit) |*| (1 |-| CL.fruit)
   CancerRisk.garden.farmer.i.j=Scomm |*| EPC.garden.soil.PCB.i |*| FS.garden.j
|*| UCF |*| ABS.garden |*| FI.garden |*| EF.adult.farmer |*| ED.cancer |*|
((ADD.farmer.expveg |+| ADD.farmer.rtveg) |*| AF.veg |+| (ADD.farmer.fruit |*|
AF.fruit)) |/| ATc |*| CSF.PCB

// SENSITIVITY ANALYSIS [Edit variable names when run different scenarios]
HI.dairy.child.area.i.j= breadth(HI.dairy.child.i.j)
HI.dairy.adult.resident.area.i.j=breadth(HI.dairy.adult.resident.i.j)
HI.dairy.adult.farmer.area.i.j=breadth(HI.dairy.adult.farmer.i.j)
CancerRisk.dairy.resident.area.i.j=breadth(CancerRisk.dairy.resident.i.j)
CancerRisk.dairy.farmer.area.i.j=breadth(CancerRisk.dairy.farmer.i.j)

_end
```

```
_end

// print tables [Edit variable names when run different scenarios]

_print "HI.dairy.child,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," HI.dairy.child.1.j "," HI.dairy.child.2.j ","
HI.dairy.child.3.j "," HI.dairy.child.4.j ","
_end

_print "HI.dairy.adult.resident,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," HI.dairy.adult.resident.1.j ","
HI.dairy.adult.resident.2.j "," HI.dairy.adult.resident.3.j ","
HI.dairy.adult.resident.4.j ","
_end

_print "Cancer Risk.dairy.resident,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," CancerRisk.dairy.resident.1.j ","
CancerRisk.dairy.resident.2.j "," CancerRisk.dairy.resident.3.j ","
CancerRisk.dairy.resident.4.j ","
_end

_print "HI.dairy.adult.farmer,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," HI.dairy.adult.farmer.1.j ","
HI.dairy.adult.farmer.2.j "," HI.dairy.adult.farmer.3.j ","
HI.dairy.adult.farmer.4.j ","
_end

_print "Cancer Risk.dairy.farmer,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," CancerRisk.dairy.farmer.1.j ","
CancerRisk.dairy.farmer.2.j "," CancerRisk.dairy.farmer.3.j ","
CancerRisk.dairy.farmer.4.j ","
_end

_print "Child HI P-Bounds Area,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","
```

```
_for j:=1 to 4 do begin
_print FS.cornfield.j "," HI.dairy.child.area.1.j "," HI.dairy.child.area.2.j
"," HI.dairy.child.area.3.j "," HI.dairy.child.area.4.j ","
_end

_print "Adult Resident HI P-Bounds Area,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," HI.dairy.adult.resident.area.1.j ","
HI.dairy.adult.resident.area.2.j "," HI.dairy.adult.resident.area.3.j ","
HI.dairy.adult.resident.area.4.j ","
_end

_print "Cancer Risk Resident P-Bounds Area,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," CancerRisk.dairy.resident.area.1.j ","
CancerRisk.dairy.resident.area.2.j "," CancerRisk.dairy.resident.area.3.j ","
CancerRisk.dairy.resident.area.4.j ","
_end

_print "Adult Farmer HI P-Bounds Area,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," HI.dairy.adult.farmer.area.1.j ","
HI.dairy.adult.farmer.area.2.j "," HI.dairy.adult.farmer.area.3.j ","
HI.dairy.adult.farmer.area.4.j ","
_end

_print "Cancer Risk Farmer P-Bounds Area,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," CancerRisk.dairy.farmer.area.1.j ","
CancerRisk.dairy.farmer.area.2.j "," CancerRisk.dairy.farmer.area.3.j ","
CancerRisk.dairy.farmer.area.4.j ","
_end
```

EXHIBIT 6-2

EXAMPLE OF RISK CALC CODE FOR PROBABILITY BOUNDS MASTER SCRIPT, TOTAL PCBs

EXHIBIT 6-2
EXAMPLE OF RISK CALC CODE FOR PROBABILITY BOUNDS MASTER SCRIPT, Total PCBs

// In the following code, annotations explaining various program elements are shown after two forward slashes (//)

```
// PARCEL - SPECIFIC INPUTS

_clear

// Scenario [specify commercial or backyard scenario with a “1” and set the
other variable to zero]
Scomm=1
Sbkyd=0

// Soil EPCs for total PCBs (tPCBs)

// Pasture
   EPC.pasture.soil.PCB.1=0.5 mg kg{-1}
   EPC.pasture.soil.PCB.2=2.0 mg kg{-1}
   EPC.pasture.soil.PCB.3=10 mg kg{-1}
   EPC.pasture.soil.PCB.4=25mg kg{-1}

// Cornfield
   EPC.cornfield.soil.PCB.1=0.5 mg kg{-1}
   EPC.cornfield.soil.PCB.2=2.0 mg kg{-1}
   EPC.cornfield.soil.PCB.3=10 mg kg{-1}
   EPC.cornfield.soil.PCB.4=25 mg kg{-1}

// Hayfield
   EPC.hayfield.soil.PCB.1=0.5 mg kg{-1}
   EPC.hayfield.soil.PCB.2=2.0 mg kg{-1}
   EPC.hayfield.soil.PCB.3=10 mg kg{-1}
   EPC.hayfield.soil.PCB.4=25 mg kg{-1}

// Grainfield
   EPC.grainfield.soil.PCB.1=0.5 mg kg{-1}
   EPC.grainfield.soil.PCB.2=2.0 mg kg{-1}
   EPC.grainfield.soil.PCB.3=10 mg kg{-1}
   EPC.grainfield.soil.PCB.4=25 mg kg{-1}

// Garden
   EPC.garden.soil.PCB.1=0.5 mg kg{-1}
   EPC.garden.soil.PCB.2=2.0 mg kg{-1}
   EPC.garden.soil.PCB.3=10 mg kg{-1}
   EPC.garden.soil.PCB.4=25 mg kg{-1}

// Fraction of farm area that is in the floodplain

// Pasture
   FS.pasture.1=0.25
   FS.pasture.2=0.50
   FS.pasture.3=0.75
   FS.pasture.4=1.00
```

```
// Cornfield
   FS.cornfield.1=0.25
   FS.cornfield.2=0.50
   FS.cornfield.3=0.75
   FS.cornfield.4=1.00

// Hayfield
   FS.hayfield.1=0.25
   FS.hayfield.2=0.50
   FS.hayfield.3=0.75
   FS.hayfield.4=1.00

// Grainfield
   FS.grainfield.1=0.25
   FS.grainfield.2=0.50
   FS.grainfield.3=0.75
   FS.grainfield.4=1.00

// Garden
   FS.garden.1=0.25
   FS.garden.2=0.50
   FS.garden.3=0.75
   FS.garden.4=1.00


// OTHER INPUTS

// Soil-to-Plant Modeling

// Soil-to-Corn Transfer Factor (dw plant/dw soil)
   TF.cornsilage.PCB=[0.00047, 0.0030]
// Soil-to-Grass Transfer Factor (dw plant/dw soil)
   TF.grass.PCB=[0.0098, 0.094]
// Soil-to-Hay Transfer Factor (dw plant/dw soil)
   TF.hay.PCB=[0.0098, 0.094]
// Soil-to-Exposed Vegetable Transfer Factor (ww plant/dw soil)
   TF.expveg.PCB=[0.00017,0.0018]
// Soil-to-Exposed Fruit Transfer Factor (ww plant/dw soil)
   TF.fruit.PCB=[0.00017,0.0018]
 // Soil-to-Root Vegetable Transfer Factor (ww plant/dw soil)
   TF.rtveg.PCB=[0.00011,0.04]
// Grainfield-to-Concentrate Transfer Factor (ww plant/dw soil)
   TF.concentrate.PCB=0.0

// Animal Intake [varies by scenario; values shown correspond to “commercial
dairy” scenario

// Animal Diet Composition (unitless)
// fraction of diet = soil
   D.soil =0
// fraction of diet = corn silage grown on farm
   D.cornsilage=[0.5,0.6]
// fraction of diet = hay or other grass-based feed grown on farm
   D.hay=0
// fraction of diet = pasture grass on farm
   D.grass=0
```

```
// fraction of diet = concentrate (e.g., grain/supplements) from off Site
   D.concentrate=1-D.cornsilage

// Soil Bioavailability (unitless)
   BA.soil.PCB=[0.65,1]

// Bioconcentration Factors (unitless)

// Mammalian BCFs (fat basis)
   BCF.mammal.PCB=[3,3.6]
// Avian BCFs (fat basis)
   BCF.poultry.meat.PCB=[2.5,4.7]
// Avian BCFs (whole food basis)
   BCF.poultry.egg.PCB=[0.57,1.1]

// Fat Concentration (mg fat/mg whole food)

// dairy-milk: jersey cows
   F.dairy.jersey= histogram(0.037, 0.064, 0.037, 0.038, 0.039, 0.04,0.04,0.041,
0.041,
0.042,0.043,0.043,0.043,0.043,0.043,0.044,0.044,0.044,0.044,0.044,0.044,0.045,0.
045,
0.046,0.046,0.046,0.046,0.046,0.046,0.046,0.046,0.046,0.047,0.047,0.047,0.047,0.
047,
0.047,0.047,0.047,0.047,0.048,0.048,0.048,0.048,0.048,0.049,0.049,0.049,0.05,0.0
5,0.05,0.051,0.051,0.052,0.053,0.053,0.053,0.053,0.054,0.055,0.056,0.057,0.059,0
.06,0.064)
// beef
   F.beef=[0.039,0.38]
// poultry meat
   F.poultry.meat=[0.03,0.24]

// Cooking loss

// dairy
   CL.dairy=0
// beef
   CL.beef=[0.19,0.37]
// poultry meat
   CL.poultry.meat=[0.22,0.43]
// poultry egg
   CL.poultry.egg=[0,0.15]
// garden produce
   CL.expveg=[0,0.64]
   CL.fruit=[0,0.41]
   CL.rtveg=[0,0.63]

// Post-cooking loss

//dairy
   PCL.dairy=0
// beef
   PCL.beef=[0.12,0.38]
// poultry meat
   PCL.poultry.meat=[0.22,0.40]
// poultry egg
   PCL.poultry.egg=0
```

```
// garden produce
   PCL.expveg=0
   PCL.fruit=0
   PCL.rtveg=0

// Human Exposure

// Fraction of PCBs, dioxins, and furans absorbed in GI tract (unitless) [Set to
1 for all foods based on the assumption that absorption in humans is the same as
absorption in animals in studies used to develop RfD and CSF]
// dairy-milk
   ABS.dairy=1
// beef
   ABS.beef=1
// poultry meat
   ABS.poultry.meat=1
// poultry egg
   ABS.poultry.egg=1
// garden produce
   ABS.garden=1

// Food consumption rates (body weight-normalized)

// unit correction factor (kg whole food/g whole food)
   UCF =0.001 kg g{-1}

// uncertainty factor associated with extrapolating consumption rates (UE)
   UE.child= lognormal2(-0.09,0.56)
   UE.teen= lognormal2(-0.09,0.37)
   UE.adult= lognormal2(0.125,0.4)

// regional adjustment factor for garden produce consumption (unitless)
   AF.fruit=0.0747 + 0.0048*t(8)
   AF.veg= 0.277   + 0.022*t(8)


// dairy-milk
// adult resident
   CR.adult.resident.dairy=mixture(0.2, minI(fivenumbers(0 g kg{-1} day{-1},
[4.6,13.4] g kg{-1} day{-1}, [12.9, 29.1] g kg{-1} day{-1}, [22.1, 44.6] g kg{-
1} day{-1}, 52.9 g kg{-1} day{-1}) * minI(UE.teen,2.08), 62.6 g kg{-1} day{-1}),
0.8, minI(fivenumbers(0 g kg{-1} day{-1}, [1.87,2.9] g kg{-1} day{-1}, [5.46,
7.41] g kg{-1} day{-1}, [10.5, 12.1] g kg{-1} day{-1}, 23.0 g kg{-1} day{-1}) *
minI(UE.adult,3.24), 43.3 g kg{-1} day{-1}))
// adult farmer
   CR.adult.farmer.dairy= mixture(0.2, minI(fivenumbers(0 g kg{-1} day{-1},
[4.6,13.4] g kg{-1} day{-1}, [12.9, 29.1] g kg{-1} day{-1}, [22.1, 44.6] g kg{-
1} day{-1}, 52.9 g kg{-1} day{-1}) * minI(UE.teen,2.08), 62.6 g kg{-1} day{-1}),
0.8, minI(fivenumbers(0 g kg{-1} day{-1}, [1.87,2.9] g kg{-1} day{-1}, [5.46,
7.41] g kg{-1} day{-1}, [10.5, 12.1] g kg{-1} day{-1}, 23.0 g kg{-1} day{-1}) *
minI(UE.adult,3.24), 43.3 g kg{-1} day{-1}))
// child
   CR.child.dairy=minI(fivenumbers(0 g kg{-1} day{-1}, [23.7,30.3] g kg{-1}
day{-1}, [47.8, 57.5] g kg{-1} day{-1}, [68.0, 86.7] g kg{-1} day{-1}, 101 g
kg{-1} day{-1}) * minI(UE.child,2.76), 109 g kg{-1} day{-1})
//cancer
  CR.resident.dairy=mixture(0.91,CR.adult.farmer.dairy,0.09,CR.child.dairy)
```

```
  CR.farmer.dairy=mixture(0.91,CR.adult.farmer.dairy, 0.09,CR.child.dairy)

// beef
// adult resident
   CR.adult.resident.beef=mixture(0.2,fivenumbers(0 g kg{-1} day{-1},
[0.896,1.32] g kg{-1} day{-1}, [1.51, 2.11] g kg{-1} day{-1}, [2.44, 4.43] g
kg{-1} day{-1}, 13.3 g kg{-1} day{-1}), 0.8, fivenumbers(0 g kg{-1} day{-1},
[0.346,0.833] g kg{-1} day{-1}, [1.05, 1.59] g kg{-1} day{-1}, [2.01, 2.73] g
kg{-1} day{-1}, 8.26 g kg{-1} day{-1}))
// adult farmer
   CR.adult.farmer.beef= mixture(0.2,fivenumbers(0 g kg{-1} day{-1},
[0.896,1.32] g kg{-1} day{-1}, [1.51, 2.11] g kg{-1} day{-1}, [2.44, 4.43] g
kg{-1} day{-1}, 13.3 g kg{-1} day{-1}), 0.8, fivenumbers(0 g kg{-1} day{-1},
[0.346,0.833] g kg{-1} day{-1}, [1.05, 1.59] g kg{-1} day{-1}, [2.01, 2.73] g
kg{-1} day{-1}, 8.26 g kg{-1} day{-1}))
// child
   CR.child.beef=minI(fivenumbers(0 g kg{-1} day{-1}, [1.16,1.22] g kg{-1} day{-
1}, [2.87, 3.31] g kg{-1} day{-1}, [4.69, 5.33] g kg{-1} day{-1}, 16 g kg{-1}
day{-1}) * minI(UE.child,2.76), 16 g kg{-1} day{-1})
//cancer
   CR.resident.beef=mixture(0.91,CR.adult.resident.beef, 0.09,CR.child.beef)
   CR.farmer.beef=mixture(0.91,CR.adult.farmer.beef, 0.09,CR.child.beef)

// poultry meat
// adult resident
   CR.adult.resident.poultry.meat= mixture(0.2, minI(fivenumbers(0 g kg{-1}
day{-1}, [0.268,0.943] g kg{-1} day{-1}, [0.466, 1.93] g kg{-1} day{-1}, [0.640,
2.43] g kg{-1} day{-1}, 8.38 g kg{-1} day{-1}) * minI(UE.teen,2.08), 8.38 g kg{-
1} day{-1}), 0.8, minI(fivenumbers(0 g kg{-1} day{-1}, [0.409,0.557] g kg{-1}
day{-1}, [0.774, 1.15] g kg{-1} day{-1}, [1.23, 2.69] g kg{-1} day{-1}, 5.15 g
kg{-1} day{-1}) * minI(UE.adult,3.24), 6.22 g kg{-1} day{-1}))
// adult farmer
   CR.adult.farmer.poultry.meat= mixture(0.2, minI(fivenumbers(0 g kg{-1} day{-
1}, [0.268,0.943] g kg{-1} day{-1}, [0.466, 1.93] g kg{-1} day{-1}, [0.640,
2.43] g kg{-1} day{-1}, 8.38 g kg{-1} day{-1}) * minI(UE.teen,2.08), 8.38 g kg{-
1} day{-1}), 0.8, minI(fivenumbers(0 g kg{-1} day{-1}, [0.409,0.557] g kg{-1}
day{-1}, [0.774, 1.15] g kg{-1} day{-1}, [1.23, 2.69] g kg{-1} day{-1}, 5.15 g
kg{-1} day{-1}) * minI(UE.adult,3.24), 6.22 g kg{-1} day{-1}))
// child
   CR.child.poultry.meat=minI(fivenumbers(0 g kg{-1} day{-1}, [1.02,1.20] g kg{-
1} day{-1}, [2.10, 2.20] g kg{-1} day{-1}, [2.94, 3.02] g kg{-1} day{-1}, 14.2 g
kg{-1} day{-1}) * minI(UE.child, 2.76), 14.2 g kg{-1} day{-1})
//cancer
   CR.resident.poultry.meat=mixture(0.91,CR.adult.resident.poultry.meat, 0.09,
CR.child.poultry.meat)
   CR.farmer.poultry.meat=mixture(0.91,CR.adult.farmer.poultry.meat, 0.09,
CR.child.poultry.meat)

// poultry egg
// adult resident
   CR.adult.resident.poultry.egg=mixture(0.2, minI(minmaxmean(0 g kg{-1} day{-
1}, 4.3 g kg{-1} day{-1}, 0.739 g kg{-1} day{-1}) * minI(UE.teen,2.08), 6.33 g
kg{-1} day{-1}), 0.8, minI(minmaxmean(0 g kg{-1} day{-1}, 2.5 g kg{-1} day{-1},
0.605 g kg{-1} day{-1}) * minI(UE.adult,3.24), 5.39 g kg{-1} day{-1}))
// adult farmer
   CR.adult.farmer.poultry.egg= mixture(0.2, minI(minmaxmean(0 g kg{-1} day{-1},
4.3 g kg{-1} day{-1}, 0.739 g kg{-1} day{-1}) * minI(UE.teen,2.08), 6.33 g kg{-
```

```
1} day{-1}), 0.8, minI(minmaxmean(0 g kg{-1} day{-1}, 2.5 g kg{-1} day{-1},
0.605 g kg{-1} day{-1}) * minI(UE.adult,3.24), 5.39 g kg{-1} day{-1}))
// child
   CR.child.poultry.egg=minI(minmaxmean(0 g kg{-1} day{-1}, 10.6 g kg{-1} day{-
1}, 1.71 g kg{-1} day{-1}) * minI(UE.child, 2.76), 10.8 g kg{-1} day{-1})
//cancer
   CR.resident.poultry.egg=mixture(0.91,CR.adult.resident.poultry.egg,
0.09,CR.child.poultry.egg)
   CR.farmer.poultry.egg=mixture(0.91,CR.adult.farmer.poultry.egg,
0.09,CR.child.poultry.egg)


// exposed vegetables
// adult resident
   CR.adult.resident.expveg=mixture(0.2,fivenumbers(0 g kg{-1} day{-1},
[0.304,0.312] g kg{-1} day{-1}, [0.643, 0.656] g kg{-1} day{-1}, [1.46, 1.60] g
kg{-1} day{-1}, 13.3 g kg{-1} day{-1}), 0.8, fivenumbers(0 g kg{-1} day{-1},
[0.255,0.522] g kg{-1} day{-1}, [0.558, 1.13] g kg{-1} day{-1}, [1.26, 2.38] g
kg{-1} day{-1}, 20.6 g kg{-1} day{-1}))
// adult farmer
   CR.adult.farmer.expveg= mixture(0.2,fivenumbers(0 g kg{-1} day{-1},
[0.304,0.312] g kg{-1} day{-1}, [0.643, 0.656] g kg{-1} day{-1}, [1.46, 1.60] g
kg{-1} day{-1}, 13.3 g kg{-1} day{-1}), 0.8, fivenumbers(0 g kg{-1} day{-1},
[0.255,0.522] g kg{-1} day{-1}, [0.558, 1.13] g kg{-1} day{-1}, [1.26, 2.38] g
kg{-1} day{-1}, 20.6 g kg{-1} day{-1}))
// child
   CR.child.expveg=fivenumbers(0 g kg{-1} day{-1}, [0.579,1.20] g kg{-1} day{-
1}, [1.16, 1.89] g kg{-1} day{-1}, [2.53, 4.23] g kg{-1} day{-1}, 12.1 g kg{-1}
day{-1})
// cancer
   CR.resident.expveg=mixture(0.91,CR.adult.resident.expveg,
0.09,CR.child.expveg)
   CR.farmer.expveg=mixture(0.91,CR.adult.farmer.expveg, 0.09,CR.child.expveg)

// exposed fruit
// adult resident
   CR.adult.resident.fruit=mixture(0.2, fivenumbers(0 g kg{-1} day{-1},
[0.404,0.619] g kg{-1} day{-1}, [0.609, 1.11] g kg{-1} day{-1}, [2.27, 2.91] g
kg{-1} day{-1}, 15.9 g kg{-1} day{-1}), 0.8, fivenumbers(0 g kg{-1} day{-1},
[0.304,0.571] g kg{-1} day{-1}, [0.615, 0.957] g kg{-1} day{-1}, [1.07, 1.66] g
kg{-1} day{-1}, 13.0 g kg{-1} day{-1}))
// adult farmer
   CR.adult.farmer.fruit=mixture(0.2, fivenumbers(0 g kg{-1} day{-1},
[0.404,0.619] g kg{-1} day{-1}, [0.609, 1.11] g kg{-1} day{-1}, [2.27, 2.91] g
kg{-1} day{-1}, 15.9 g kg{-1} day{-1}), 0.8, fivenumbers(0 g kg{-1} day{-1},
[0.304,0.571] g kg{-1} day{-1}, [0.615, 0.957] g kg{-1} day{-1}, [1.07, 1.66] g
kg{-1} day{-1}, 13.0 g kg{-1} day{-1}))
// child [There was no home produced data and no per capita data available to
extrapolate a consumption rate for the 1-2 age group, therefore, the CR for the
1-2 age group was extrapolated based on the relative body weight of 3-5 and 1-2
year olds. Note: Max of 48.8 is for 1-2 year old.]
   CR.child.fruit=fivenumbers(0 g kg{-1} day{-1}, [1.00,1.50] g kg{-1} day{-1},
[1.82,2.73] g kg{-1} day{-1}, [2.64, 3.96] g kg{-1} day{-1}, 48.8 g kg{-1} day{-
1})
//cancer
   CR.resident.fruit=mixture(0.91,CR.adult.resident.fruit, 0.09,CR.child.fruit)
   CR.farmer.fruit=mixture(0.91,CR.adult.farmer.fruit, 0.09,CR.child.fruit)
```

```
// root vegetables
// adult resident
   CR.adult.resident.rtveg=mixture(0.2, fivenumbers(0 g kg{-1} day{-1}, 
[0.232,0.269] g kg{-1} day{-1}, [0.523, 0.565] g kg{-1} day{-1}, [1.37, 1.63] g 
kg{-1} day{-1}, 7.47 g kg{-1} day{-1}), 0.8, fivenumbers(0 g kg{-1} day{-1}, 
[0.200,0.376] g kg{-1} day{-1}, [0.564, 0.851] g kg{-1} day{-1}, [1.24, 1.71] g 
kg{-1} day{-1}, 12.8 g kg{-1} day{-1}))
// adult farmer
   CR.adult.farmer.rtveg= mixture(0.2, fivenumbers(0 g kg{-1} day{-1}, 
[0.232,0.269] g kg{-1} day{-1}, [0.523, 0.565] g kg{-1} day{-1}, [1.37, 1.63] g 
kg{-1} day{-1}, 7.47 g kg{-1} day{-1}), 0.8, fivenumbers(0 g kg{-1} day{-1}, 
[0.200,0.376] g kg{-1} day{-1}, [0.564, 0.851] g kg{-1} day{-1}, [1.24, 1.71] g 
kg{-1} day{-1}, 12.8 g kg{-1} day{-1}))
// child
   CR.child.rtveg=fivenumbers(0 g kg{-1} day{-1}, [0.225,0.359] g kg{-1} day{-
1}, [0.462, 0.920] g kg{-1} day{-1}, [1.68, 3.67] g kg{-1} day{-1}, 10.4 g kg{-
1} day{-1})
//cancer
   CR.resident.rtveg=mixture(0.91,CR.adult.resident.rtveg, 0.09,CR.child.rtveg)
   CR.farmer.rtveg=mixture(0.91,CR.adult.farmer.rtveg, 0.09,CR.child.rtveg)

// Fraction ingested from the floodplain (unitless) [The fact that agriculture 
areas might not all be located entirely within the floodplain is addressed with 
FS, which represents different assumed fractions within the floodplain]

// dairy-milk
   FI.dairy=1
// beef
   FI.beef=1
// poultry meat
   FI.poultry.meat=1
// poultry egg
   FI.poultry.egg=1
// garden produce
   FI.garden=1

// Exposure Frequency [consumption rates are annualized; therefore, EF equal 365 
day per year minus 2-week vacation]

// child
   EF.child=350 day year{-1}
// adult resident
   EF.adult.resident=350 day year{-1}
// adult farmer
   EF.adult.farmer=350 day year{-1}

// Exposure Duration

//calculate confidence intervals around mean and std dev for p-box
// xbar is average from MADPH, 2001
xbar=14.75
//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=14.75
```

```
//s2 = ss^2 i.e. the variance
s2= (14.75) * (14.75)
n=1882
// 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))
// calculate confidence intervals around variance(Sokal and Rolf, Section 7.7)
slcl=14.3
sucl=15.2

// exposure duration for resident or farmer cancer risk
   ED.cancer=mmms(1 year, 70 year, [xlcl,xucl] year, [slcl,sucl] year)

// Body Weight (not needed; all food consumption rates are normalized to body
weight of interviewees)

// Averaging Time, Cancer
   ATc=25550 day
// conversion factor, years to days for non-cancer equations
   ATcf=365 day year {-1}

// Toxicity Information
   CSF.PCB=2 mg{-1} kg day
   RfD.PCB=0.00002 mg kg{-1} day{-1}

// RISK CALCULATION

_for j:=1 to 4 do begin // Fraction of Pasture, Cornfield, Hayfield, or Garden
on the Site (unitless)
_for i:=1 to 4 do begin // Total PCB Concentration Pasture, Cornfield, Hayfield,
or Garden (mg/kg, dw)

// Animal product concentrations

// cow and poultry intake equations [reflects time on pasture given regional
climate and farming practices]

// cow intake [assumes dependence among intake items]
   Intake.cow= (EPC.pasture.soil.PCB.i |*| FS.pasture.j |*| ((BA.soil.PCB |*|
D.soil) + (TF.grass.PCB |*| D.grass))) + (EPC.cornfield.soil.PCB.i |*|
FS.cornfield.j |*| TF.cornsilage.PCB |*| D.cornsilage) +
(EPC.hayfield.soil.PCB.i |*| FS.hayfield.j |*| TF.hay.PCB |*| D.hay) +
(EPC.grainfield.soil.PCB.i |*| FS.grainfield.j |*| TF.concentrate.PCB |*|
D.concentrate)
// poultry intake (assumes dependence among intake items)
   Intake.poultry= (EPC.pasture.soil.PCB.i |*| FS.pasture.j |*| ((BA.soil.PCB
|*| D.soil) + (TF.grass.PCB |*| D.grass))) + (EPC.grainfield.soil.PCB.i |*|
FS.grainfield.j |*| TF.concentrate.PCB |*| D.concentrate)

// food concentration: dairy
   Cfood.dairy.i.j= BCF.mammal.PCB |*| F.dairy.jersey |*| Intake.cow
// food concentration: beef
   Cfood.beef.i.j= BCF.mammal.PCB |*| F.beef |*| Intake.cow
// food concentration: poultry meat
   Cfood.poultry.meat.i.j= BCF.poultry.meat.PCB |*| F.poultry.meat |*|
Intake.poultry
```

```
// food concentration: poultry egg
   Cfood.poultry.egg.i.j= BCF.poultry.egg.PCB |*| Intake.poultry

// dairy-milk
// child non-cancer
   ADD.child.dairy=Cfood.dairy.i.j |*| CR.child.dairy |*| UCF |*| ABS.dairy |*|
FI.dairy |*|((1 |-| PCL.dairy) * (1 |-| CL.dairy))|*| EF.child
   HI.dairy.child.i.j= (ADD.child.dairy |/| ATcf) |/| RfD.PCB
 // adult resident non-cancer
   ADD.adult.resident.dairy=Sbkyd |*| Cfood.dairy.i.j |*|
CR.adult.resident.dairy |*| UCF |*| ABS.dairy |*| FI.dairy |*|((1 |-| PCL.dairy)
* (1 |-| CL.dairy))|*| EF.adult.resident
   HI.dairy.adult.resident.i.j= (ADD.adult.resident.dairy |/| ATcf) |/| RfD.PCB
// adult farmer non-cancer
   ADD.adult.farmer.dairy=Scomm |*| Cfood.dairy.i.j |*| CR.adult.farmer.dairy
|*| UCF |*| ABS.dairy |*| FI.dairy |*|((1 |-| PCL.dairy) * (1 |-| CL.dairy))|*|
EF.adult.farmer
   HI.dairy.adult.farmer.i.j= (ADD.adult.farmer.dairy |/| ATcf) |/| RfD.PCB
// child and adult resident combined cancer risk
   ADD.resident.dairy=Sbkyd |*| Cfood.dairy.i.j |*| UCF |*| ABS.dairy |*|
FI.dairy |*|((1 |-| PCL.dairy) * (1 |-| CL.dairy))|*| EF.adult.resident |*|
(CR.resident.dairy * ED.cancer)
   CancerRisk.dairy.resident.i.j= (ADD.resident.dairy |/| ATc)|*| CSF.PCB
// child and adult farmer combined cancer risk
   ADD.farmer.dairy=Scomm |*| Cfood.dairy.i.j |*| UCF |*| ABS.dairy |*| FI.dairy
|*|((1 |-| PCL.dairy) * (1 |-| CL.dairy))|*| EF.adult.farmer |*|
(CR.farmer.dairy * ED.cancer)
   CancerRisk.dairy.farmer.i.j= (ADD.farmer.dairy |/| ATc)|*| CSF.PCB

// beef
// child non-cancer
   ADD.child.beef=Cfood.beef.i.j |*| CR.child.beef |*| UCF |*| ABS.beef |*|
FI.beef |*| ((1 |-| PCL.beef) * (1 |-| CL.beef)) |*| EF.child
   HI.beef.child.i.j= (ADD.child.beef |/| ATcf) |/| RfD.PCB
// adult resident non-cancer
   ADD.adult.resident.beef=Sbkyd |*| Cfood.beef.i.j |*| CR.adult.resident.beef
|*| UCF |*| ABS.beef |*| FI.beef |*| ((1 |-| PCL.beef) * (1 |-| CL.beef)) |*|
EF.adult.resident
   HI.beef.adult.resident.i.j= (ADD.adult.resident.beef |/| ATcf) |/| RfD.PCB
// adult farmer non-cancer
   ADD.adult.farmer.beef=Scomm |*| Cfood.beef.i.j |*| CR.adult.farmer.beef |*|
UCF |*| ABS.beef |*| FI.beef |*| ((1 |-| PCL.beef) * (1 |-| CL.beef)) |*|
EF.adult.farmer
   HI.beef.adult.farmer.i.j= (ADD.adult.farmer.beef |/| ATcf) |/| RfD.PCB
// child and adult resident combined cancer risk
   ADD.resident.beef=Sbkyd |*| Cfood.beef.i.j |*| UCF |*| ABS.beef |*| FI.beef
|*| ((1 |-| PCL.beef) * (1 |-| CL.beef)) |*| EF.adult.resident |*|
(CR.resident.beef * ED.cancer)
   CancerRisk.beef.resident.i.j= (ADD.resident.beef |/| ATc)|*| CSF.PCB
// child and adult farmer combined cancer risk
   ADD.farmer.beef=Scomm |*| Cfood.beef.i.j |*| UCF |*| ABS.beef |*| FI.beef |*|
((1 |-| PCL.beef) * (1 |-| CL.beef)) |*| EF.adult.farmer |*| (CR.farmer.beef *
ED.cancer)
   CancerRisk.beef.farmer.i.j= (ADD.farmer.beef |/| ATc)|*| CSF.PCB

// poultry meat
// child non-cancer
```

```
   ADD.child.poultry.meat=Cfood.poultry.meat.i.j |*| CR.child.poultry.meat |*|
UCF |*| ABS.poultry.meat |*| FI.poultry.meat |*| ((1 |-| PCL.poultry.meat) * (1
|-| CL.poultry.meat))|*| EF.child
   HI.poultry.meat.child.i.j= (ADD.child.poultry.meat |/| ATcf) |/| RfD.PCB
// adult resident non-cancer
   ADD.adult.resident.poultry.meat=Sbkyd |*| Cfood.poultry.meat.i.j |*|
CR.adult.resident.poultry.meat |*| UCF |*| ABS.poultry.meat |*| FI.poultry.meat
|*| ((1 |-| PCL.poultry.meat) * (1 |-| CL.poultry.meat))|*| EF.adult.resident
   HI.poultry.meat.adult.resident.i.j= (ADD.adult.resident.poultry.meat |/|
ATcf) |/| RfD.PCB
// adult farmer non-cancer
   ADD.adult.farmer.poultry.meat=Scomm |*| Cfood.poultry.meat.i.j |*|
CR.adult.farmer.poultry.meat |*| UCF |*| ABS.poultry.meat |*| FI.poultry.meat
|*| ((1 |-| PCL.poultry.meat) * (1 |-| CL.poultry.meat))|*| EF.adult.farmer
   HI.poultry.meat.adult.farmer.i.j= (ADD.adult.farmer.poultry.meat |/| ATcf)
|/| RfD.PCB
// child and adult resident combined cancer risk
   ADD.resident.poultry.meat=Sbkyd |*| Cfood.poultry.meat.i.j |*| UCF |*|
ABS.poultry.meat |*| FI.poultry.meat |*| ((1 |-| PCL.poultry.meat) * (1 |-|
CL.poultry.meat))|*| EF.adult.resident |*| (CR.resident.poultry.meat *
ED.cancer)
   CancerRisk.poultry.meat.resident.i.j= (ADD.resident.poultry.meat |/| ATc)|*|
CSF.PCB
// child and adult farmer combined cancer risk
   ADD.farmer.poultry.meat=Scomm |*| Cfood.poultry.meat.i.j |*| UCF |*|
ABS.poultry.meat |*| FI.poultry.meat |*| ((1 |-| PCL.poultry.meat) * (1 |-|
CL.poultry.meat))|*| EF.adult.farmer |*| (CR.farmer.poultry.meat * ED.cancer)
   CancerRisk.poultry.meat.farmer.i.j= (ADD.farmer.poultry.meat |/| ATc)|*|
CSF.PCB

// poultry egg
// child non-cancer
   ADD.child.poultry.egg=Cfood.poultry.egg.i.j |*| CR.child.poultry.egg |*| UCF
|*| ABS.poultry.egg |*| FI.poultry.egg |*| ((1 |-| PCL.poultry.egg) * (1 |-|
CL.poultry.egg))|*| EF.child
   HI.poultry.egg.child.i.j= (ADD.child.poultry.egg |/| ATcf) |/| RfD.PCB
// adult resident non-cancer
   ADD.adult.resident.poultry.egg=Sbkyd |*| Cfood.poultry.egg.i.j |*|
CR.adult.resident.poultry.egg |*| UCF |*| ABS.poultry.egg |*| FI.poultry.egg |*|
((1 |-| PCL.poultry.egg) * (1 |-| CL.poultry.egg))|*| EF.adult.resident
   HI.poultry.egg.adult.resident.i.j= (ADD.adult.resident.poultry.egg |/| ATcf)
|/| RfD.PCB
// adult farmer non-cancer
   ADD.adult.farmer.poultry.egg=Scomm |*| Cfood.poultry.egg.i.j |*|
CR.adult.farmer.poultry.egg |*| UCF |*| ABS.poultry.egg |*| FI.poultry.egg |*|
((1 |-| PCL.poultry.egg) * (1 |-| CL.poultry.egg))|*| EF.adult.farmer
   HI.poultry.egg.adult.farmer.i.j= (ADD.adult.farmer.poultry.egg |/| ATcf) |/|
RfD.PCB
// child and adult resident combined cancer risk
   ADD.resident.poultry.egg=Sbkyd |*| Cfood.poultry.egg.i.j |*| UCF |*|
ABS.poultry.egg |*| FI.poultry.egg |*| ((1 |-| PCL.poultry.egg) * (1 |-|
CL.poultry.egg))|*| EF.adult.resident |*| (CR.resident.poultry.egg * ED.cancer)
   CancerRisk.poultry.egg.resident.i.j= (ADD.resident.poultry.egg |/| ATc)|*|
CSF.PCB
// child and adult farmer combined cancer risk
```

```
   ADD.farmer.poultry.egg=Scomm |*| Cfood.poultry.egg.i.j |*| UCF |*|
ABS.poultry.egg |*| FI.poultry.egg |*| ((1 |-| PCL.poultry.egg) * (1 |-|
CL.poultry.egg))|*| EF.adult.farmer |*| (CR.farmer.poultry.egg * ED.cancer)
   CancerRisk.poultry.egg.farmer.i.j= (ADD.farmer.poultry.egg |/| ATc)|*|
CSF.PCB

// garden produce (sum of exposed vegetables, root vegetables, exposed fruit)
// reduced version of intermediate calculations not including repeated
parameters
// take out EPC.garden.soil.PCB.i |*| FS.garden.j from Cfood
//exposed vegetables
   Cfood.garden.expveg.i.j= TF.expveg.PCB
// root vegetables
   Cfood.garden.rtveg.i.j= TF.rtveg.PCB
// fruits
   Cfood.garden.fruit.i.j= TF.fruit.PCB
// take out repeated use of UCF |*| ABS.garden |*| FI.garden |*| EF.child from
ADD
// child non-cancer
   ADD.child.expveg =Cfood.garden.expveg.i.j |*| CR.child.expveg |*| ((1 |-|
PCL.expveg) * (1 |-| CL.expveg))
   ADD.child.rtveg =Cfood.garden.rtveg.i.j |*| CR.child.rtveg |*| ((1 |-|
PCL.rtveg) * (1 |-| CL.rtveg))
   ADD.child.fruit =Cfood.garden.fruit.i.j |*| CR.child.fruit |*| ((1 |-|
PCL.fruit) * (1 |-| CL.fruit))
   HI.garden.child.i.j = EPC.garden.soil.PCB.i |*| FS.garden.j |*| UCF |*|
ABS.garden |*| FI.garden |*| EF.child |*| (((ADD.child.expveg + ADD.child.rtveg)
* AF.veg) + (ADD.child.fruit * AF.fruit)) |/| ATcf |/| RfD.PCB
//adult resident non-cancer
   ADD.adult.resident.expveg =Cfood.garden.expveg.i.j |*|
CR.adult.resident.expveg |*| ((1 |-| PCL.expveg) * (1 |-| CL.expveg))
   ADD.adult.resident.rtveg =Cfood.garden.rtveg.i.j |*| CR.adult.resident.rtveg
|*| ((1 |-| PCL.rtveg) * (1 |-| CL.rtveg))
   ADD.adult.resident.fruit =Cfood.garden.fruit.i.j |*| CR.adult.resident.fruit
|*| ((1 |-| PCL.fruit) * (1 |-| CL.fruit))
   HI.garden.adult.resident.i.j = Sbkyd |*| EPC.garden.soil.PCB.i |*|
FS.garden.j |*| UCF |*| ABS.garden |*| FI.garden |*| EF.adult.resident |*|
(((ADD.adult.resident.expveg + ADD.adult.resident.rtveg) * AF.veg) +
(ADD.adult.resident.fruit * AF.fruit)) |/| ATcf |/| RfD.PCB
// adult farmer non-cancer
   ADD.adult.farmer.expveg =Cfood.garden.expveg.i.j |*| CR.adult.farmer.expveg
|*| ((1 |-| PCL.expveg) * (1 |-| CL.expveg))
   ADD.adult.farmer.rtveg =Cfood.garden.rtveg.i.j |*| CR.adult.farmer.rtveg |*|
((1 |-| PCL.rtveg) * (1 |-| CL.rtveg))
   ADD.adult.farmer.fruit =Cfood.garden.fruit.i.j |*| CR.adult.farmer.fruit |*|
((1 |-| PCL.fruit) * (1 |-| CL.fruit))
   HI.garden.adult.farmer.i.j = Scomm |*|  EPC.garden.soil.PCB.i |*| FS.garden.j
|*| UCF |*| ABS.garden |*| FI.garden |*| EF.adult.farmer |*|
(((ADD.adult.farmer.expveg + ADD.adult.farmer.rtveg) * AF.veg) +
(ADD.adult.farmer.fruit * AF.fruit)) |/| ATcf |/| RfD.PCB
// child and adult resident combined cancer risk
   ADD.resident.expveg= Cfood.garden.expveg.i.j |*| CR.resident.expveg |*|((1 |-
| PCL.expveg) * (1 |-| CL.expveg))
   ADD.resident.rtveg= Cfood.garden.rtveg.i.j |*| CR.resident.rtveg |*| ((1 |-|
PCL.rtveg) * (1 |-| CL.rtveg))
   ADD.resident.fruit= Cfood.garden.fruit.i.j |*| CR.resident.fruit |*| ((1 |-|
PCL.fruit) * (1 |-| CL.fruit))
```

```
   CancerRisk.garden.resident.i.j =Sbkyd |*| EPC.garden.soil.PCB.i |*|
FS.garden.j |*| UCF |*| ABS.garden |*| FI.garden |*| EF.adult.resident |*|
(ED.cancer * (((ADD.resident.expveg + ADD.resident.rtveg) * AF.veg) +
(ADD.resident.fruit * AF.fruit))) |/| ATc |*| CSF.PCB
// child and adult farmer combined cancer risk
   ADD.farmer.expveg= Cfood.garden.expveg.i.j |*| CR.farmer.expveg |*| ((1 |-|
PCL.expveg) * (1 |-| CL.expveg))
   ADD.farmer.rtveg= Cfood.garden.rtveg.i.j |*| CR.farmer.rtveg |*| ((1 |-|
PCL.rtveg) * (1 |-| CL.rtveg))
   ADD.farmer.fruit= Cfood.garden.fruit.i.j |*| CR.farmer.fruit |*| ((1 |-|
PCL.fruit) * (1 |-| CL.fruit))
   CancerRisk.garden.farmer.i.j=Scomm |*| EPC.garden.soil.PCB.i |*| FS.garden.j
|*| UCF |*| ABS.garden |*| FI.garden |*| EF.adult.farmer |*| (ED.cancer *
(((ADD.farmer.expveg + ADD.farmer.rtveg) * AF.veg) + (ADD.farmer.fruit *
AF.fruit))) |/| ATc |*| CSF.PCB

// SENSITIVITY ANALYSIS [Edit variable names when run different scenarios]
HI.dairy.child.area.i.j= breadth(HI.dairy.child.i.j)
HI.dairy.adult.resident.area.i.j=breadth(HI.dairy.adult.resident.i.j)
HI.dairy.adult.farmer.area.i.j=breadth(HI.dairy.adult.farmer.i.j)
CancerRisk.dairy.resident.area.i.j=breadth(CancerRisk.dairy.resident.i.j)
CancerRisk.dairy.farmer.area.i.j=breadth(CancerRisk.dairy.farmer.i.j)

_end
_end

// print tables [Edit variable names when run different scenarios]

_print "HI.dairy.child,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," HI.dairy.child.1.j "," HI.dairy.child.2.j ","
HI.dairy.child.3.j "," HI.dairy.child.4.j ","
_end

_print "HI.dairy.adult.resident,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," HI.dairy.adult.resident.1.j ","
HI.dairy.adult.resident.2.j "," HI.dairy.adult.resident.3.j ","
HI.dairy.adult.resident.4.j ","
_end

_print "Cancer Risk.dairy.resident,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," CancerRisk.dairy.resident.1.j ","
CancerRisk.dairy.resident.2.j "," CancerRisk.dairy.resident.3.j ","
CancerRisk.dairy.resident.4.j ","
_end
```

```
_print "HI.dairy.adult.farmer,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," HI.dairy.adult.farmer.1.j ","
HI.dairy.adult.farmer.2.j "," HI.dairy.adult.farmer.3.j ","
HI.dairy.adult.farmer.4.j ","
_end

_print "Cancer Risk.dairy.farmer,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," CancerRisk.dairy.farmer.1.j ","
CancerRisk.dairy.farmer.2.j "," CancerRisk.dairy.farmer.3.j ","
CancerRisk.dairy.farmer.4.j ","
_end

_print "Child HI P-Bounds Area,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," HI.dairy.child.area.1.j "," HI.dairy.child.area.2.j
"," HI.dairy.child.area.3.j "," HI.dairy.child.area.4.j ","
_end

_print "Adult Resident HI P-Bounds Area,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," HI.dairy.adult.resident.area.1.j ","
HI.dairy.adult.resident.area.2.j "," HI.dairy.adult.resident.area.3.j ","
HI.dairy.adult.resident.area.4.j ","
_end

_print "Cancer Risk Resident P-Bounds Area,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," CancerRisk.dairy.resident.area.1.j ","
CancerRisk.dairy.resident.area.2.j "," CancerRisk.dairy.resident.area.3.j ","
CancerRisk.dairy.resident.area.4.j ","
_end

_print "Adult Farmer HI P-Bounds Area,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," HI.dairy.adult.farmer.area.1.j ","
HI.dairy.adult.farmer.area.2.j "," HI.dairy.adult.farmer.area.3.j ","
HI.dairy.adult.farmer.area.4.j ","
```

```
_end

_print "Cancer Risk Farmer P-Bounds Area,,,,"
_print "area\conc,"  EPC.cornfield.soil.PCB.1 "," EPC.cornfield.soil.PCB.2 ","
EPC.cornfield.soil.PCB.3 "," EPC.cornfield.soil.PCB.4 ","

_for j:=1 to 4 do begin
_print FS.cornfield.j "," CancerRisk.dairy.farmer.area.1.j ","
CancerRisk.dairy.farmer.area.2.j "," CancerRisk.dairy.farmer.area.3.j ","
CancerRisk.dairy.farmer.area.4.j ","
_end
```

ADDENDUM 6.1

PROBABILISTIC RISK CHARACTERIZATION OF PCB CONGENER 126 FOR THE COMMERCIAL DAIRY SCENARIO

ADDENDUM 6.1

PROBABILISTIC RISK CHARACTERIZATION OF PCB CONGENER 126 FOR THE COMMERCIAL DAIRY SCENARIO

This attachment provides a probabilistic risk assessment for PCB congener 126 (PCB-126) because it is the dioxin-like congener that dominates toxic equivalence (TEQ) cancer risk estimates presented in Section 7.2.4.1. The commercial dairy scenario was selected to illustrate uncertainty and variability in risk estimates for PCB-126 because it is the most prevalent among current commercial agricultural activities in the Housatonic River floodplain. This attachment does not provide an exhaustive treatment of uncertainty and variability in risk estimates for all dioxin-like congeners in all agricultural scenarios. Instead, it focuses on the most important congener combined with the most common current agricultural scenario that involves bioaccumulation in an animal product food chain.

DERIVING THE INPUTS

Most inputs for the Monte Carlo analysis analog (MCA analog) and probability bounds analysis (PBA) are not chemical-specific and did not need to be modified from the values used in the assessment of total PCBs (tPCBs) (See Section 6). This section includes a description of those inputs that are specific to PCB-126:

1. Mammalian bioconcentration factor (BCF); and

2. Soil-to-corn silage transfer factor (TF) specific

3. Predicted exposure point concentration (EPC) for PCB-126 in floodplain soil.

Mammalian Bioconcentration Factor (BCF)

In the MCA analog, the mammalian BCF for PCB-126 is 11.5, which represents the maximum theoretical value that was predicted using the method described in Section 4.4.2.2.2 based on Thomas et al. (1999). Insufficient data are available to describe variability in this BCF. In the PBA, the mammalian BCF for PCB-126 is defined by the range of likely values, from 6.2 to

11.5. The value 6.2 is derived from Tuinstra et al. (1981) and represents the BCF for PCB-128 (See Table 4-8b). It is the highest BCF for an individual non-dioxin-like congener that is not metabolized and has a chlorination level similar to PCB-126 (hexachlorobiphenyl versus pentachlorobiphenyl). The BCF for PCB-126 is unlikely to be lower than this value. Use of these data was judged to be a more reliable method for estimating uncertainty compared with estimating uncertainty in the equation used to predict the theoretical maximum BCF (See Section 4.4.2.2.2).

Soil-to-Corn Silage Transfer Factor (TF)

Site-specific grass samples were analyzed for PCB-126 but site-specific corn samples were not. Therefore, a soil-to-corn silage transfer factor (TF) for PCB-126 was extrapolated for use in the point estimate risk assessment (Section 5) by assuming the ratio between the soil-to-corn silage and soil-to-grass TFs for PCB-126 is the same as the ratio for tPCB, which was analyzed in all grass and corn samples. In the MCA analog, a point estimate soil-to-corn silage transfer factor used was used (0.0082) because insufficient data are available to quantify variability in the PCB-126 with any confidence. In the PBA, the soil-to-corn silage transfer factor was specified as an interval (0.0014, 0.27). The minimum and maximum values for the interval were calculated as follows:

Minimum PCB-126 soil-to-corn silage TF = minimum PCB-126 soil-to-grass TF * (min tPCB soil-to-corn silage TF/max tPCB soil-to-grass TF)

Maximum PCB-126 soil-to-corn silage TF = maximum PCB-126 soil-to-grass TF * (max tPCB soil-to-corn silage TF/min tPCB soil-to-grass TF)

All corn, soil, and grass data are provided in Tables 2-6 (corn and soil), 2-10a (grass), and 2-10b (soil from grass study). The upper end of the interval is similar to the soil-to-grass TF used for PCB-126 in the point estimate risk assessment (0.25).

Incorporating Uncertainty Associated with Soil EPC Regression Model

Cancer risk and noncancer hazard estimates were calculated for different combinations of two agricultural model inputs: (1) tPCB EPC in floodplain soil on current or possible future agricultural land, and (2) fraction of cultivated land or pasture that is in the floodplain. However, to calculate risk and hazard from PCB-126, soil EPCs for PCB-126 were predicted based on a regression model (See Table 4-2), which has uncertainty associated with it.

The PCB-126 regression model has the form:

(1) $\ln(C_{Congener}) = \beta_0 + \beta_1 \ln(C_{TotalPCB})$

The following equation is used to obtain confidence limits (CLs) on mean predictions from this regression model:

(2)
$$CL_{1-\alpha}(\ln(C_{Congener})) = \beta_0 + \beta_1 \ln(C_{TotalPCB}) \pm t(1-\alpha, n-2) \cdot \sqrt{\frac{\sigma^2}{n} + \sigma^2(\beta_1)[\ln(C_{TotalPCB}) - Average(\ln(C_{TotalPCB}))]^2}$$

This equation provides CLs on the mean prediction instead of the prediction of a single, future measurement because the exposure point concentration (EPC) being estimated represents the exposure of an individual who effectively averages site concentrations over space and time (i.e., the exposure duration).

Equation (2) permits simulation of a random congener concentration $C_{Congener}$ while accounting for regression uncertainties with the expression:

(3)
$$C_{Congener} = \exp\{\beta_0 + \beta_1 \ln(C_{TotalPCB}) + t_{n-2} \cdot \sqrt{\frac{\sigma^2}{n} + \sigma^2(\beta_1)[\ln(C_{TotalPCB}) - Average(\ln(C_{TotalPCB}))]^2}\}$$

where the random value t has a Student's t-distribution with n-2 degrees of freedom.

All values in equation 3 were calculated using raw data for tPCB and congener concentrations, and prediction intervals were incorporated into the PBA.

RESULTS

Cancer risk results are summarized in Table 1, assuming a tPCB floodplain EPC of 2 mg/kg and all agricultural activities occur in the floodplain (fraction =1), and the risk distribution is presented in Figure 1. The RME, or highest exposure reasonably likely to occur (EPA, 1989), is generally between the 90th and 99.9th percentile of the probabilistic risk distribution. Three percentiles, 90th, 95th, and 99th, in this RME range are presented in Table 1.

Table 1

Cancer Risk Summary for Commercial Dairy—PCB 126

P-BOUNDS

Total PCB Concentration in Cornfield (mg/kg dw)	Fraction of Cornfield on the Site	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	[0E+00 4E-04]	[2E-09, 8E-04]	[6E-09, 1E-03]	[1E-08, 2E-03]	[1E-08, 3E-03]	[2E-08, 6E-03]
0.5	0.50	[0E+00 8E-04]	[4E-09, 2E-03]	[1E-08, 3E-03]	[2E-08, 5E-03]	[3E-08, 7E-03]	[4E-08, 1E-02]
0.5	0.75	[0E+00 1E-03]	[6E-09, 2E-03]	[2E-08, 4E-03]	[3E-08, 7E-03]	[4E-08, 1E-02]	[7E-08, 2E-02]
0.5	1.0	[0E+00 2E-03]	[8E-09, 3E-03]	[2E-08, 6E-03]	[4E-08, 1E-02]	[5E-08, 1E-02]	[9E-08, 2E-02]
2	0.25	[0E+00 1E-03]	[6E-09, 2E-03]	[2E-08, 4E-03]	[2E-08, 6E-03]	[3E-08, 8E-03]	[6E-08, 1E-02]
2	0.50	[0E+00 2E-03]	[1E-08, 4E-03]	[3E-08, 8E-03]	[5E-08, 1E-02]	[7E-08, 2E-02]	[1E-07, 3E-02]
2	0.75	[0E+00 3E-03]	[2E-08, 6E-03]	[5E-08, 1E-02]	[7E-08, 2E-02]	[1E-07, 3E-02]	[2E-07, 4E-02]
2	1.0	[0E+00 4E-03]	[2E-08, 8E-03]	[6E-08, 2E-02]	[1E-07, 3E-02]	[1E-07, 3E-02]	[2E-07, 5E-02]
10	0.25	[0E+00 3E-03]	[2E-08, 7E-03]	[5E-08, 1E-02]	[8E-08, 2E-02]	[1E-07, 3E-02]	[2E-07, 4E-02]
10	0.50	[0E+00 7E-03]	[4E-08, 1E-02]	[1E-07, 2E-02]	[2E-07, 4E-02]	[2E-07, 5E-02]	[4E-07, 8E-02]
10	0.75	[0E+00 1E-02]	[5E-08, 2E-02]	[1E-07, 4E-02]	[2E-07, 6E-02]	[3E-07, 8E-02]	[5E-07, 1E-01]
10	1.0	[0E+00 1E-02]	[7E-08, 3E-02]	[2E-07, 5E-02]	[3E-07, 8E-02]	[4E-07, 1E-01]	[7E-07, 2E-01]
25	0.25	[0E+00 6E-03]	[3E-08, 1E-02]	[9E-08, 2E-02]	[2E-07, 4E-02]	[2E-07, 5E-02]	[4E-07, 8E-02]
25	0.50	[0E+00 1E-02]	[7E-08, 3E-02]	[2E-07, 5E-02]	[3E-07, 8E-02]	[4E-07, 1E-01]	[7E-07, 2E-01]
25	0.75	[0E+00 2E-02]	[1E-07, 4E-02]	[3E-07, 7E-02]	[5E-07, 1E-01]	[6E-07, 2E-01]	[1E-06, 2E-01]
25	1.0	[0E+00 3E-02]	[1E-07, 5E-02]	[4E-07, 9E-02]	[6E-07, 2E-01]	[8E-07, 2E-01]	[1E-06, 3E-01]

MONTE CARLO ANALOG

Total PCB Concentration in Cornfield (mg/kg dw)	Fraction of Cornfield on the Site	Cancer risk percentiles					
					RME range		
		25%	50%	75%	90%	95%	99%
0.5	0.25	1.E-07	1.E-06	3.E-06	4.E-06	5.E-06	5.E-06
0.5	0.50	3.E-07	2.E-06	5.E-06	8.E-06	1.E-05	1.E-05
0.5	0.75	4.E-07	4.E-06	8.E-06	1.E-05	1.E-05	2.E-05
0.5	1.0	6.E-07	5.E-06	1.E-05	2.E-05	2.E-05	2.E-05
2	0.25	4.E-07	3.E-06	7.E-06	1.E-05	1.E-05	1.E-05
2	0.50	8.E-07	6.E-06	1.E-05	2.E-05	3.E-05	3.E-05
2	0.75	1.E-06	1.E-05	2.E-05	3.E-05	4.E-05	4.E-05
2	1.0	2.E-06	1.E-05	3.E-05	5.E-05	5.E-05	6.E-05
10	0.25	1.E-06	1.E-05	2.E-05	4.E-05	4.E-05	5.E-05
10	0.50	3.E-06	2.E-05	5.E-05	7.E-05	8.E-05	1.E-04
10	0.75	4.E-06	3.E-05	7.E-05	1.E-04	1.E-04	1.E-04
10	1.0	5.E-06	4.E-05	9.E-05	1.E-04	2.E-04	2.E-04
25	0.25	3.E-06	2.E-05	5.E-05	7.E-05	8.E-05	9.E-05
25	0.50	5.E-06	4.E-05	9.E-05	1.E-04	2.E-04	2.E-04
25	0.75	8.E-06	6.E-05	1.E-04	2.E-04	2.E-04	3.E-04
25	1.0	1.E-05	8.E-05	2.E-04	3.E-04	3.E-04	4.E-04

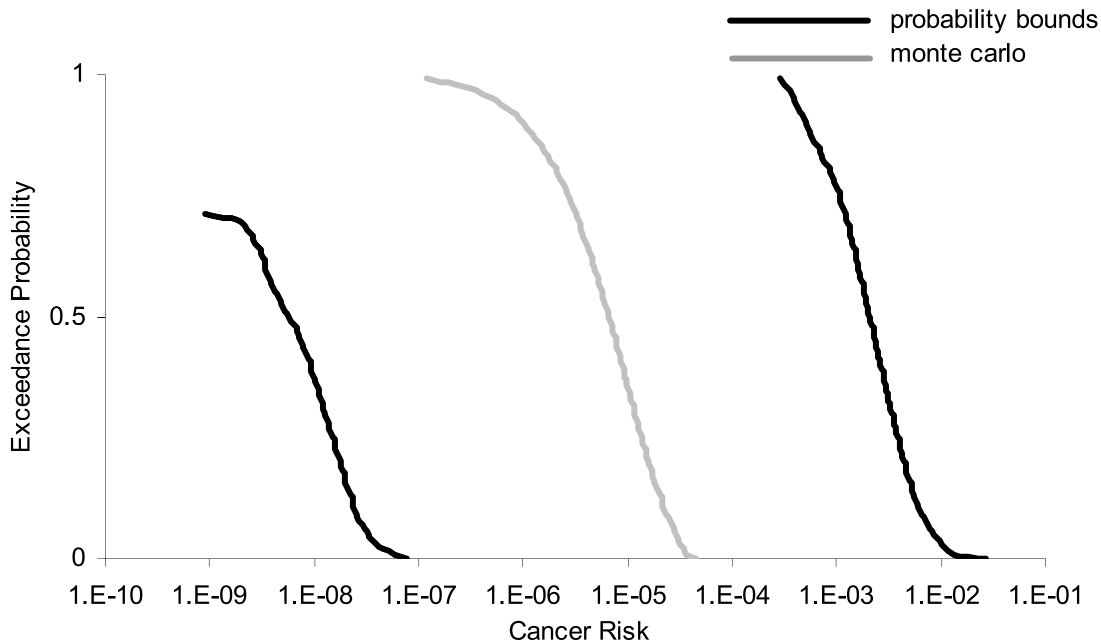

Figure 1 Cancer risk for PCB-126—Commercial Dairy Scenario (x-axis is in log-scale)

The RME and CTE cancer risk point estimates for PCB-126 are both higher than the 99th percentile MCA analog results. As shown in Figure 1, the p-boxes around the MCA analog results are wider than those for the tPCB analysis (see Figure 6-54), reflecting the increased uncertainty in cancer and noncancer hazard estimates.

REFERENCES

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Tuinstra, L.G.M.Th, K. Vreman, A.H. Roos, H.J. Keukens. 1981. Excretion of certain chlorobiphenyls into the milk fat after oral administration. *Neth. Milk Dairy J*. 35:147-157.

7. UNCERTAINTY ANALYSIS

7.1 INTRODUCTION

EPA guidance and policy (EPA, 1995) recommend that a thorough discussion of the variability and uncertainty surrounding the calculation of risk be provided 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).
- Monte Carlo analysis to characterize variability in risks, providing estimates of both a CTE and an RME range (i.e., 90^{th} to 99.9^{th} 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.

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 the risk manager 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 for quantifying the variability and uncertainty associated with the risk estimates. 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 semi-analytic 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 perspectives on the uncertainties associated with both the point estimate and probabilistic risk estimates. Section 7.2 provides a discussion of the uncertainties associated with the data underlying the parameters incorporated into the agricultural risk assessments. These uncertainties apply to both the point estimate and probabilistic risk assessment approaches because both approaches are based on the same data sets. Section 7.3 describes the treatment of uncertainties in the probabilistic analyses.

7.2 UNCERTAINTIES ASSOCIATED WITH SUPPORTING DATA

This section provides a qualitative, and in some cases semiquantitative, discussion of uncertainties associated with the data and assumptions that underlie hazard identification and the basis for the EPCs, exposure assessment, and dose response assessment.

7.2.1 Uncertainties Associated with the Hazard Identification

The hazard identification section of a risk assessment defines the conceptual model of current and potential future agricultural product and other food exposure pathways. The accuracy of this model depends on the relevance, comprehensiveness, and quality of data and information about conditions at the GE/Housatonic River Site.

For this risk assessment, current and potential future agricultural product and other food exposure pathways in the Housatonic River floodplain were considered. Site-specific data and information were used in this assessment when available. Multiple field visits were conducted to identify current agricultural activities in the Housatonic River floodplain. These field visits were supplemented with interviews with local farmers and USDA Farm Services Agency officials (Noble, personal communication, 2002; Williams, personal communication, 2002). Soil and plant samples were collected from currently cultivated areas. Use of such site-specific information was helpful in minimizing uncertainty in risk estimates. Uncertainties associated with these data are described in detail in Section 2 of this volume, and are addressed quantitatively in the probabilistic risk assessment (Section 6).

7.2.1.1 EPCs for tPCBs, Dioxin-Like PCBs, Dioxins, and Furans in Agricultural Soil

Total PCB exposure point concentrations (EPCs) were assumed (i.e., risks were determined for a number of discrete EPCs that represent the range of measured tPCB soil concentrations in the floodplain) rather than calculated from data because the exposure scenarios considered in this assessment were non-parcel-specific. All EPCs were assumed to be unchanged over the exposure duration considered for each scenario.

There were fewer PCB, dioxin, and furan congener data available for floodplain soil than for tPCBs. Therefore, regression analyses were performed relating tPCB concentrations (measured as Aroclors) to congener concentrations so that congener concentrations could be predicted for areas with Aroclor data but no congener data. The methods used to develop these regression models and uncertainties associated with their use are discussed in Attachment 2 of HHRA Volume I. The approach used to estimate dioxin-like PCBs, dioxins, and furans may overestimate or underestimate risk associated with congeners. Because of the uncertainty associated with predicting congener concentrations from tPCB concentrations, as well as uncertainties associated with some of the BCFs and TFs for congeners, TEQ cancer risk estimates are not included in the point estimate risk assessment. Instead, estimates of TEQ cancer risk are presented in Section 7.2.4.1. PCB-126 dominates TEQ risk estimates, and uncertainty associated with predicting PCB-126 concentrations in soil is quantified in Section 6.

7.2.2 Uncertainties Associated with Exposure Assessment

Exposure estimates were based on assumptions about the exposed population, including characteristics of the receptor group, the frequency and intensity of exposure, and the concentrations to which they may be exposed. These estimates also depended on predictions of PCB, dioxin, and furan concentrations in animal feed and human food products. Exposures are uncertain and variable because they are estimates of human activities that cannot be readily measured and that may vary. RME and CTE exposure estimates, along with a probabilistic risk assessment, were performed to address this uncertainty and variability.

7.2.2.1 Prediction of PCB, Dioxin, and Furan Concentrations in Animal Feed and Human Food Products

Most agricultural product concentrations were modeled rather than measured. Modeling of such EPCs introduces uncertainty into the analysis because models are based on assumptions about the behavior of a contaminant in the environment, site conditions that influence the fate and transport of contaminants, and the representativeness of the analytical data used in the models. These uncertainties were avoided to some extent by using available site-specific data and information about agricultural practices in the area.

Food concentration predictions accounted for cooking loss of COPCs, where appropriate. However, they did not account for any formation of furan congeners during the cooking process because such predictions would be highly uncertain.

7.2.2.1.1 Soil-to-Plant Transfer Factors (TFs)

Site-specific soil-to-plant transfer factor data were used in this assessment. TFs represent the ratio of PCB concentration in a plant to the concentration in soil. Use of such factors was based on the assumption of steady state. Recent investigations suggest that, at least for dioxins and furans, steady state between pasture grass and soil might be reached in as little as 2 weeks (Thomas et al., 2002).

Strong correlations between plant and soil concentrations were not observed in site-specific data. This could be due to several factors. For example, soil samples were collected from the immediate area where plants grew. However, plants could be affected by soil concentrations over a wider area, particularly in the case of grass, which was growing adjacent to the river channel where relatively large areas of bank soil and sediment can be exposed during periods of low flow. Therefore, the soil samples might only partially reflect the exposure of an individual plant. Also, both plants and soil might reflect varying amounts of regional background PCB concentrations in addition to site-related contamination. However, Aroclor patterns in grass were similar to Aroclor patterns in co-located soil samples, but with a shift toward less volatile congeners in grass compared with soil (see Aroclor results in Tables 2-10a and 2-10b). This pattern of a relatively low volatility congener mixture similar to co-located soil samples suggests dominance of the local source.

Despite the lack of strong correlations between plant and soil concentration data, the simple concentration ratio approach based on empirical plant-soil relationships was favored over more complex modeling. Such modeling is an active area of scientific research with much of the focus on air-to-leaf partitioning rather than soil-to-air-to-plant partitioning.

Soil-to-plant TFs have been reported in the literature for a wide range of PCB mixtures, field conditions, laboratory analytical procedures, and plant types. However, site-specific data are preferred over these literature-based TFs because they are applicable to the PCB mixture and field conditions that exist in the Housatonic River area. The range of literature-based values is also quite large, with ATSDR (2000) reporting TFs ranging over several orders of magnitude. Numerous studies involve grass species, but these studies provide air-to-leaf TFs rather than the soil-to-plant TFs needed in this risk assessment. The soil-to-plant TFs used in this assessment fall within the range of values reported in the literature, although the soil-to-grass TFs are at the high end of this range.

PCB Soil-to-Grass Transfer Factors

Site-specific grass samples were analyzed for tPCBs and dioxin-like PCB congeners, and these data were used to estimate TFs for these COPCs. TFs for PCB congeners PCB-123 and PCB-157 were affected to some extent by the co-elution of these congeners with other PCB congeners. However, neither of these congeners contributed significantly to risk estimates (see Section 7.2.4.1).

PCB Soil-to-Corn Transfer Factors

Corn samples were not analyzed for PCB congeners. Therefore, congener-specific soil-to-corn TFs were estimated for PCB congeners from grass sampling results. The validity of this extrapolation is dependent upon the assumption that relative soil-to-plant transfer rates among congeners are the same in both plant species. Although different sampling conditions might lead to some differences in congener pattern, this assumption is generally reasonable.

PCB Soil-to-Garden-Produce Transfer Factors

Some of the TFs used in this assessment assumed that produce would be washed and peeled. This could result in an underestimate of risk for individuals who do not wash and/or peel their produce prior to consumption. For example, most of the PCBs measured in carrots have been found in the carrot peel (Iwata et al., 1974). This source of uncertainty is addressed in the probabilistic risk assessment, where the input distribution for root vegetable TF includes data for carrot peels (see Section 6.5.6.1.2).

Few data were available to estimate a soil-to-exposed fruit TF; therefore, this TF was assumed to be equal to the exposed vegetable TF. The uncertainty in this TF is addressed quantitatively in Section 6.5.6.1.3. If the exposed fruit category is excluded from the garden produce consumption scenario, RME cancer risks and noncancer hazard estimates (assuming a tPCB soil EPC of 2 mg/kg) decrease by less than a factor of two.

Dioxin and Furan Transfer Factors

Site-specific grass samples were analyzed for dioxins and furans; however, desired detection limits were not attained. Other site-specific plant samples were not analyzed for these congeners. Consequently, site-specific TFs could not be calculated for dioxins and furans. Results from the grass study, combined with the generally higher PCB concentrations across the site, suggest that dioxin-like PCB congeners are likely to contribute more than dioxins and furans to TEQ exposure for cattle. Nevertheless, the literature was reviewed to find TFs for dioxins and furans (Table 4-6) that could be used to demonstrate how risk estimates would increase if non-site-specific screening-level TFs for dioxins and furans were used. A wide range of literature values for several plant types was found primarily for 2,3,7,8-TCDD and TEQ (which is the total

TEQ for the dioxin-like congeners measured in the particular study). Therefore, screening-level soil-to-plant TFs for all dioxin and furan congeners from Appendix A of EPA's *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA, 1998) were used to estimate how much risk estimates might increase if dioxin and furan transfer to plants was included in bioaccumulation models (see Section 7.2.4.2).

EPA (1998) provides screening level TFs for aboveground and belowground produce. TFs for aboveground and belowground produce were calculated using Travis and Arms (1988) and Briggs (1982), respectively. All TFs were reported on a dry weight plant/dry weight soil basis. The TFs for aboveground produce were used to represent transfer of dioxin and furan congeners into grass (forage). The TFs for aboveground produce were reduced by 50% to represent transfer to corn silage. This step is analogous to what was done in the point estimate risk assessment to account for the fact that corn ears, a protected crop, contribute about 50% of the dry matter weight of corn silage (see Section 4.3.3.2).

The aboveground produce TFs were converted to a wet weight/dry weight basis, assuming 85% moisture, and used to represent transfer from soil to exposed vegetables and exposed fruit in a home garden. A moisture content of 85% was selected based on the moisture contents of crops that can be grown in the New England climate (Table 9-27 in EPA, 1997b), which range from 79% for shallots to 95% for radishes. TFs for belowground produce were multiplied by an empirical correction factor of 0.01 to adjust for the lipophilicity of dioxin and furan congeners, as recommended by EPA (1998). The belowground produce TFs were converted to a wet weight/dry weight basis to estimate transfer to root vegetables.

7.2.2.1.2 Bioconcentration Factors (BCFs)

BCFs were used to estimate transfer of tPCBs, dioxin-like PCB congeners, dioxin congeners, and furan congeners from dietary roughage and soil to animal products, including milk, beef, poultry meat, and poultry eggs. For cattle milk and beef, there were fewer data available in the literature for dioxin-like PCB congeners than dioxins and furans. Therefore, there was greater uncertainty about dioxin-like PCB congener BCFs than dioxin and furan congener BCFs. This is one of the reasons that all TEQ cancer risk estimates from dioxin-like PCBs, dioxins, and furans are provided in the uncertainty analysis section (Section 7.2.4.1) instead of the point estimate risk assessment (Section 5).

The predicted contaminant concentration in cattle (beef and dairy) is based on the assumption that the contamination in soil upon ingestion has the same bioavailability as the contamination in normal feeds. This assumption may overestimate the amount of contaminant absorbed and thus the predicted concentration in animal fat. However, risk estimates for exposure pathways involving cattle were dominated by feed concentrations. Therefore, accounting for this reduced bioavailability would not result in a large change in risk estimates. This source of uncertainty is addressed quantitatively in Section 6.

The predicted concentrations in animal fat also did not incorporate any reduction that might result from a change in the diet to one with a higher proportion of concentrates that is often implemented to fatten the animals before slaughter. Such dietary changes could result in lower fat concentrations than those estimated in this assessment.

BCFs were not available for the Aroclor mixture that site-related contamination most closely resembles (i.e., Aroclor 1260) or for some of the congeners considered in this assessment. The general approach for defining BCFs was intended to err on the side of conservatism given the limited data available for some COPCs. This means that animal product concentrations were more likely to be overestimated than underestimated in the point estimate risk assessment, and this source of uncertainty is addressed quantitatively in Section 6.

Because the long-term mean concentrations of contaminants in milk fat and beef fat are of primary importance in the evaluation of cancer risk and chronic hazards, relatively simple BCFs were used to relate contaminant intake of animals to tissue accumulation or to elimination through milk.

Temporal changes in contaminant concentrations in milk might result from the fact that only part of the land devoted to the production of a specific crop will be located in the floodplain. Thus, at various times of the year, the crop that is fed might be entirely from the floodplain with a maximum containment concentration, entirely from outside the floodplain with near-background concentrations, or a situation between the two extremes. Typically, contaminant concentrations in milk fluctuate in response to changes in concentrations in the diet.

Temporal changes in contaminant concentrations in milk are also caused by changes in levels of milk production and body fat pool sizes during lactation. Body fat and stored contaminants are lost early in lactation, with a corresponding increase of contaminant concentrations in milk. Late in lactation, the body fat pool size increases and a larger fraction of the ingested compound is stored in body fat. A consumer who obtains milk from a single cow will have a varying exposure over the lactation cycle; however, these changes in exposure due to physiological changes will be less than the changes resulting from variability in contaminant concentrations in feed.

In comparison, exposure from beef and other meat animals is more easily characterized. The half-lives of the PCBs, dioxins, and furans are very long in non-lactating animals. The concentrations in the fat of animals at slaughter are a function of lifetime contaminant intake and the size of the body fat pool; therefore, the timing of the contaminant intake by the animal is not important.

Some furan congeners and one dioxin congener do not have BCFs assigned to them (see Table 4-8a) because these congeners are metabolized by animals and, consequently, have typically not been detected in animal products or, in the case of 1,2,3,4,6,7,8-CDD and 1,2,3,4,6,7,8,9-CDF, have been detected only at very low concentrations in some studies. Assuming these congeners are present in animal tissue at detection limits does not substantially change the TEQ cancer risk (see Table 7.1).

7.2.2.1.3 Animal Intakes

All risk estimates were based on best estimates for daily roughage and soil intake. It is possible that intakes could be somewhat higher or lower (see Table 4-3). Also, farmers could feed varying proportions of hay and grass. This proportion is significant because the average soil-to-grass TF exceeds the soil-to-corn TF for tPCBs. Current dairy farm management practices favor use of corn silage almost exclusively (Williams, 2002).

The commercial and backyard beef scenarios did not include consideration of dietary changes prior to slaughter that might result in reduced body fat concentrations relative to those predicted in this assessment.

If animals have access to the river, they might be exposed to contamination in suspended sediment. This exposure was assumed to be small relative to the pasture and feed exposures because animals would be unlikely to go to the river if they are provided with a sufficient water supply.

7.2.2.2 Human Exposure Assumptions

Estimates of average daily exposures require numerous assumptions about how frequently and to what extent people consume contaminated foods.

7.2.2.2.1 Home-Produced Food Consumption Rates

The home-produced food consumption rates used were the most appropriate available data for the farm exposure scenario. Uncertainties associated with these data were discussed in Section 4 and are addressed quantitatively in Section 6.

7.2.2.2.2 Degree of Exposure to Home-Produced Foods

This assessment required information about exposure duration, exposure frequency, and the fraction of food that is contaminated. Without additional site-specific study, these inputs are uncertain.

7.2.3 Uncertainty Associated with the Dose-Response

The toxicity values used in this risk assessment for the COPCs were the most current values published by EPA (EPA, 2004 and 1997a). A more detailed discussion of the toxicology of PCBs, dioxins, and furans is included in Section 4 of HHRA Volume I. 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 contaminant intake to the incremental probability of an individual developing cancer over a lifetime. The CSFs developed by EPA are plausible upper-bound estimates, which means that 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 CSF is based on animal studies using commercial mixtures. 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 PCBs, such as those detected in floodplain soil and sediment in the HRA, differ by only a factor of two. There are many 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 greater detail in the HHRA Volume I, Section 4.

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 congener effects 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 equivalent to 2,3,7,8-TCDD. Cancer risks are characterized by multiplying the TEQ, expressed as average daily dose, by 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, 1997a), 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 and determined that 2,3,7,8-TCDD is a human carcinogen and concluded it was a Group 1, human carcinogen. In other words, IARC believed 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 (NAS) 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 uncertainty regarding the appropriate CSF for TCDD. The CSF derived by EPA (1985) and published in HEAST (EPA, 1997a), 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 approximately a 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 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 data set, 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 of uncertainty is described in the HHRA Volume I, 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 exposure of nursing infants is provided in the HHRA Volume I, Section 10.

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 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 quantitatively evaluated 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

In risk characterization, assumptions about exposure and dose-response information are combined to estimate cancer risk and noncancer hazard. Risk estimates presented in this report are the result of a conservative, point estimate assessment that does not provide a quantitative assessment of uncertainty. Compounding conservatism (Cullen, 1994) in estimating RME risks was avoided by choosing a mix of central tendency and upper-bound exposure assumptions. On balance, noncancer hazards and cancer risks were reasonably conservative estimates of the upper-bound risk level experienced by the exposed population (see Table 4-12), which are more likely to overestimate than underestimate risk to individuals consuming agricultural products from the floodplain.

7.2.4.1 TEQ Cancer Risk

TEQ risk estimates were subject to more uncertainty than risk estimates for tPCBs due to a number of factors. Fewer soil samples were analyzed for congeners than for tPCBs, and concentrations were predicted from regression models. Corn samples were analyzed only for tPCBs; therefore, TFs for dioxin-like PCBs were extrapolated. Site-specific data for dioxin and furan congeners are not available; therefore, screening-level soil-to-plant TFs for all dioxin and furan congeners were calculated. The BCF literature is more extensive for tPCBs than for dioxin-like PCB congeners, and it was necessary to estimate many congener BCFs.

An example of the TEQ cancer risk estimates from dioxin-like PCB, dioxin and furan congeners are presented in Table 7-1. Total TEQ cancer risk is primarily from dioxin-like PCB congeners, especially PCB-126. RME TEQ cancer risks for all commercial animal product scenarios exceed

EPA's cancer risk range. The RME TEQ cancer risk also exceeds EPA's risk range for backyard dairy, beef, and egg scenarios. Commercial and backyard produce TEQ cancer risks are within the risk range.

Cancer risk from consumption of agricultural products from the floodplain might be underestimated by not simultaneously accounting for risk from tPCBs and from TEQ.

7.2.4.2 Cancer Risk Estimates with Dioxin and Furan TFs

An example of the cancer risk estimates incorporating soil-to-plant TFs for dioxin and furan congeners, as described in Section 7.2.2.1.1, are shown in Table 7-1. The contribution of dioxins and furans to total TEQ cancer risk is negligible in comparison to that from dioxin-like PCB congeners. The addition of dioxins and furans does not change the total TEQ cancer risk for the commercial and backyard dairy and beef scenarios. Addition of dioxins and furans does change the total TEQ cancer risk for the home garden scenario, but it is still within EPA's risk range.

7.2.4.3 Cumulative Risk

Risk estimates were presented for individual food exposure pathways. Some individuals might be exposed by more than one pathway. For example:

- Individuals living on dairy farms might have a home garden within the 1-ppm isopleth, they might buy produce or other animal products originating elsewhere in the floodplain, or they might consume meat from cull or surplus dairy animals.
- Residents might consume home garden produce in addition to wild edible plants.

In Volume I, Section 10, risk estimates for such exposure pathways were combined where appropriate.

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 all of 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 discussion of the effect of the quantitative modeling of uncertainty on the risk distributions is presented in Section 6. Attachment 5 to the HHRA provides detailed examples of the sensitivity analysis process.

In Section 8, the CTE and RME point estimate risk results are compared to results of the probabilistic risk assessment presented in Section 6. This comparison indicates that risks were sometimes slightly overestimated and sometimes slightly underestimated with the point estimate approach. However, results from the point estimate and probabilistic risk assessments are generally in good agreement.

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SECTION 7

TABLES

Table 7-1
PCB, Dioxin and Furan Congener Cancer Risk Summary for Agricultural Scenarios
(example assuming a tPCB floodplain soil EPC of 2 mg/kg and all agricultural operations are in the floodplain)[1]

Commercial Farm Family: Dairy Consumption

	RME			CTE		
	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans
Dioxin-like PCB Congeners	2.0E-04	2.0E-04	2.0E-04	8.8E-05	8.8E-05	8.8E-05
Dioxins	0.0E+00	0.0E+00	3.1E-06	0.0E+00	0.0E+00	1.4E-06
Furans	0.0E+00	0.0E+00	5.7E-06	0.0E+00	0.0E+00	2.6E-06
Total TEQ Cancer Risk	**2E-04**	**2E-04**	**2E-04**	**9E-05**	**9E-05**	**9E-05**

Backyard Farm Family: Dairy Consumption

	RME			CTE		
	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans
Dioxin-like PCB Congeners	5.5E-03	5.5E-03	5.5E-03	2.2E-03	2.2E-03	2.2E-03
Dioxins	1.8E-05	1.8E-05	2.4E-05	7.3E-06	7.3E-06	9.5E-06
Furans	4.7E-05	4.7E-05	5.7E-05	1.9E-05	1.9E-05	2.3E-05
Total TEQ Cancer Risk	**6E-03**	**6E-03**	**6E-03**	**2E-03**	**2E-03**	**2E-03**

Commercial Farm Family: Beef Consumption

	RME			CTE		
	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans
Dioxin-like PCB Congeners	1.5E-03	1.5E-03	1.5E-03	4.4E-04	4.4E-04	4.4E-04
Dioxins	1.1E-05	1.1E-05	1.3E-05	3.4E-06	3.4E-06	4.0E-06
Furans	2.9E-05	2.9E-05	3.2E-05	8.7E-06	8.8E-06	9.7E-06
Total TEQ Cancer Risk	**1E-03**	**1E-03**	**2E-03**	**4E-04**	**4E-04**	**5E-04**

Backyard Farm Family: Beef Consumption

	RME			CTE		
	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans
Dioxin-like PCB Congeners	2.0E-03	2.0E-03	2.0E-03	4.7E-04	4.7E-04	4.7E-04
Dioxins	8.0E-06	8.0E-06	9.9E-06	1.9E-06	1.9E-06	2.3E-06
Furans	2.0E-05	2.1E-05	2.4E-05	4.8E-06	4.8E-06	5.6E-06
Total TEQ Cancer Risk	**2E-03**	**2E-03**	**2E-03**	**5E-04**	**5E-04**	**5E-04**

Table 7-1
PCB, Dioxin and Furan Congener Cancer Risk Summary for Agricultural Scenarios
(example assuming a tPCB floodplain soil EPC of 2 mg/kg and all agricultural operations are in the floodplain)[1]

Commercial Farm Family: Poultry Meat Consumption

	RME			CTE		
	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans
Dioxin-like PCB Congeners	2.1E-04	2.1E-04	NC	4.0E-05	4.0E-05	NC
Dioxins	1.6E-05	1.6E-05	NC	3.1E-06	3.1E-06	NC
Furans	5.2E-05	5.2E-05	NC	9.9E-06	9.9E-06	NC
Total TEQ Cancer Risk	**3E-04**	**3E-04**	NC	**5E-05**	**5E-05**	NC

Backyard Farm Family: Poultry Meat Consumption

	RME			CTE		
	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans
Dioxin-like PCB Congeners	1.2E-04	1.2E-04	NC	2.2E-05	2.2E-05	NC
Dioxins	9.1E-06	9.1E-06	NC	1.7E-06	1.7E-06	NC
Furans	2.9E-05	2.9E-05	NC	5.4E-06	5.4E-06	NC
Total TEQ Cancer Risk	**2E-04**	**2E-04**	NC	**3E-05**	**3E-05**	NC

Commercial Farm Family: Poultry Egg Consumption

	RME			CTE		
	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans
Dioxin-like PCB Congeners	7.2E-04	7.2E-04	NC	3.2E-04	3.2E-04	NC
Dioxins	7.6E-05	7.6E-05	NC	3.4E-05	3.4E-05	NC
Furans	2.9E-04	3.2E-04	NC	1.3E-04	1.4E-04	NC
Total TEQ Cancer Risk	**1E-03**	**1E-03**	NC	**5E-04**	**5E-04**	NC

Backyard Farm Family: Poultry Egg Consumption

	RME			CTE		
	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans	Baseline	With BCFs based on detection limits	With soil-to-plant TFs for dioxins and furans
Dioxin-like PCB Congeners	4.9E-04	4.9E-04	NC	1.8E-04	1.8E-04	NC
Dioxins	5.2E-05	5.2E-05	NC	1.9E-05	1.9E-05	NC
Furans	2.0E-04	2.2E-04	NC	7.3E-05	8.2E-05	NC
Total TEQ Cancer Risk	**7E-04**	**8E-04**	NC	**3E-04**	**3E-04**	NC

Table 7-1
PCB, Dioxin and Furan Congener Cancer Risk Summary for Agricultural Scenarios
(example assuming a tPCB floodplain soil EPC of 2 mg/kg and all agricultural operations are in the floodplain)[1]

Commercial Farm Family: Produce Consumption

	RME			CTE		
	Baseline	**With BCFs based on detection limits**	**With soil-to-plant TFs for dioxins and furans**	**Baseline**	**With BCFs based on detection limits**	**With soil-to-plant TFs for dioxins and furans**
Dioxin-like PCB Congeners	4E-05	NC	4E-05	1E-05	NC	1E-05
Dioxins	0E+00	NC	3E-06	0E+00	NC	1E-06
Furans	0E+00	NC	1E-05	0E+00	NC	4E-06
Total TEQ Cancer Risk	**4E-05**	NC	**5E-05**	**1E-05**	NC	**2E-05**

Backyard Farm Family: Produce Consumption

	RME			CTE		
	Baseline	**With BCFs based on detection limits**	**With soil-to-plant TFs for dioxins and furans**	**Baseline**	**With BCFs based on detection limits**	**With soil-to-plant TFs for dioxins and furans**
Dioxin-like PCB Congeners	2E-05	NC	2E-05	7E-06	NC	7E-06
Dioxins	0E+00	NC	2E-06	0E+00	NC	6E-07
Furans	0E+00	NC	7E-06	0E+00	NC	2E-06
Total TEQ Cancer Risk	**2E-05**	NC	**3E-05**	**7E-06**	NC	**9E-06**

NC = No change (BCFs not used to calculate risk for produce consumption, soil-to-plant TFs not used to calculate risk for poultry consumption).

[1] These are cancer risk point estimates provided as an example assuming a tPCB concentration of 2 mg/kg and the fraction of the cultivation, grazing or garden area in the floodplain is 1. Estimates that exceed EPA's cancer risk range are shaded.

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 risk to individuals who consume agricultural products from the Housatonic River floodplain. Both approaches were used to evaluate potential cancer risks and noncancer health effects to children and adults from consumption of agricultural products produced commercially or from backyard farms. 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).

Probabilistic analyses consisted of probability bounds analysis (PBA) and a semi-analytic analog of one-dimensional Monte Carlo analysis (MCA analog) that was performed using PBA. These latter analyses are 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 results as Monte Carlo simulation if it is provided with the same inputs and assumptions (see Attachment 5 of HHRA Volume I).

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 and express the variability among individuals in the population in terms of their individual characteristics and specific exposure. The results of the Monte Carlo analog analyses are expressed in terms of 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) lie in the risk range.

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.

8.2 POINT ESTIMATE AND MONTE CARLO ANALOG 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 8-1 and 8-2 provide an example of 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 floodplain soil EPC of 2 mg/kg with all agricultural activities within the floodplain (i.e., fraction = 1). These assumptions were selected from the 16 tPCB EPC and fraction combinations quantified in this assessment to illustrate how results from these methods compare. 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 8-1, the RME cancer risk for commercial dairy, poultry meat, and produce is approximately two (1.5 to 1.7) times higher than the 95^{th} percentile of the risk calculated using the MCA analog. In general, the point estimate RME risks are between the 95^{th} and 99^{th} percentile. The point estimate CTE cancer risk for commercial dairy consumption is nearly three times higher than the 50^{th} percentile risk of the MCA analog. CTE cancer risks associated with consumption of commercial poultry eggs and commercial produce are approximately two times higher than the 50^{th} percentile risk of the MCA analog. For the backyard beef scenario, the RME and CTE tPCB point estimate cancer risks are approximately equal to the 95^{th} and 50^{th} percentile risk of the MCA analog, respectively.

Table 8-2 provides a comparison of the point estimate and Monte Carlo analog analyses for noncancer hazards to both adults and children. At the high-end range, the point estimate HIs are less than the 95th percentile HIs calculated using the MCA analog, whereas the CTE point estimate HIs are greater than the 50th percentile MCA analog HIs. The backyard beef RME point estimate HIs are approximately one third of the 95th percentile of the risk calculated using the MCA analog analysis, placing them between the 50th and 75th percentiles (see Table 6-16). RME point estimate HIs for commercial poultry meat, poultry egg, and commercial produce scenarios are approximately half of the 95th percentile Monte Carlo analog estimates, placing them around the 75th percentile. The commercial dairy CTE point estimate adult hazard index (HI) is approximately two times higher than the 50th percentile of the risk distribution identified in the MCA analog, placing it in approximately the 75th percentile. The CTE point estimate child HI for the commercial dairy scenario and CTE HIs for all other agricultural scenarios are less than two times the 50th percentile of the MCA analog.

8.3 RELATIONSHIP BETWEEN RISK ESTIMATES AND THE EPA RISK RANGE

The results of the point and probabilistic risk assessments were compared to the EPA risk range. The EPA cancer risk range identified in the National Contingency Plan (NCP) (EPA, 1990) is approximately 1E-06 to 1E-04, or an increased probability of developing cancer of 1 in 1,000,000 to 1 in 10,000 over a 70-year lifetime.

Where the cumulative site risk to an individual based on the RME exceeds the 1E-04 lifetime excess cancer risk end of the risk range, 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 warrant 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.

Figures 8-1 through 8-3 provide an example of summaries of the tPCB cancer risks and tPCB hazard indices calculated using the point estimate, MCA analog, and probability bounds approaches, and a comparison of these cancer risks and hazard indices to the EPA risk range. Like Tables 8-1 and 8-2, all results in these figures are based on an assumed tPCB floodplain soil EPC of 2 mg/kg with all agricultural activities occurring within the floodplain (i.e., fraction=1). 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 agricultural scenario. EPA guidelines for cancer risks and noncancer health effects are noted by a gray shaded area and a gray line, respectively.

Using Figure 8-1 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 due to consumption of backyard beef is 1E-05 for both the point estimate CTE and the median of the MCA analog. The light bands of red 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 bands of blue correspond to the uncertainty surrounding the high-end percentiles of the MCA analog calculated with probability bounds analysis.

8.3.1 Cancer Risks

Figure 8-1 presents an example of the tPCB cancer risk results for the five agricultural pathways currently in the floodplain. Risks are calculated assuming that the tPCB floodplain soil EPC is 2 mg/kg and that all agricultural operations occur in the floodplain. This figure includes results presented in Tables 5-1, 6-13, 6-15, 6-17, 6-19, and 6-21.

Commercial poultry egg consumption tPCB cancer risks calculated with the point estimate RME and the 95th percentile of the MCA analog are above the upper end of the EPA risk range. The RME point estimate and MCA analog results for the backyard beef and commercial poultry meat scenarios span the upper end of EPA's risk range (i.e., the 99th percentile of the MCA analog is above the upper end of the EPA risk range, but the 90th percentile of the MCA analog is within EPA's risk range). Point estimate and MCA analog results for other agricultural exposure scenarios are within or, in the case of commercial produce, below EPA's risk range. However, the uncertainty around the median and RME range of the MCA analog generally spans the entire EPA risk range.

8.3.2 Hazard Indices

Figures 8-2 and 8-3 present an example of the tPCB hazard index results, for an adult and child respectively, for the five agricultural pathways currently in the floodplain. Risks are calculated assuming that the tPCB floodplain soil EPC is 2 mg/kg and that all agricultural operations occur in the floodplain. This figure includes results presented in Tables 5-2, 6-14, 6-16, 6-18, 6-20, and 6-22.

The tPCB HIs based on the both the adult and child backyard beef, commercial poultry meat, and commercial poultry egg consumption point estimate and Monte Carlo analog analysis for high-end and central tendency are above the EPA benchmark of 1. The commercial dairy and commercial produce point estimate and Monte Carlo analog HIs are below the benchmark for both central tendency and high-end exposure. However, when the uncertainty is taken into account, the upper bound HIs are above the risk range, with the exception of the median probability bounds for the adult commercial dairy scenario.

8.4 REFERENCES

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SECTION 8

TABLES

Table 8-1

Cancer Risk from Agricultural Product Consumption: Point Estimate and Monte Carlo Analog Analyses [1]

	RME Range		Central Tendency Range	
	RME Point Estimate	95th Percentile MCA	CTE Point Estimate	50th Percentile MCA
Commercial Dairy	8.E-06	5.E-06	2.E-06	7.E-07
Backyard Beef	1.E-04	1.E-04	1.E-05	1.E-05
Commercial Poultry Meat	1.E-04	8.E-05	1.E-05	1.E-05
Commercial Poultry Egg	3.E-04	2.E-04	7.E-05	3.E-05
Commercial Produce	5.E-06	3.E-06	8.E-07	4.E-07

[1] This table provides cancer risk estimates assuming a tPCB floodplain soil EPC of 2 mg/kg with all agricultural activities within the floodplain (i.e., fraction =1), the risks will vary for other combinations of EPC and fraction of use in floodplain.

Table 8-2

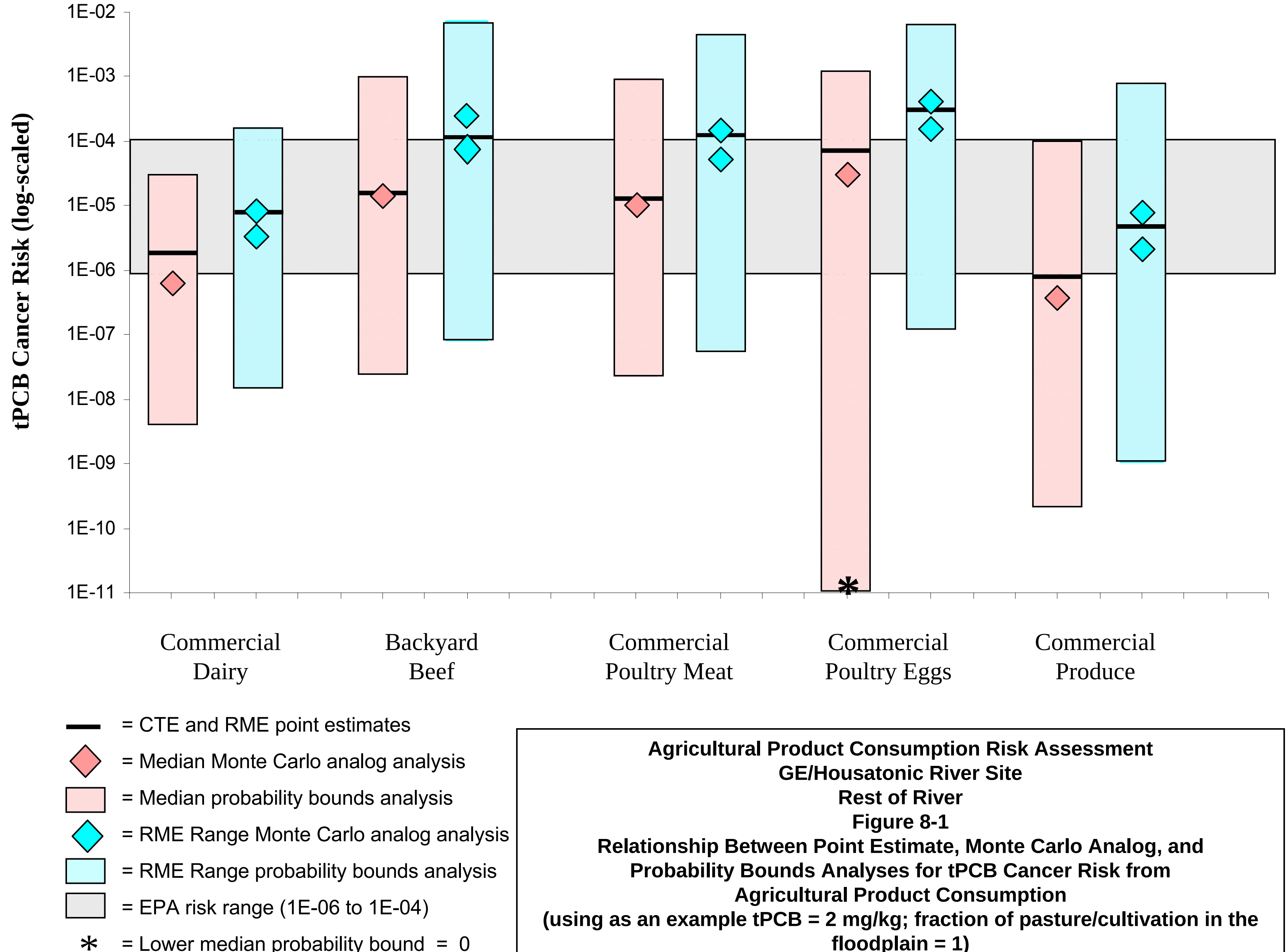
Noncancer Hazards from Agricultural Product Consumption: Point Estimate and Monte Carlo Analog Analyses [1]

	RME Range		Central Tendency Range	
	RME Point Estimate	95th Percentile Monte Carlo	CTE Point Estimate	50th Percentile Monte Carlo
Hazard Index - Adult				
Commercial Dairy	0.2	0.2	0.1	0.08
Backyard Beef	4	11	3	2
Commercial Poultry Meat	3	5	1	1
Commercial Poultry Egg	7	13	6	4
Commercial Produce	0.1	0.2	0.07	0.05
Hazard Index - Child				
Commercial Dairy	0.7	0.8	0.5	0.5
Backyard Beef	8	21	4	4
Commercial Poultry Meat	4	8	2	2
Commercial Poultry Egg	16	37	14	10
Commercial Produce	0.2	0.4	0.1	0.09

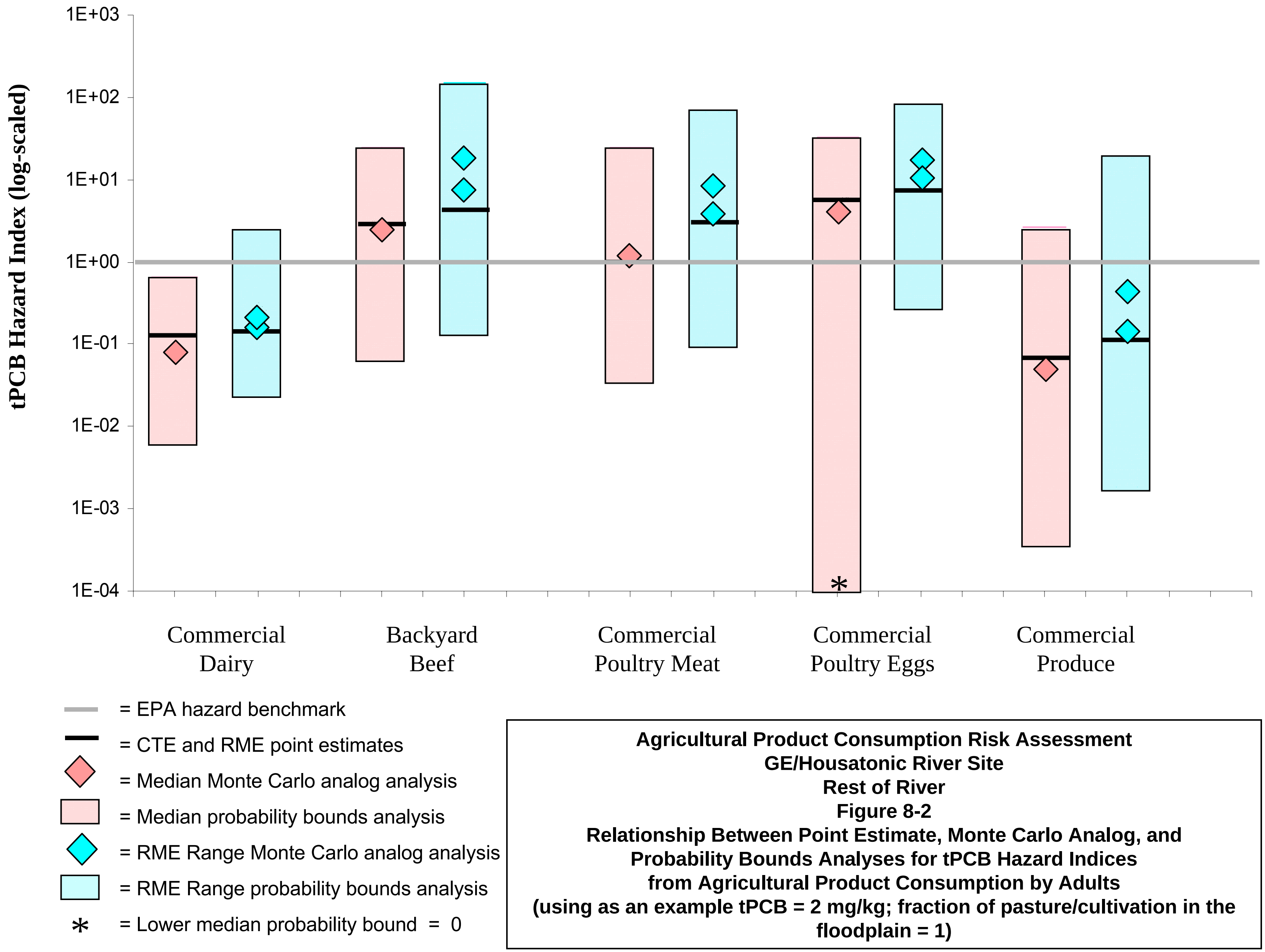
[1] Example hazard indices assuming a tPCB floodplain soil EPC of 2 mg/kg with all agricultural activities within the floodplain (i.e., fraction =1).

SECTION 8

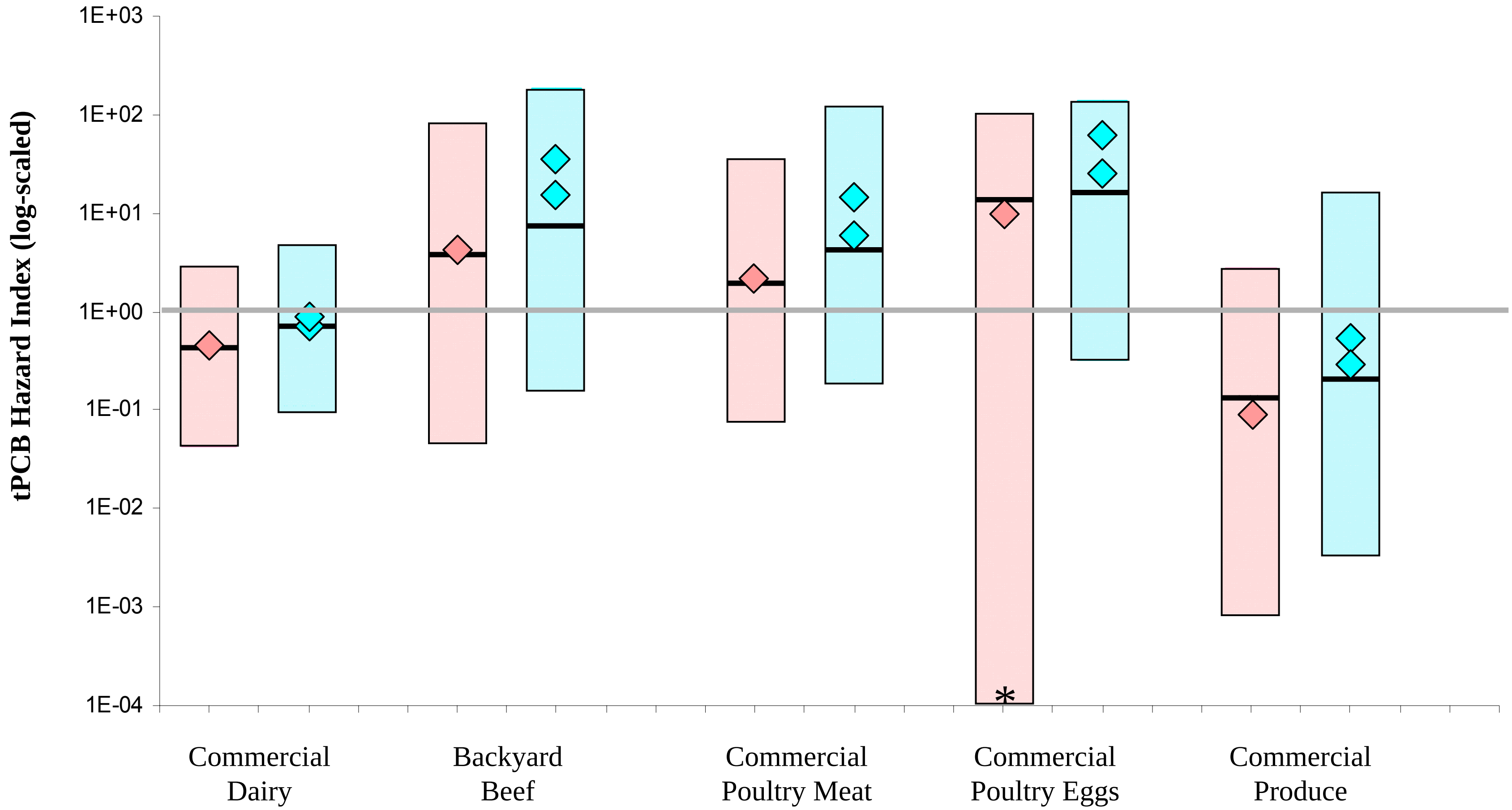
FIGURES



Agricultural Product Consumption Risk Assessment
GE/Housatonic River Site
Rest of River
Figure 8-1
Relationship Between Point Estimate, Monte Carlo Analog, and Probability Bounds Analyses for tPCB Cancer Risk from Agricultural Product Consumption
(using as an example tPCB = 2 mg/kg; fraction of pasture/cultivation in the floodplain = 1)



Agricultural Product Consumption Risk Assessment
GE/Housatonic River Site
Rest of River
Figure 8-2
Relationship Between Point Estimate, Monte Carlo Analog, and Probability Bounds Analyses for tPCB Hazard Indices from Agricultural Product Consumption by Adults (using as an example tPCB = 2 mg/kg; fraction of pasture/cultivation in the floodplain = 1)



= EPA hazard benchmark
= CTE and RME point estimates
= Median Monte Carlo analog analysis
= Median probability bounds analysis
= RME Range Monte Carlo analog analysis
= RME Range probability bounds analysis
* = Lower median probability bound = 0

Agricultural Product Consumption Risk Assessment
GE/Housatonic River Site
Rest of River
Figure 8-3
Relationship Between Point Estimate, Monte Carlo Analog, and Probability Bounds Analyses for tPCB Hazard Indices from Agricultural Product Consumption by Children
(using as an example tPCB = 2 mg/kg; fraction of pasture/cultivation in the floodplain = 1)

O:\20123001.096\HHRA_FNL_AG\AG_FNL_8_Figs8-1to8-3.ppt

ATTACHMENT D.1

VARIATIONS FROM THE SUPPLEMENTAL INVESTIGATION WORK PLAN

ATTACHMENT D.1

VARIATIONS FROM THE SUPPLEMENTAL INVESTIGATION WORK PLAN

This attachment describes differences between the proposed approach for assessing agricultural product and other food exposure pathways presented in the *Supplemental Investigation Work Plan for the Lower Housatonic River* (WESTON, 2000) and the approach used to complete this 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.

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 toxic equivalence (TEQ) concentrations. Therefore, the approach followed was not presented in the SIWP.

Deviation/Rationale

Along with total PCBs (tPCBs), dioxins, furans, and dioxin-like PCB congeners were selected as COPCs. These congeners were evaluated as 2,3,7,8-TCDD TEQs; however, given the limited data for these congeners, a different approach was taken to estimate TEQ concentrations. Also, the agricultural assessment was based on assumed tPCB concentrations in soil of 0.5 mg/kg and 2 mg/kg. Therefore, the relationship between tPCB concentrations and congener concentrations had to be quantified to predict the TEQ associated with these assumed tPCB concentrations. Linear regression models were developed to predict congener concentrations from tPCB concentrations (quantified as the sum of Aroclors). These regression models were based on congener and tPCB concentration data from sampling locations where tPCBs, dioxin congeners, furan congeners, and dioxin-like PCB congeners were analyzed. This regression analysis is presented in Attachment 2 of the Human Health Risk Assessment.

USE OF EPA RAGS PART D TABLES

SIWP

- The medium-specific exposure point concentrations (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

Because of the number of risk assessments conducted, the tables presented in this report do not use EPA RAGS Part D format. Instead, a table is provided for each central tendency exposure (CTE) and reasonable maximum exposure (RME) exposure scenario with the EPC, the average daily dose, the lifetime average daily dose, and the cancer risk and noncancer hazard results. This was done to limit the number of tables in the report.

REFERENCES

WESTON (Roy F. Weston, Inc.). 2000. Supplemental Investigation Work Plan for the Lower Housatonic River, Volumes I and II. Prepared for U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. 22 February 2000.

ATTACHMENT D.2

COMPARISON OF MODELED AND MEASURED MILK CONCENTRATIONS

ATTACHMENT D.2

COMPARISON OF MODELED AND MEASURED MILK CONCENTRATIONS

Commercial and backyard dairy production scenarios were assessed in the Human Health Risk Assessment (HHRA) for the GE/Housatonic River Site, Rest of River. As part of the assessment, whole milk concentrations of total polychlorinated biphenyls (tPCBs) and dioxin-like congeners were modeled. This attachment provides a comparison of results from this modeling effort to concentrations measured in milk samples collected from dairy farms in the Housatonic River area in two separate sampling efforts. Concentrations of dioxin-like congeners were not measured in any milk samples; therefore, only modeled tPCB concentrations are compared to data.

Information is available regarding two milk sampling events involving Housatonic River area dairy farms:

1. The General Electric Company (GE) provided tPCB concentration data for whole milk samples collected in 1970-71 that might have been collected from the former William DeVos dairy farm in Lenox, Massachusetts (Connecticut Agricultural Experiment Station, 1970a,b,c,d,e; New England Milk Producers' Association, 1970; GE, 1971). GE records do not identify the source of the milk samples, but they were collected around the same time that the State of Connecticut was collecting milk samples from the DeVos farm to investigate PCB contamination.

2. The Massachusetts Department of Food and Agriculture (MADFA) collected bulk tank milk samples from active dairy farms in 1993 (see HHRA Volume V, Section 2.3.2 for a description of these data). The 1993 sampling event was prompted by concern arising from the prior sampling effort during which elevated concentrations of PCBs were detected in milk samples from the DeVos farm. The DeVos farm was not part of the 1993 sampling program.

This attachment compares these data to concentrations predicted by the model used in the HHRA. Comparisons are subject to considerable uncertainty given the limited documentation of analytical methods and farm management practices at the time of sampling.

COMPARISON OF PREDICTED MILK CONCENTRATIONS TO RESULTS FROM MADFA MILK SAMPLING PROGRAM

Milk samples collected by the Massachusetts Department of Food and Agriculture (MADFA) from active dairy farms in 1993 did not contain detectable levels of PCBs (see Exhibit D.2-1). However, analytical detection limits were not reported. As described in Section 2.3.2.2, assuming the laboratory followed standard laboratory procedures for 1993, the limit of quantitation (LOQ) would have been ≤ 10 μg/L on a whole milk basis, with a limit of detection (LOD) ≤ 5 μg/L. These are the highest LOD and LOQ values that might be expected, given the variations in analytical methods that might have been used by the U.S. Food and Drug Administration Winchester Engineering and Analytical Center, the laboratory that analyzed all samples in 1993.

According to MADFA sampling records, farm management practices at the time of the 1993 sampling were similar to current practices. Farmers reported that dairy cattle exercise lots were outside of the floodplain, although several farmers responded to this question in an ambiguous fashion (i.e., they reported that the exercise lot was outside of the floodplain but that it flooded in spring). All farmers reported that corn silage was the primary feed, and most farmers reported that they also fed hay. Farmers reported that they grew these crops in the floodplain but did not report the proportion of cultivation areas within the floodplain. These practices are consistent with the hypothetical commercial dairy scenario evaluated in this assessment, in which dairy cattle were assumed to be exposed to tPCBs exclusively from corn silage growing in the floodplain. In addition, a sensitivity analysis of the commercial dairy scenario was conducted to illustrate the effect of changing the dairy cattle roughage diet assumption from 100% corn silage to 50% corn silage and 50% grass-based feed.

Predicted tPCB whole milk concentrations for the commercial dairy scenario were less than the estimated LOD and LOQ for the 1993 sampling event assuming the following:

- 100% of roughage diet came from corn silage.
- 100% of corn silage cultivation occurred in the floodplain in soils with a tPCB EPCs in the range measured on current farms (i.e., 0.5, 2, 10, or 25 mg/kg).

Predicted tPCB whole milk concentrations for the commercial dairy scenario sensitivity analysis involving a roughage diet composed of 50% corn silage and 50% hay were less than the estimated LOD and LOQ for the 1993 sampling event at assumed tPCB soil EPCs of 0.5 and 2 mg/kg, but not at assumed tPCB soil EPCs of 10 and 25 mg/kg, which resulted in predicted whole-milk tPCB concentrations of 17 and 42 μg/L, respectively. This result likely reflects the fact that corn silage is the dominant feed, and most cultivation areas are not located entirely within areas with EPCs of 10 mg/kg and higher.

The 1993 sampling program represents a “snapshot” of milk concentrations. It is possible that dairy cows were consuming corn silage or hay from the floodplain near the time of sampling, but this could not be confirmed. Therefore, these comparisons are uncertain but are useful in showing that tPCB milk predictions in this assessment are not inconsistent with results from the MADFA 1993 sampling program.

COMPARISON OF PREDICTED MILK CONCENTRATIONS TO MILK DATA FROM THE FORMER DEVOS DAIRY FARM

A 1972 aerial photograph indicates that part of the former William DeVos dairy farm in Lenox, MA, was within the 1-ppm total PCB isopleth (Figure D.2-1). Consequently, it is possible that animals from this farm were exposed to tPCBs in floodplain soil, river sediment, and river water.

DeVos Farm Milk Data

On July 10, 1970, the Connecticut Department of Agriculture (CT DA) collected a milk sample from the farm of William DeVos in Lenox, MA, as part of routine testing for pesticides (New England Milk Producers’ Association, 1970). Because PCBs were identified in that sample, the CT DA resampled milk from the DeVos dairy farm in September, November, and December of that year. Concentrations of PCBs in these samples were not quantified, but chemists at the CT Agricultural Experiment Station documented a relative decline in concentrations following removal of animals from a pasture near the Housatonic River (Connecticut Agricultural Experiment Station, 1970a,b,c,d,e). The amount of decline is not clear from available records but could be as much as 78%.

Milk Data Analyzed by GE

GE provided milk sampling results, which were collected and analyzed in late 1970 and early 1971, but the source of the milk samples was not identified (GE, 1971) (see Exhibit D.2-2). Given the timing of GE's analytical effort, it is possible that the samples were collected from the DeVos farm, but this could not be confirmed from available records. However, for the purposes of this comparison, these GE samples were assumed to have been collected from the DeVos farm.

GE quantified concentrations of PCBs as the "Pyranol concentration ppb in Aroclor 1254" according to a partially handwritten notation (see Exhibit D.2-2), but no information is available about sampling and analytical protocols. Three "machine" samples and one "hand" sample were collected. The lowest concentration of 44 ppb was detected in the "hand" sample. The three "machine" samples had concentrations of 49, 52, and 65 ppb. Three handwritten numbers appear next to the "65" in the January 1971 column on the milk data sheet; however, it is not clear what these numbers represent.

Assumed Management Practices on the DeVos Farm

The 1972 aerial photograph was used to estimate boundaries of potential cattle grazing areas and cultivation areas for animal feed. These estimated areas are shown in Figure D.2-2. In the early 1970s, the large "Cultivation Area" probably was used to grow hay, which was more likely the dominant feed at that time than corn silage. Animals might have grazed in any or all of the open areas.

Milk concentrations were predicted assuming that animals pastured on the farm for 6 months of the year, and consumed hay from the "Cultivation Area" on the farm for the other 6 months of the year. In the early 1970s, their diet likely consisted of 59% roughage (half grass and half hay), 40% concentrate and 1% soil. These dietary assumptions are comparable to the "backyard dairy" scenario in HHRA Volume V, Section 5. Animals more likely pastured near the farm and river near the farm buildings and river in "Open Area 1," but probably did not graze in this area exclusively. Animals could have grazed over a larger area, including "Open Area 2" and "Other Open Areas." Therefore, milk concentrations were predicted for two general pasturing scenarios:

- Scenario 1: Animals pastured only in “Open Area 1.”
- Scenario 2: Animals pastured in all open areas (i.e., “Open Area 1,” “Open Area 2,” and “Other Open Areas.”)

DeVos Farm Soil Exposure Point Concentrations

Soil concentration data for the DeVos farm are not available from the early 1970s. In this assessment, whole milk concentrations of total polychlorinated biphenyls (tPCBs) were modeled using 0- to 6-inch floodplain soil data for 37 samples collected from the DeVos farm between 1988 and 2002. Only one of these samples was collected prior to 1998. These measured soil concentrations may differ from concentrations in DeVos farm pastures and cultivation areas at the time of milk sampling as a result of subsequent PCB release to the river, flooding events, and weathering.

Floodplain soil EPCs were calculated for pasture and cultivation areas using spatially weighted data for the DeVos farm. Attachment 3 in Volume 1 of this report describes how spatially weighted data were generated using measured soil data. Figure D.2-3 illustrates the raw and spatially weighted tPCB concentration data for floodplain surface soil used in this assessment.

To calculate EPCs for these areas using spatially weighted soil data, two software programs were used: ProUCL (version 3.0) and “hallbig2.exe.” (for more details on calculation of EPCs, see the HHRA Volume I, Attachment 4) The distribution of the data for each exposure area was tested using the Lilliefors normality goodness-of-fit test in ProUCL. The “hallbig2” program was used to calculate a 95% UCL on the mean for each exposure area where the distribution of the data was neither normal nor lognormal (which was the case for “Open Area 1” and all “Open Areas” combined). The fractions of pasture and cultivation area within the 1-ppm total PCB isopleth were calculated using GIS-based maps of the former DeVos farm. The EPCs and fractions used to model milk concentrations for the DeVos farm are shown in Table D.2-1.

Comparison of Modeled Milk Concentrations and Measured Milk Concentrations

Assuming the DeVos farm had Jersey cows, predicted whole milk concentrations of tPCBs were 58.4 µg/L and 52.4 µg/L for cows grazing in Open Area 1 and all Open Areas, respectively. Assuming the DeVos farm had Holstein cows, which have a lower milk fat content than Jersey cows, the predicted whole milk concentrations of tPCBs were 45.7 µg/L and 41.0 µg/L for cows grazing in Open Area 1 and all Open Areas, respectively. These modeled milk concentrations are within the range of total PCB concentrations (quantified as Aroclor 1254) in samples collected by GE in 1970 and 1971 (i.e., 44 to 65 µg/L, or ppb).

This comparison is highly uncertain because available records do not identify the source of milk samples analyzed by GE. Assuming that the milk samples came from the DeVos farm, the comparison is subject to other important uncertainties:

- *Farm management practices at the time of sampling are not known with certainty*. Unlike current commercial dairy farms in the floodplain, lactating animals might have been able to access contamination in river sediments, a pathway of exposure that was not part of the model used in this assessment. Also, based on CT DA records, milk samples were collected approximately 2 months after animals were taken off of the pasture near the river; therefore, milk concentrations were likely higher at the time animals accessed this area. CT DA records indicate a decline in tPCB concentrations after animals were removed from the pasture near the river, but tPCBs were not quantified.

- *Soil EPCs in the early 1970s might differ from soil EPCs estimated using samples collected primarily after 1998.* Additional PCB releases to the river might have occurred after 1971 as well as additional flooding events. Also, tPCBs in floodplain soils were subject to weathering processes.

- *Milk data might not be from the DeVos farm and, assuming that they are, sampling and analytical procedures are not available.* This information would be useful to understand any differences between measured and modeled milk concentrations. Modeled predictions represent average whole milk concentrations for a farm, which depend on the dietary exposures of the herd. Although animals were likely not pasturing near the river at the time of sampling, they might have been eating contaminated feeds. Also, milk samples might be from individual cows rather than homogenized bulk milk samples that better represent the herd.

REFERENCES

Connecticut Agricultural Experiment Station. 1970a. J. Gordon Hanna, Chief Chemist, letter to Richard M. Parry, State Department of Agriculture regarding milk samples from the William Devos Farm. July 10, 1970.

Connecticut Agricultural Experiment Station. 1970b. J. Gordon Hanna, Chief Chemist, letter to Richard M. Parry, State Department of Agriculture regarding milk samples from the William Devos Farm. July 30, 1970.

Connecticut Agricultural Experiment Station. 1970c. J. Gordon Hanna, Chief Chemist, letter to Richard M. Parry, State Department of Agriculture regarding milk samples from the William Devos Farm. October 27, 1970.

Connecticut Agricultural Experiment Station. 1970d. J. Gordon Hanna, Chief Chemist, letter to Richard M. Parry, State Department of Agriculture regarding milk samples from the William Devos Farm. November 23, 1970.

Connecticut Agricultural Experiment Station. 1970e. J. Gordon Hanna, Chief Chemist, letter to Richard M. Parry, State Department of Agriculture regarding milk samples from the William Devos Farm. December 17, 1970.

GE (General Electric Company). 1971. Pyranol Sampling – 1970-1971. Confidential Memorandum prepared by Edward C. Fan. January 20, 1971.

MADFA (Massachusetts Department of Food and Agriculture). 1993. Milk sample collection certification form. April 20, 1993.

New England Milk Producers' Association. 1970. Alfred C. Drew, Jr. letter to Mr. Doubleday of the Water Pollution Control Center, University of Massachusetts regarding PCB contamination of milk from the William Devos farm. October 19, 1970.

Table D.2-1

DeVos Farm Pasture and Cultivation Area Summary

Spatially-weighted data from	Fraction of area within 1-ppm tPCB isopleth	tPCB EPC (mg/kg)
Pasture = “Open Area 1” Pasture	0.728	22.6
Pasture = All open areas (i.e. “Open Area 1,” “Open Area 2,” and “Other Open Areas”)	0.563	27.1
Cultivation Area (assumed to be hayfield)	0.122	3.3*

* Only one sample was available from the cultivation area; therefore, this EPC is equal to the measured concentration for this one sample instead of a 95% UCL on the mean.

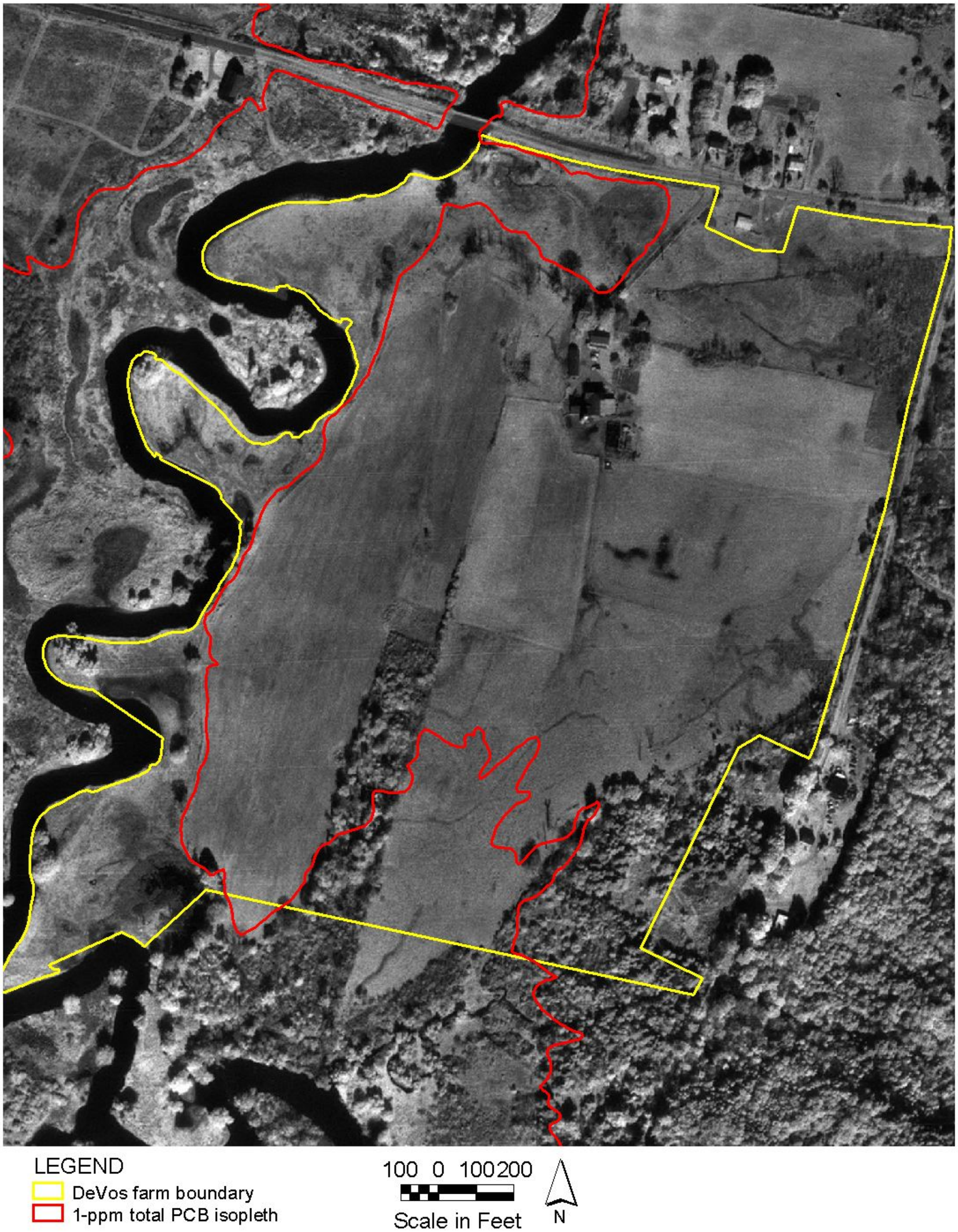


Figure D.2-1 Aerial Photograph of the DeVos Farm, 1972

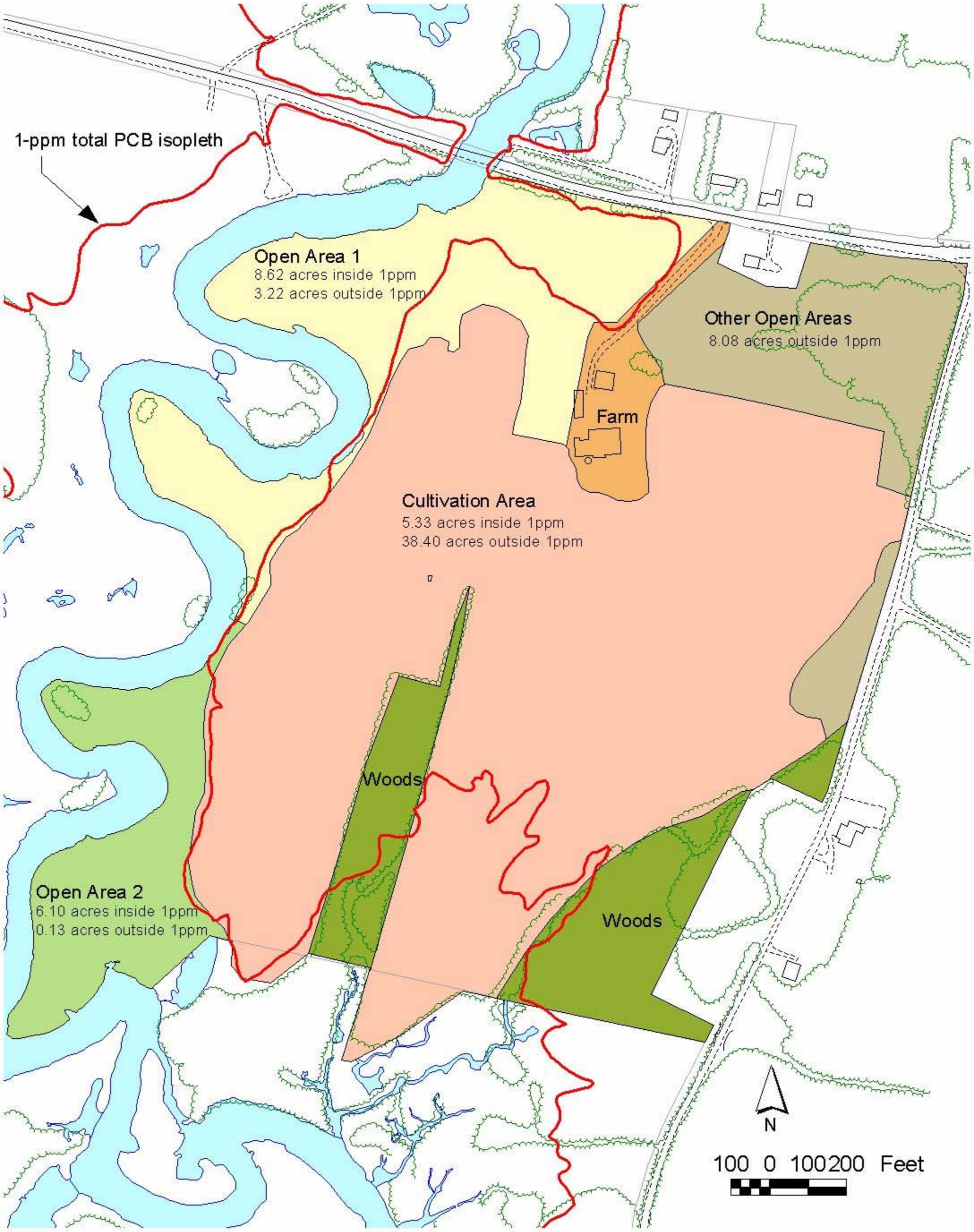
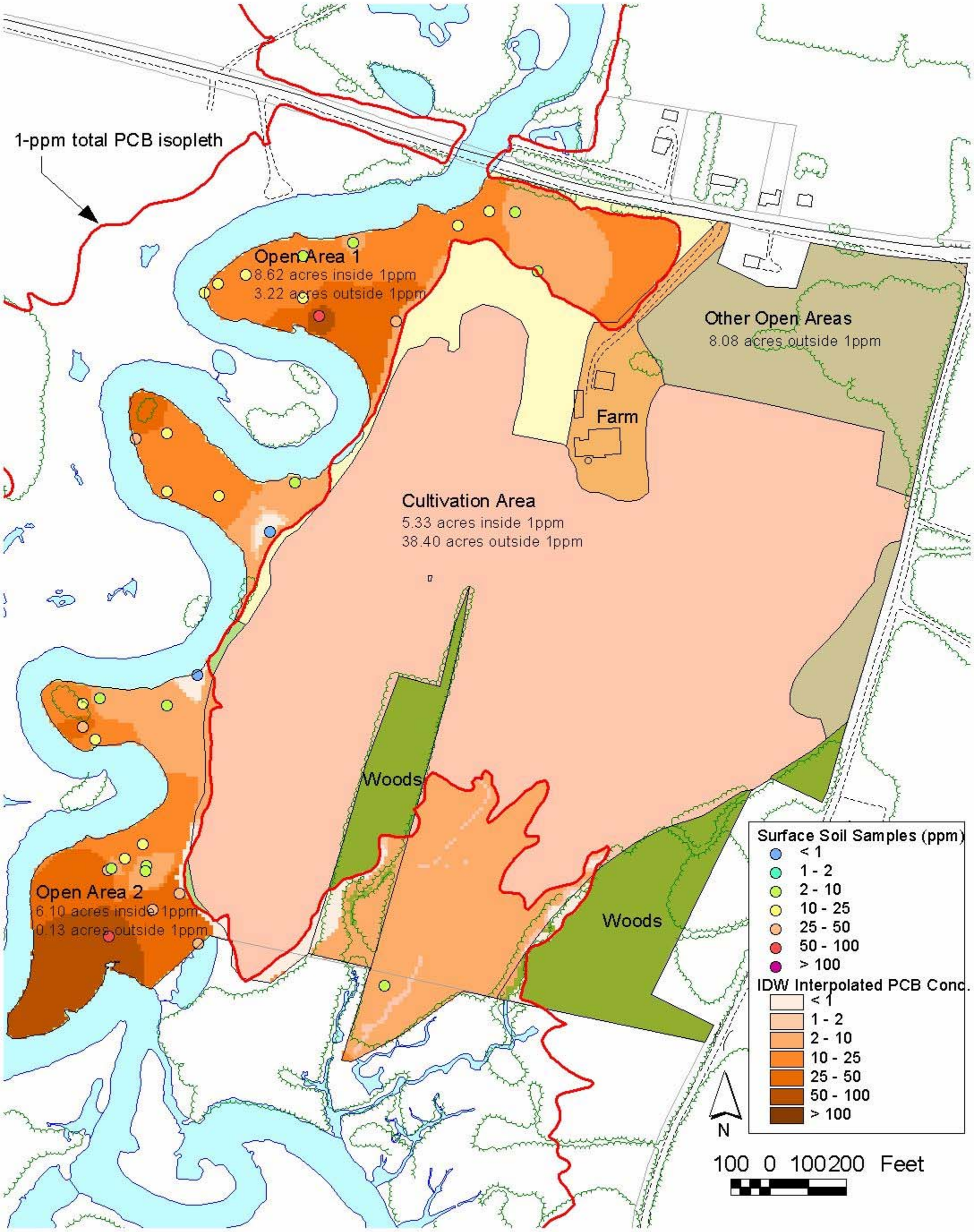


Figure D.2-2 Approximate Cattle Exposure Areas on DeVos Farm, 1972



Note: These samples were collected between 1988 and 2002.

Figure D.2-3 Raw and Spatially Weighted tPCB Concentration Data for Floodplain Soil (0- to 6-inch depth) on the DeVos Farm

EXHIBIT D.2-1

DEPARTMENT OF HEALTH AND HUMAN SERVICES SAMPLING CORRESPONDENCE

DEPARTMENT OF HEALTH & HUMAN SERVICES PUBLIC HEALTH SERVICE

FOOD AND DRUG ADMINISTRATION
Winchester Engineering and Analytical Center
109 Holton Street, Winchester, MA 01890
Telephone: 617-729-5700

May 10, 1993

781-729-5700

Mr. Richard Waskiewicz
Mass. Dept. of Public Health
Div. of Food & Drugs
305 South St.
Jamaica Plain, MA 02130

Dear Richard,

We have examined the seven (7) raw milk samples you submitted to us for PCB's and Organochlorine Pesticide residue analysis. Our examination revealed the following:

FDA Sample No.	MA Sample No.	PCB's	Organochlorine Pesticides
INV93-401-105	1 A-B-C	None	None
INV93-401-106	2 A-B-C	None	None
INV93-401-107	3 A-B-C	None	None
INV93-401-108	4 A-B-C	None	None
INV93-401-109	5 A-B-C	None	None
INV93-401-110	6 A-B-C	None	None
INV93-401-111	7 A-B-C	None	None

Sincerely,

Martin J. Finkelson

Martin J. Finkelson
Director, Analytical Branch

cc: D. Field, BOS-DO
cc: w/Lead Sple. No. C/R 93-401-105

EXHIBIT D.2-2

PYRANOL SAMPLING, 1970-1971

GENERAL ELECTRIC

DIAL COMM. 8*234-2269 DATE: January 20, 1971 COPIES: CONFIDENTIAL

DEPT: R&U - POLLUTION CONTROL

ADDRESS: Building 43 - 390

SUBJECT: Pyranol Sampling - 1970 - 1971

Mr. James H. Thayer
Building 43 - 390

The following pyranol results were obtained from samples sent to Monsanto Chemical Company, St. Louis:

	Pyranol Concentration ppb in Aroclor 1254				
Sample	11/18/70	12/3/70	12/14/70	1/14/71	
14	50.0	50.0			
274	13.0	155.0			
S	21.0	1.2			
4	0.8	0.75			
Gaging Station	0.5	0.31			
Elm St. Bridge	5.0	4.4			
North Bridge		2.9			
Woods Pond Outlet		1.0			
Milk #1 (Machine)			52		
Milk #2 (Machine)			49		
Milk #3 (Hand)			44		67
Milk #4 (Machine)				65	57 70

Edward C. Fan

/jr

ATTACHMENT D.3

CANCER RISK AND NONCANCER HAZARD CALCULATIONS FOR EACH EXPOSURE SCENARIO

ATTACHMENT D.3

CANCER RISK AND NONCANCER HAZARD CALCULATIONS FOR EACH EXPOSURE SCENARIO

This attachment consists of worksheets showing the estimated total PCB (tPCB), dioxin, and furan concentrations in food and the average daily doses (ADDs), lifetime average daily doses (LADDs), cancer risks, and noncancer hazard indices (HIs) associated with these concentrations for each scenario. To avoid redundancy given the linear nature of the risk model, worksheets are provided for only one of the 16 combinations of tPCB concentration and fraction in the floodplain (i.e., 2 mg/kg tPCB and fraction = 1) evaluated in Section 5 of this appendix.

In Attachment D.3a, food concentrations, ADDs, LADDs, cancer risks and noncancer HIs for tPCBs are shown on the first row of each worksheet. These results are discussed in Section 5 of this appendix. Estimates for dioxin and furan congeners, reported as TEQ cancer risk as discussed in Section 7.2.4.1 of this appendix, are provided on the same worksheets.

Attachment D.3b includes food concentrations, LADDs, and cancer risks from TEQ, using bioconcentration factors for undetected congeners that are based on detection limits rather than measured concentrations in animal tissue.

Attachment D.3c includes worksheets with food concentrations, LADDs, and cancer risks from TEQ incorporating soil-to-plant TFs for dioxin and furan congeners. The soil-to-plant TFs used in these calculations are shown in a table preceding the worksheets.

ATTACHMENT D.3A

PREDICTED FOOD CONCENTRATIONS, ADDs, LADDs, CANCER RISKS, AND NONCANCER HIs FOR tPCBs

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR COMMERCIAL DAIRY AT 2 MG/KG TOTAL PCBS IN SOIL

	Milk concentration (mg total PCBs/kg whole milk; mg congener TEQ/kg whole milk) [a]	CTE ADD_{milk} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{milk}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	2.19E-04	9.24E-06	2.60E-06	4.62E-01	1.30E-01	7.92E-07	1.08E-06	7.92E-07	1.08E-06	1.87E-06
PCB-77	3.70E-11	1.56E-12	4.40E-13	NA	NA	1.34E-13	1.82E-13	2.01E-08	2.73E-08	4.75E-08
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-10	5.02E-12	1.41E-12	NA	NA	4.30E-13	5.85E-13	6.45E-08	8.77E-08	1.52E-07
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	6.44E-10	2.72E-11	7.66E-12	NA	NA	2.34E-12	3.17E-12	3.50E-07	4.76E-07	8.26E-07
PCB-123	1.54E-11	6.49E-13	1.83E-13	NA	NA	5.56E-14	7.56E-14	8.35E-09	1.13E-08	1.97E-08
PCB-126	6.23E-08	2.64E-09	7.41E-10	NA	NA	2.26E-10	3.07E-10	3.39E-05	4.61E-05	8.00E-05
PCB-156	7.02E-10	2.97E-11	8.35E-12	NA	NA	2.54E-12	3.46E-12	3.82E-07	5.19E-07	9.00E-07
PCB-157	1.89E-10	7.99E-12	2.25E-12	NA	NA	6.85E-13	9.31E-13	1.03E-07	1.40E-07	2.42E-07
PCB-167	1.02E-11	4.31E-13	1.21E-13	NA	NA	3.69E-14	5.02E-14	5.54E-09	7.52E-09	1.31E-08
PCB-169	4.27E-09	1.81E-10	5.08E-11	NA	NA	1.55E-11	2.10E-11	2.32E-06	3.16E-06	5.48E-06
PCB-189	5.25E-11	2.22E-12	6.24E-13	NA	NA	1.90E-13	2.59E-13	2.85E-08	3.88E-08	6.73E-08
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**8E-07**	**1E-06**	**2E-06**
Dioxin-like PCB congeners	3.7E-05	5.1E-05	8.8E-05
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**4E-05**	**5E-05**	**9E-05**
Total CTE Hazard Index	**5E-01**	**1E-01**	

Notes:
a Modeled from corn and based on fat content of Jersey cow milk.

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR COMMERCIAL DAIRY AT 2 MG/KG TOTAL PCBS IN SOIL

	RME ADD_{milk} (mg/kg-day)		RME Hazard Index		RME $LADD_{milk}$ (mg/kg-day)		RME Cancer Risk		
	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	1.47E-05	3.17E-06	7.37E-01	1.58E-01	1.26E-06	2.89E-06	2.53E-06	5.79E-06	8.31E-06
PCB-77	2.49E-12	5.36E-13	NA	NA	2.14E-13	4.90E-13	3.21E-08	7.35E-08	1.06E-07
PCB-81	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	8.00E-12	1.72E-12	NA	NA	6.86E-13	1.57E-12	1.03E-07	2.36E-07	3.39E-07
PCB-114	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	4.34E-11	9.33E-12	NA	NA	3.72E-12	8.53E-12	5.58E-07	1.28E-06	1.84E-06
PCB-123	1.03E-12	2.22E-13	NA	NA	8.87E-14	2.03E-13	1.33E-08	3.05E-08	4.38E-08
PCB-126	4.20E-09	9.03E-10	NA	NA	3.60E-10	8.25E-10	5.40E-05	1.24E-04	1.78E-04
PCB-156	4.73E-11	1.02E-11	NA	NA	4.06E-12	9.29E-12	6.08E-07	1.39E-06	2.00E-06
PCB-157	1.27E-11	2.74E-12	NA	NA	1.09E-12	2.50E-12	1.64E-07	3.75E-07	5.39E-07
PCB-167	6.86E-13	1.47E-13	NA	NA	5.88E-14	1.35E-13	8.82E-09	2.02E-08	2.90E-08
PCB-169	2.88E-10	6.18E-11	NA	NA	2.47E-11	5.65E-11	3.70E-06	8.48E-06	1.22E-05
PCB-189	3.54E-12	7.60E-13	NA	NA	3.03E-13	6.95E-13	4.55E-08	1.04E-07	1.50E-07
2,3,7,8-TCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**3E-06**	**6E-06**	**8E-06**
Dioxin-like PCB congeners	5.9E-05	1.4E-04	2.0E-04
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ RME Cancer Risk	**6E-05**	**1E-04**	**2E-04**
Total RME Hazard Index	**7E-01**	**2E-01**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR COMMERCIAL BEEF AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE beef concentration (mg total PCB/kg beef; mg congener TEQ/kg beef)	CTE ADD_{beef} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{beef}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	2.59E-02	5.13E-05	3.12E-05	2.57E+00	1.56E+00	4.40E-06	1.29E-05	4.40E-06	1.29E-05	1.73E-05
PCB-77	2.43E-09	4.82E-12	2.93E-12	NA	NA	4.13E-13	1.21E-12	6.19E-08	1.82E-07	2.44E-07
PCB-81	9.35E-12	1.85E-14	1.12E-14	NA	NA	1.59E-15	4.66E-15	2.38E-10	6.99E-10	9.36E-10
PCB-105	1.22E-08	2.42E-11	1.47E-11	NA	NA	2.08E-12	6.10E-12	3.11E-07	9.15E-07	1.23E-06
PCB-114	1.29E-09	2.56E-12	1.55E-12	NA	NA	2.19E-13	6.44E-13	3.29E-08	9.66E-08	1.29E-07
PCB-118	6.03E-08	1.19E-10	7.25E-11	NA	NA	1.02E-11	3.00E-11	1.53E-06	4.50E-06	6.04E-06
PCB-123	1.98E-09	3.92E-12	2.38E-12	NA	NA	3.36E-13	9.86E-13	5.04E-08	1.48E-07	1.98E-07
PCB-126	3.93E-06	7.77E-09	4.72E-09	NA	NA	6.66E-10	1.96E-09	9.99E-05	2.93E-04	3.93E-04
PCB-156	8.71E-08	1.72E-10	1.05E-10	NA	NA	1.48E-11	4.34E-11	2.22E-06	6.51E-06	8.72E-06
PCB-157	2.57E-08	5.08E-11	3.09E-11	NA	NA	4.35E-12	1.28E-11	6.53E-07	1.92E-06	2.57E-06
PCB-167	1.13E-09	2.24E-12	1.36E-12	NA	NA	1.92E-13	5.63E-13	2.87E-08	8.44E-08	1.13E-07
PCB-169	2.36E-07	4.67E-10	2.84E-10	NA	NA	4.00E-11	1.17E-10	6.00E-06	1.76E-05	2.36E-05
PCB-189	5.93E-09	1.17E-11	7.13E-12	NA	NA	1.01E-12	2.95E-12	1.51E-07	4.43E-07	5.94E-07
2,3,7,8-TCDD	9.39E-09	1.86E-11	1.13E-11	NA	NA	1.59E-12	4.68E-12	2.39E-07	7.02E-07	9.41E-07
1,2,3,7,8-PeCDD	1.81E-08	3.58E-11	2.17E-11	NA	NA	3.07E-12	9.00E-12	4.60E-07	1.35E-06	1.81E-06
1,2,3,4,7,8-HxCDD	1.19E-09	2.35E-12	1.43E-12	NA	NA	2.01E-13	5.91E-13	3.02E-08	8.87E-08	1.19E-07
1,2,3,6,7,8-HxCDD	3.15E-09	6.24E-12	3.79E-12	NA	NA	5.35E-13	1.57E-12	8.02E-08	2.35E-07	3.16E-07
1,2,3,7,8,9-HxCDD	1.49E-09	2.94E-12	1.79E-12	NA	NA	2.52E-13	7.41E-13	3.79E-08	1.11E-07	1.49E-07
1,2,3,4,6,7,8-HpCDD	6.80E-10	1.35E-12	8.18E-13	NA	NA	1.15E-13	3.39E-13	1.73E-08	5.08E-08	6.81E-08
OCDD	9.30E-12	1.84E-14	1.12E-14	NA	NA	1.58E-15	4.63E-15	2.37E-10	6.95E-10	9.32E-10
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	6.95E-08	1.38E-10	8.36E-11	NA	NA	1.18E-11	3.46E-11	1.77E-06	5.19E-06	6.96E-06
1,2,3,4,7,8-HxCDF	8.09E-09	1.60E-11	9.73E-12	NA	NA	1.37E-12	4.03E-12	2.06E-07	6.04E-07	8.10E-07
1,2,3,6,7,8-HXCDF	4.31E-09	8.52E-12	5.18E-12	NA	NA	7.31E-13	2.15E-12	1.10E-07	3.22E-07	4.31E-07
2,3,4,6,7,8-HxCDF	4.04E-09	7.99E-12	4.85E-12	NA	NA	6.85E-13	2.01E-12	1.03E-07	3.02E-07	4.04E-07
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	9.13E-10	1.81E-12	1.10E-12	NA	NA	1.55E-13	4.55E-13	2.32E-08	6.82E-08	9.15E-08
1,2,3,4,7,8,9-HpCDF	1.09E-10	2.15E-13	1.31E-13	NA	NA	1.85E-14	5.42E-14	2.77E-09	8.13E-09	1.09E-08
OCDF	1.46E-12	2.88E-15	1.75E-15	NA	NA	2.47E-16	7.26E-16	3.71E-11	1.09E-10	1.46E-10

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**4E-06**	**1E-05**	**2E-05**
Dioxin-like PCB congeners	1.1E-04	3.3E-04	4.4E-04
Dioxins	8.6E-07	2.5E-06	3.4E-06
Furans	2.2E-06	6.5E-06	8.7E-06
Total TEQ CTE Cancer Risk	**1E-04**	**3E-04**	**4E-04**
Total CTE Hazard Index	**3E+00**	**2E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR COMMERCIAL BEEF AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Beef Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME ADD_{beef} (mg/kg-day)		RME Hazard Index		RME $LADD_{beef}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.82E-02	9.88E-05	5.39E-05	4.94E+00	2.69E+00	8.47E-06	4.93E-05	1.69E-05	9.86E-05	1.15E-04
PCB-77	3.59E-09	9.28E-12	5.06E-12	NA	NA	7.95E-13	4.63E-12	1.19E-07	6.94E-07	8.13E-07
PCB-81	1.38E-11	3.56E-14	1.94E-14	NA	NA	3.06E-15	1.78E-14	4.58E-10	2.67E-09	3.12E-09
PCB-105	1.81E-08	4.67E-11	2.54E-11	NA	NA	4.00E-12	2.33E-11	6.00E-07	3.49E-06	4.09E-06
PCB-114	1.91E-09	4.93E-12	2.69E-12	NA	NA	4.22E-13	2.46E-12	6.34E-08	3.69E-07	4.32E-07
PCB-118	8.89E-08	2.30E-10	1.25E-10	NA	NA	1.97E-11	1.15E-10	2.95E-06	1.72E-05	2.01E-05
PCB-123	2.92E-09	7.55E-12	4.12E-12	NA	NA	6.47E-13	3.76E-12	9.71E-08	5.64E-07	6.62E-07
PCB-126	5.79E-06	1.50E-08	8.16E-09	NA	NA	1.28E-09	7.46E-09	1.92E-04	1.12E-03	1.31E-03
PCB-156	1.28E-07	3.32E-10	1.81E-10	NA	NA	2.85E-11	1.66E-10	4.27E-06	2.48E-05	2.91E-05
PCB-157	3.79E-08	9.79E-11	5.34E-11	NA	NA	8.39E-12	4.88E-11	1.26E-06	7.32E-06	8.58E-06
PCB-167	1.67E-09	4.31E-12	2.35E-12	NA	NA	3.69E-13	2.15E-12	5.54E-08	3.22E-07	3.78E-07
PCB-169	3.48E-07	8.99E-10	4.90E-10	NA	NA	7.71E-11	4.48E-10	1.16E-05	6.72E-05	7.88E-05
PCB-189	8.75E-09	2.26E-11	1.23E-11	NA	NA	1.94E-12	1.13E-11	2.91E-07	1.69E-06	1.98E-06
2,3,7,8-TCDD	1.38E-08	3.58E-11	1.95E-11	NA	NA	3.07E-12	1.79E-11	4.60E-07	2.68E-06	3.14E-06
1,2,3,7,8-PeCDD	2.67E-08	6.89E-11	3.76E-11	NA	NA	5.91E-12	3.44E-11	8.86E-07	5.15E-06	6.04E-06
1,2,3,4,7,8-HxCDD	1.75E-09	4.53E-12	2.47E-12	NA	NA	3.88E-13	2.26E-12	5.82E-08	3.38E-07	3.97E-07
1,2,3,6,7,8-HxCDD	4.65E-09	1.20E-11	6.55E-12	NA	NA	1.03E-12	5.99E-12	1.55E-07	8.99E-07	1.05E-06
1,2,3,7,8,9-HxCDD	2.19E-09	5.67E-12	3.09E-12	NA	NA	4.86E-13	2.83E-12	7.29E-08	4.24E-07	4.97E-07
1,2,3,4,6,7,8-HpCDD	1.00E-09	2.59E-12	1.41E-12	NA	NA	2.22E-13	1.29E-12	3.33E-08	1.94E-07	2.27E-07
OCDD	1.37E-11	3.55E-14	1.93E-14	NA	NA	3.04E-15	1.77E-14	4.56E-10	2.65E-09	3.11E-09
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.03E-07	2.65E-10	1.45E-10	NA	NA	2.27E-11	1.32E-10	3.41E-06	1.98E-05	2.32E-05
1,2,3,4,7,8-HxCDF	1.19E-08	3.08E-11	1.68E-11	NA	NA	2.64E-12	1.54E-11	3.97E-07	2.31E-06	2.70E-06
1,2,3,6,7,8-HXCDF	6.35E-09	1.64E-11	8.95E-12	NA	NA	1.41E-12	8.19E-12	2.11E-07	1.23E-06	1.44E-06
2,3,4,6,7,8-HxCDF	5.95E-09	1.54E-11	8.40E-12	NA	NA	1.32E-12	7.68E-12	1.98E-07	1.15E-06	1.35E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	1.35E-09	3.48E-12	1.90E-12	NA	NA	2.98E-13	1.74E-12	4.48E-08	2.60E-07	3.05E-07
1,2,3,4,7,8,9-HpCDF	1.60E-10	4.15E-13	2.26E-13	NA	NA	3.56E-14	2.07E-13	5.33E-09	3.10E-08	3.64E-08
OCDF	2.15E-12	5.56E-15	3.03E-15	NA	NA	4.76E-16	2.77E-15	7.14E-11	4.15E-10	4.87E-10

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**2E-05**	**1E-04**	**1E-04**
Dioxin-like PCB congeners	2.1E-04	1.2E-03	1.5E-03
Dioxins	1.7E-06	9.7E-06	1.1E-05
Furans	4.3E-06	2.5E-05	2.9E-05
Total TEQ RME Cancer Risk	**2E-04**	**1E-03**	**1E-03**
Total RME Hazard Index	**5E+00**	**3E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR BACKYARD DAIRY AT 2 MG/KG TOTAL PCBS IN SOIL

	Milk concentration (mg total PCBs/kg whole milk; mg congener TEQ/kg whole milk) [a]	CTE ADD_{milk} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{milk}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	1.03E-02	4.38E-04	2.07E-04	2.19E+01	1.04E+01	3.75E-05	2.67E-05	3.75E-05	2.67E-05	6.42E-05
PCB-77	1.30E-09	5.49E-11	2.60E-11	NA	NA	4.70E-12	3.34E-12	7.05E-07	5.01E-07	1.21E-06
PCB-81	2.17E-12	9.18E-14	4.35E-14	NA	NA	7.87E-15	5.60E-15	1.18E-09	8.39E-10	2.02E-09
PCB-105	5.19E-09	2.20E-10	1.04E-10	NA	NA	1.88E-11	1.34E-11	2.82E-06	2.01E-06	4.83E-06
PCB-114	3.00E-10	1.27E-11	6.02E-12	NA	NA	1.09E-12	7.74E-13	1.63E-07	1.16E-07	2.79E-07
PCB-118	2.67E-08	1.13E-09	5.36E-10	NA	NA	9.70E-11	6.89E-11	1.45E-05	1.03E-05	2.49E-05
PCB-123	7.64E-10	3.23E-11	1.53E-11	NA	NA	2.77E-12	1.97E-12	4.15E-07	2.95E-07	7.10E-07
PCB-126	2.15E-06	9.08E-08	4.30E-08	NA	NA	7.78E-09	5.53E-09	1.17E-03	8.30E-04	2.00E-03
PCB-156	3.41E-08	1.44E-09	6.84E-10	NA	NA	1.24E-10	8.79E-11	1.86E-05	1.32E-05	3.17E-05
PCB-157	9.70E-09	4.10E-10	1.94E-10	NA	NA	3.52E-11	2.50E-11	5.28E-06	3.75E-06	9.03E-06
PCB-167	4.64E-10	1.96E-11	9.30E-12	NA	NA	1.68E-12	1.20E-12	2.52E-07	1.79E-07	4.32E-07
PCB-169	1.39E-07	5.89E-09	2.79E-09	NA	NA	5.05E-10	3.59E-10	7.57E-05	5.38E-05	1.30E-04
PCB-189	2.42E-09	1.02E-10	4.84E-11	NA	NA	8.76E-12	6.23E-12	1.31E-06	9.34E-07	2.25E-06
2,3,7,8-TCDD	2.18E-09	9.23E-11	4.37E-11	NA	NA	7.91E-12	5.62E-12	1.19E-06	8.43E-07	2.03E-06
1,2,3,7,8-PeCDD	4.20E-09	1.78E-10	8.41E-11	NA	NA	1.52E-11	1.08E-11	2.28E-06	1.62E-06	3.91E-06
1,2,3,4,7,8-HxCDD	2.76E-10	1.17E-11	5.53E-12	NA	NA	9.99E-13	7.10E-13	1.50E-07	1.07E-07	2.56E-07
1,2,3,6,7,8-HxCDD	7.32E-10	3.10E-11	1.47E-11	NA	NA	2.65E-12	1.89E-12	3.98E-07	2.83E-07	6.81E-07
1,2,3,7,8,9-HxCDD	3.46E-10	1.46E-11	6.93E-12	NA	NA	1.25E-12	8.91E-13	1.88E-07	1.34E-07	3.22E-07
1,2,3,4,6,7,8-HpCDD	1.58E-10	6.68E-12	3.17E-12	NA	NA	5.73E-13	4.07E-13	8.59E-08	6.11E-08	1.47E-07
OCDD	2.16E-12	9.14E-14	4.33E-14	NA	NA	7.83E-15	5.57E-15	1.17E-09	8.35E-10	2.01E-09
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.62E-08	6.83E-10	3.24E-10	NA	NA	5.85E-11	4.16E-11	8.78E-06	6.24E-06	1.50E-05
1,2,3,4,7,8-HxCDF	1.88E-09	7.95E-11	3.77E-11	NA	NA	6.81E-12	4.84E-12	1.02E-06	7.26E-07	1.75E-06
1,2,3,6,7,8-HXCDF	1.00E-09	4.23E-11	2.01E-11	NA	NA	3.63E-12	2.58E-12	5.44E-07	3.87E-07	9.31E-07
2,3,4,6,7,8-HxCDF	9.38E-10	3.97E-11	1.88E-11	NA	NA	3.40E-12	2.42E-12	5.10E-07	3.63E-07	8.73E-07
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	2.12E-10	8.97E-12	4.25E-12	NA	NA	7.69E-13	5.47E-13	1.15E-07	8.20E-08	1.97E-07
1,2,3,4,7,8,9-HpCDF	2.53E-11	1.07E-12	5.07E-13	NA	NA	9.16E-14	6.51E-14	1.37E-08	9.77E-09	2.35E-08
OCDF	3.39E-13	1.43E-14	6.78E-15	NA	NA	1.23E-15	8.72E-16	1.84E-10	1.31E-10	3.15E-10

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**4E-05**	**3E-05**	**6E-05**
Dioxin-like PCB congeners	1.3E-03	9.1E-04	2.2E-03
Dioxins	4.3E-06	3.1E-06	7.3E-06
Furans	1.1E-05	7.8E-06	1.9E-05
Total TEQ CTE Cancer Risk	**1E-03**	**9E-04**	**2E-03**
Total CTE Hazard Index	**2E+01**	**1E+01**	

Notes:

a Modeled from corn and based on fat content of Jersey cow milk.

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR BACKYARD DAIRY AT 2 MG/KG TOTAL PCBS IN SOIL

	RME ADD_{milk} (mg/kg-day)		RME Hazard Index		RME $LADD_{milk}$ (mg/kg-day)		RME Cancer Risk		
	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.97E-04	1.80E-04	3.49E+01	8.98E+00	5.98E-05	1.00E-04	1.20E-04	2.00E-04	3.20E-04
PCB-77	8.74E-11	2.25E-11	NA	NA	7.50E-12	1.25E-11	1.12E-06	1.88E-06	3.01E-06
PCB-81	1.46E-13	3.77E-14	NA	NA	1.25E-14	2.10E-14	1.88E-09	3.15E-09	5.03E-09
PCB-105	3.50E-10	9.01E-11	NA	NA	3.00E-11	5.02E-11	4.50E-06	7.53E-06	1.20E-05
PCB-114	2.02E-11	5.21E-12	NA	NA	1.74E-12	2.90E-12	2.60E-07	4.36E-07	6.96E-07
PCB-118	1.80E-09	4.64E-10	NA	NA	1.55E-10	2.59E-10	2.32E-05	3.88E-05	6.20E-05
PCB-123	5.15E-11	1.33E-11	NA	NA	4.41E-12	7.38E-12	6.62E-07	1.11E-06	1.77E-06
PCB-126	1.45E-07	3.73E-08	NA	NA	1.24E-08	2.08E-08	1.86E-03	3.11E-03	4.97E-03
PCB-156	2.30E-09	5.92E-10	NA	NA	1.97E-10	3.30E-10	2.96E-05	4.95E-05	7.91E-05
PCB-157	6.54E-10	1.68E-10	NA	NA	5.61E-11	9.38E-11	8.41E-06	1.41E-05	2.25E-05
PCB-167	3.13E-11	8.05E-12	NA	NA	2.68E-12	4.49E-12	4.02E-07	6.73E-07	1.07E-06
PCB-169	9.39E-09	2.42E-09	NA	NA	8.05E-10	1.35E-09	1.21E-04	2.02E-04	3.23E-04
PCB-189	1.63E-10	4.19E-11	NA	NA	1.40E-11	2.34E-11	2.09E-06	3.50E-06	5.60E-06
2,3,7,8-TCDD	1.47E-10	3.79E-11	NA	NA	1.26E-11	2.11E-11	1.89E-06	3.16E-06	5.06E-06
1,2,3,7,8-PeCDD	2.83E-10	7.29E-11	NA	NA	2.43E-11	4.06E-11	3.64E-06	6.09E-06	9.73E-06
1,2,3,4,7,8-HxCDD	1.86E-11	4.79E-12	NA	NA	1.59E-12	2.67E-12	2.39E-07	4.00E-07	6.39E-07
1,2,3,6,7,8-HxCDD	4.94E-11	1.27E-11	NA	NA	4.23E-12	7.08E-12	6.35E-07	1.06E-06	1.70E-06
1,2,3,7,8,9-HxCDD	2.33E-11	6.00E-12	NA	NA	2.00E-12	3.34E-12	3.00E-07	5.01E-07	8.01E-07
1,2,3,4,6,7,8-HpCDD	1.06E-11	2.74E-12	NA	NA	9.13E-13	1.53E-12	1.37E-07	2.29E-07	3.66E-07
OCDD	1.46E-13	3.75E-14	NA	NA	1.25E-14	2.09E-14	1.87E-09	3.13E-09	5.01E-09
2,3,7,8-TCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.09E-09	2.80E-10	NA	NA	9.33E-11	1.56E-10	1.40E-05	2.34E-05	3.74E-05
1,2,3,4,7,8-HxCDF	1.27E-10	3.26E-11	NA	NA	1.09E-11	1.82E-11	1.63E-06	2.73E-06	4.35E-06
1,2,3,6,7,8-HXCDF	6.74E-11	1.74E-11	NA	NA	5.78E-12	9.67E-12	8.67E-07	1.45E-06	2.32E-06
2,3,4,6,7,8-HxCDF	6.32E-11	1.63E-11	NA	NA	5.42E-12	9.07E-12	8.13E-07	1.36E-06	2.17E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	1.43E-11	3.68E-12	NA	NA	1.23E-12	2.05E-12	1.84E-07	3.08E-07	4.92E-07
1,2,3,4,7,8,9-HpCDF	1.70E-12	4.39E-13	NA	NA	1.46E-13	2.44E-13	2.19E-08	3.67E-08	5.86E-08
OCDF	2.28E-14	5.88E-15	NA	NA	1.96E-15	3.27E-15	2.93E-10	4.91E-10	7.84E-10

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**1E-04**	**2E-04**	**3E-04**
Dioxin-like PCB congeners	2.1E-03	3.4E-03	5.5E-03
Dioxins	6.8E-06	1.1E-05	1.8E-05
Furans	1.8E-05	2.9E-05	4.7E-05
Total TEQ RME Cancer Risk	**2E-03**	**3E-03**	**6E-03**
Total RME Hazard Index	**3E+01**	**9E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR BACKYARD BEEF AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE beef concentration (mg total PCB/kg beef; mg congener TEQ/kg beef)	CTE ADD_{beef} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{beef}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.94E-02	7.80E-05	6.00E-05	3.90E+00	3.00E+00	6.68E-06	7.71E-06	6.68E-06	7.71E-06	1.44E-05
PCB-77	4.72E-09	9.33E-12	7.17E-12	NA	NA	8.00E-13	9.22E-13	1.20E-07	1.38E-07	2.58E-07
PCB-81	9.35E-12	1.85E-14	1.42E-14	NA	NA	1.59E-15	1.83E-15	2.38E-10	2.74E-10	5.12E-10
PCB-105	1.96E-08	3.87E-11	2.98E-11	NA	NA	3.32E-12	3.83E-12	4.98E-07	5.74E-07	1.07E-06
PCB-114	1.29E-09	2.56E-12	1.97E-12	NA	NA	2.19E-13	2.53E-13	3.29E-08	3.79E-08	7.08E-08
PCB-118	1.00E-07	1.98E-10	1.52E-10	NA	NA	1.70E-11	1.96E-11	2.54E-06	2.93E-06	5.48E-06
PCB-123	2.93E-09	5.79E-12	4.45E-12	NA	NA	4.96E-13	5.72E-13	7.45E-08	8.59E-08	1.60E-07
PCB-126	7.77E-06	1.54E-08	1.18E-08	NA	NA	1.32E-09	1.52E-09	1.98E-04	2.28E-04	4.26E-04
PCB-156	1.30E-07	2.58E-10	1.98E-10	NA	NA	2.21E-11	2.55E-11	3.32E-06	3.83E-06	7.14E-06
PCB-157	3.73E-08	7.39E-11	5.68E-11	NA	NA	6.33E-12	7.30E-12	9.50E-07	1.10E-06	2.05E-06
PCB-167	1.76E-09	3.48E-12	2.67E-12	NA	NA	2.98E-13	3.44E-13	4.47E-08	5.16E-08	9.63E-08
PCB-169	4.99E-07	9.88E-10	7.60E-10	NA	NA	8.47E-11	9.77E-11	1.27E-05	1.46E-05	2.73E-05
PCB-189	9.17E-09	1.81E-11	1.40E-11	NA	NA	1.56E-12	1.79E-12	2.33E-07	2.69E-07	5.02E-07
2,3,7,8-TCDD	9.39E-09	1.86E-11	1.43E-11	NA	NA	1.59E-12	1.84E-12	2.39E-07	2.76E-07	5.14E-07
1,2,3,7,8-PeCDD	1.81E-08	3.58E-11	2.75E-11	NA	NA	3.07E-12	3.54E-12	4.60E-07	5.30E-07	9.90E-07
1,2,3,4,7,8-HxCDD	1.19E-09	2.35E-12	1.81E-12	NA	NA	2.01E-13	2.32E-13	3.02E-08	3.48E-08	6.50E-08
1,2,3,6,7,8-HxCDD	3.15E-09	6.24E-12	4.80E-12	NA	NA	5.35E-13	6.17E-13	8.02E-08	9.25E-08	1.73E-07
1,2,3,7,8,9-HxCDD	1.49E-09	2.94E-12	2.26E-12	NA	NA	2.52E-13	2.91E-13	3.79E-08	4.37E-08	8.15E-08
1,2,3,4,6,7,8-HpCDD	6.80E-10	1.35E-12	1.03E-12	NA	NA	1.15E-13	1.33E-13	1.73E-08	2.00E-08	3.73E-08
OCDD	9.30E-12	1.84E-14	1.42E-14	NA	NA	1.58E-15	1.82E-15	2.37E-10	2.73E-10	5.10E-10
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	6.95E-08	1.38E-10	1.06E-10	NA	NA	1.18E-11	1.36E-11	1.77E-06	2.04E-06	3.81E-06
1,2,3,4,7,8-HxCDF	8.09E-09	1.60E-11	1.23E-11	NA	NA	1.37E-12	1.58E-12	2.06E-07	2.37E-07	4.43E-07
1,2,3,6,7,8-HXCDF	4.31E-09	8.52E-12	6.55E-12	NA	NA	7.31E-13	8.42E-13	1.10E-07	1.26E-07	2.36E-07
2,3,4,6,7,8-HxCDF	4.04E-09	7.99E-12	6.14E-12	NA	NA	6.85E-13	7.90E-13	1.03E-07	1.18E-07	2.21E-07
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	9.13E-10	1.81E-12	1.39E-12	NA	NA	1.55E-13	1.79E-13	2.32E-08	2.68E-08	5.00E-08
1,2,3,4,7,8,9-HpCDF	1.09E-10	2.15E-13	1.66E-13	NA	NA	1.85E-14	2.13E-14	2.77E-09	3.19E-09	5.96E-09
OCDF	1.46E-12	2.88E-15	2.22E-15	NA	NA	2.47E-16	2.85E-16	3.71E-11	4.28E-11	7.98E-11

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**7E-06**	**8E-06**	**1E-05**
Dioxin-like PCB congeners	2.2E-04	2.5E-04	4.7E-04
Dioxins	8.6E-07	1.0E-06	1.9E-06
Furans	2.2E-06	2.6E-06	4.8E-06
Total TEQ CTE Cancer Risk	**2E-04**	**3E-04**	**5E-04**
Total CTE Hazard Index	**4E+00**	**3E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR BACKYARD BEEF AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Beef Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME ADD_{beef} (mg/kg-day)		RME Hazard Index		RME $LADD_{beef}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	5.81E-02	1.50E-04	8.75E-05	7.51E+00	4.37E+00	1.29E-05	4.87E-05	2.58E-05	9.75E-05	1.23E-04
PCB-77	6.95E-09	1.80E-11	1.05E-11	NA	NA	1.54E-12	5.83E-12	2.31E-07	8.75E-07	1.11E-06
PCB-81	1.38E-11	3.56E-14	2.08E-14	NA	NA	3.06E-15	1.16E-14	4.58E-10	1.73E-09	2.19E-09
PCB-105	2.88E-08	7.46E-11	4.34E-11	NA	NA	6.39E-12	2.42E-11	9.59E-07	3.63E-06	4.59E-06
PCB-114	1.91E-09	4.93E-12	2.87E-12	NA	NA	4.22E-13	1.60E-12	6.34E-08	2.40E-07	3.03E-07
PCB-118	1.47E-07	3.81E-10	2.22E-10	NA	NA	3.27E-11	1.24E-10	4.90E-06	1.86E-05	2.35E-05
PCB-123	4.32E-09	1.12E-11	6.50E-12	NA	NA	9.56E-13	3.62E-12	1.43E-07	5.43E-07	6.86E-07
PCB-126	1.15E-05	2.96E-08	1.73E-08	NA	NA	2.54E-09	9.62E-09	3.81E-04	1.44E-03	1.82E-03
PCB-156	1.92E-07	4.97E-10	2.90E-10	NA	NA	4.26E-11	1.61E-10	6.39E-06	2.42E-05	3.06E-05
PCB-157	5.50E-08	1.42E-10	8.29E-11	NA	NA	1.22E-11	4.62E-11	1.83E-06	6.93E-06	8.76E-06
PCB-167	2.59E-09	6.70E-12	3.90E-12	NA	NA	5.74E-13	2.17E-12	8.62E-08	3.26E-07	4.12E-07
PCB-169	7.36E-07	1.90E-09	1.11E-09	NA	NA	1.63E-10	6.18E-10	2.45E-05	9.26E-05	1.17E-04
PCB-189	1.35E-08	3.50E-11	2.04E-11	NA	NA	3.00E-12	1.13E-11	4.50E-07	1.70E-06	2.15E-06
2,3,7,8-TCDD	1.38E-08	3.58E-11	2.08E-11	NA	NA	3.07E-12	1.16E-11	4.60E-07	1.74E-06	2.20E-06
1,2,3,7,8-PeCDD	2.67E-08	6.89E-11	4.01E-11	NA	NA	5.91E-12	2.24E-11	8.86E-07	3.35E-06	4.24E-06
1,2,3,4,7,8-HxCDD	1.75E-09	4.53E-12	2.64E-12	NA	NA	3.88E-13	1.47E-12	5.82E-08	2.20E-07	2.78E-07
1,2,3,6,7,8-HxCDD	4.65E-09	1.20E-11	7.00E-12	NA	NA	1.03E-12	3.90E-12	1.55E-07	5.85E-07	7.39E-07
1,2,3,7,8,9-HxCDD	2.19E-09	5.67E-12	3.30E-12	NA	NA	4.86E-13	1.84E-12	7.29E-08	2.76E-07	3.49E-07
1,2,3,4,6,7,8-HpCDD	1.00E-09	2.59E-12	1.51E-12	NA	NA	2.22E-13	8.41E-13	3.33E-08	1.26E-07	1.60E-07
OCDD	1.37E-11	3.55E-14	2.07E-14	NA	NA	3.04E-15	1.15E-14	4.56E-10	1.73E-09	2.18E-09
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.03E-07	2.65E-10	1.54E-10	NA	NA	2.27E-11	8.60E-11	3.41E-06	1.29E-05	1.63E-05
1,2,3,4,7,8-HxCDF	1.19E-08	3.08E-11	1.80E-11	NA	NA	2.64E-12	1.00E-11	3.97E-07	1.50E-06	1.90E-06
1,2,3,6,7,8-HXCDF	6.35E-09	1.64E-11	9.56E-12	NA	NA	1.41E-12	5.33E-12	2.11E-07	7.99E-07	1.01E-06
2,3,4,6,7,8-HxCDF	5.95E-09	1.54E-11	8.97E-12	NA	NA	1.32E-12	5.00E-12	1.98E-07	7.49E-07	9.47E-07
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	1.35E-09	3.48E-12	2.03E-12	NA	NA	2.98E-13	1.13E-12	4.48E-08	1.69E-07	2.14E-07
1,2,3,4,7,8,9-HpCDF	1.60E-10	4.15E-13	2.42E-13	NA	NA	3.56E-14	1.35E-13	5.33E-09	2.02E-08	2.55E-08
OCDF	2.15E-12	5.56E-15	3.24E-15	NA	NA	4.76E-16	1.80E-15	7.14E-11	2.70E-10	3.42E-10

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**3E-05**	**1E-04**	**1E-04**
Dioxin-like PCB congeners	4.2E-04	1.6E-03	2.0E-03
Dioxins	1.7E-06	6.3E-06	8.0E-06
Furans	4.3E-06	1.6E-05	2.0E-05
Total TEQ RME Cancer Risk	**5E-04**	**2E-03**	**2E-03**
Total RME Hazard Index	**8E+00**	**4E+00**	

O:\20123001.096\HHRA_FNL_AG\AG_FNL_ATD-3a Ag risks (wo farms) for comp to scripts.xls
Beef Risk - Bkyd (2 ppm) P4

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR POULTRY (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE poultry concentration (mg total PCB/kg poultry; mg congener TEQ/kg poultry)	CTE $ADD_{poultry}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{poultry}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.71E-02	3.92E-05	2.20E-05	1.96E+00	1.10E+00	3.36E-06	9.12E-06	3.36E-06	9.12E-06	1.25E-05
PCB-77	6.44E-10	6.80E-13	3.82E-13	NA	NA	5.83E-14	1.58E-13	8.75E-09	2.38E-08	3.25E-08
PCB-81	1.75E-11	1.85E-14	1.04E-14	NA	NA	1.59E-15	4.30E-15	2.38E-10	6.46E-10	8.83E-10
PCB-105	9.36E-09	9.90E-12	5.56E-12	NA	NA	8.49E-13	2.30E-12	1.27E-07	3.46E-07	4.73E-07
PCB-114	1.76E-09	1.86E-12	1.04E-12	NA	NA	1.59E-13	4.33E-13	2.39E-08	6.49E-08	8.88E-08
PCB-118	1.82E-08	1.92E-11	1.08E-11	NA	NA	1.65E-12	4.47E-12	2.47E-07	6.70E-07	9.17E-07
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	6.78E-07	7.17E-10	4.02E-10	NA	NA	6.14E-11	1.67E-10	9.21E-06	2.50E-05	3.42E-05
PCB-156	4.59E-08	4.86E-11	2.73E-11	NA	NA	4.16E-12	1.13E-11	6.25E-07	1.70E-06	2.32E-06
PCB-157	1.77E-08	1.87E-11	1.05E-11	NA	NA	1.60E-12	4.35E-12	2.41E-07	6.53E-07	8.93E-07
PCB-167	6.24E-10	6.59E-13	3.70E-13	NA	NA	5.65E-14	1.53E-13	8.48E-09	2.30E-08	3.15E-08
PCB-169	9.54E-09	1.01E-11	5.67E-12	NA	NA	8.65E-13	2.35E-12	1.30E-07	3.52E-07	4.82E-07
PCB-189	3.01E-09	3.18E-12	1.79E-12	NA	NA	2.73E-13	7.40E-13	4.09E-08	1.11E-07	1.52E-07
2,3,7,8-TCDD	1.61E-08	1.71E-11	9.58E-12	NA	NA	1.46E-12	3.97E-12	2.19E-07	5.95E-07	8.15E-07
1,2,3,7,8-PeCDD	2.94E-08	3.10E-11	1.74E-11	NA	NA	2.66E-12	7.22E-12	3.99E-07	1.08E-06	1.48E-06
1,2,3,4,7,8-HxCDD	2.22E-09	2.35E-12	1.32E-12	NA	NA	2.01E-13	5.46E-13	3.02E-08	8.20E-08	1.12E-07
1,2,3,6,7,8-HxCDD	1.02E-08	1.07E-11	6.03E-12	NA	NA	9.20E-13	2.50E-12	1.38E-07	3.75E-07	5.13E-07
1,2,3,7,8,9-HxCDD	2.57E-09	2.72E-12	1.53E-12	NA	NA	2.33E-13	6.32E-13	3.49E-08	9.48E-08	1.30E-07
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	3.48E-10	3.68E-13	2.07E-13	NA	NA	3.15E-14	8.56E-14	4.73E-09	1.28E-08	1.76E-08
2,3,7,8-TCDF	3.38E-08	3.58E-11	2.01E-11	NA	NA	3.07E-12	8.33E-12	4.60E-07	1.25E-06	1.71E-06
1,2,3,7,8-PeCDF	8.90E-09	9.41E-12	5.29E-12	NA	NA	8.07E-13	2.19E-12	1.21E-07	3.29E-07	4.50E-07
2,3,4,7,8-PeCDF	1.24E-07	1.31E-10	7.38E-11	NA	NA	1.13E-11	3.06E-11	1.69E-06	4.58E-06	6.27E-06
1,2,3,4,7,8-HxCDF	1.32E-08	1.40E-11	7.87E-12	NA	NA	1.20E-12	3.26E-12	1.80E-07	4.89E-07	6.69E-07
1,2,3,6,7,8-HXCDF	8.06E-09	8.52E-12	4.79E-12	NA	NA	7.30E-13	1.98E-12	1.10E-07	2.97E-07	4.07E-07
2,3,4,6,7,8-HxCDF	5.91E-09	6.25E-12	3.51E-12	NA	NA	5.36E-13	1.45E-12	8.04E-08	2.18E-07	2.99E-07
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	1.71E-09	1.81E-12	1.01E-12	NA	NA	1.55E-13	4.20E-13	2.32E-08	6.31E-08	8.63E-08
1,2,3,4,7,8,9-HpCDF	1.48E-10	1.57E-13	8.79E-14	NA	NA	1.34E-14	3.64E-14	2.01E-09	5.46E-09	7.48E-09
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**3E-06**	**9E-06**	**1E-05**
Dioxin-like PCB congeners	1.1E-05	2.9E-05	4.0E-05
Dioxins	8.3E-07	2.2E-06	3.1E-06
Furans	2.7E-06	7.2E-06	9.9E-06
Total TEQ CTE Cancer Risk	**1E-05**	**4E-05**	**5E-05**
Total CTE Hazard Index	**2E+00**	**1E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR POULTRY (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Poultry Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME $ADD_{poultry}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{poultry}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.80E-02	8.81E-05	6.36E-05	4.41E+00	3.18E+00	7.55E-06	5.82E-05	1.51E-05	1.16E-04	1.31E-04
PCB-77	1.18E-09	1.53E-12	1.11E-12	NA	NA	1.31E-13	1.01E-12	1.97E-08	1.52E-07	1.71E-07
PCB-81	3.21E-11	4.16E-14	3.00E-14	NA	NA	3.57E-15	2.75E-14	5.35E-10	4.12E-09	4.66E-09
PCB-105	1.72E-08	2.23E-11	1.61E-11	NA	NA	1.91E-12	1.47E-11	2.86E-07	2.21E-06	2.49E-06
PCB-114	3.23E-09	4.18E-12	3.02E-12	NA	NA	3.59E-13	2.76E-12	5.38E-08	4.14E-07	4.68E-07
PCB-118	3.33E-08	4.32E-11	3.12E-11	NA	NA	3.70E-12	2.85E-11	5.55E-07	4.28E-06	4.83E-06
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	1.24E-06	1.61E-09	1.16E-09	NA	NA	1.38E-10	1.06E-09	2.07E-05	1.60E-04	1.80E-04
PCB-156	8.43E-08	1.09E-10	7.89E-11	NA	NA	9.37E-12	7.21E-11	1.40E-06	1.08E-05	1.22E-05
PCB-157	3.25E-08	4.21E-11	3.04E-11	NA	NA	3.61E-12	2.78E-11	5.41E-07	4.17E-06	4.71E-06
PCB-167	1.14E-09	1.48E-12	1.07E-12	NA	NA	1.27E-13	9.79E-13	1.91E-08	1.47E-07	1.66E-07
PCB-169	1.75E-08	2.27E-11	1.64E-11	NA	NA	1.94E-12	1.50E-11	2.92E-07	2.25E-06	2.54E-06
PCB-189	5.52E-09	7.16E-12	5.17E-12	NA	NA	6.13E-13	4.72E-12	9.20E-08	7.09E-07	8.01E-07
2,3,7,8-TCDD	2.96E-08	3.84E-11	2.77E-11	NA	NA	3.29E-12	2.53E-11	4.93E-07	3.80E-06	4.29E-06
1,2,3,7,8-PeCDD	5.39E-08	6.98E-11	5.04E-11	NA	NA	5.98E-12	4.61E-11	8.97E-07	6.91E-06	7.81E-06
1,2,3,4,7,8-HxCDD	4.08E-09	5.28E-12	3.81E-12	NA	NA	4.53E-13	3.49E-12	6.79E-08	5.23E-07	5.91E-07
1,2,3,6,7,8-HxCDD	1.86E-08	2.42E-11	1.74E-11	NA	NA	2.07E-12	1.59E-11	3.11E-07	2.39E-06	2.70E-06
1,2,3,7,8,9-HxCDD	4.72E-09	6.11E-12	4.41E-12	NA	NA	5.24E-13	4.04E-12	7.86E-08	6.05E-07	6.84E-07
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	6.39E-10	8.28E-13	5.98E-13	NA	NA	7.10E-14	5.47E-13	1.06E-08	8.20E-08	9.26E-08
2,3,7,8-TCDF	6.21E-08	8.05E-11	5.81E-11	NA	NA	6.90E-12	5.31E-11	1.03E-06	7.97E-06	9.01E-06
1,2,3,7,8-PeCDF	1.63E-08	2.12E-11	1.53E-11	NA	NA	1.81E-12	1.40E-11	2.72E-07	2.10E-06	2.37E-06
2,3,4,7,8-PeCDF	2.28E-07	2.95E-10	2.13E-10	NA	NA	2.53E-11	1.95E-10	3.80E-06	2.93E-05	3.31E-05
1,2,3,4,7,8-HxCDF	2.43E-08	3.15E-11	2.27E-11	NA	NA	2.70E-12	2.08E-11	4.05E-07	3.12E-06	3.52E-06
1,2,3,6,7,8-HXCDF	1.48E-08	1.92E-11	1.38E-11	NA	NA	1.64E-12	1.27E-11	2.46E-07	1.90E-06	2.14E-06
2,3,4,6,7,8-HxCDF	1.09E-08	1.41E-11	1.02E-11	NA	NA	1.21E-12	9.29E-12	1.81E-07	1.39E-06	1.57E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	3.14E-09	4.06E-12	2.93E-12	NA	NA	3.48E-13	2.68E-12	5.22E-08	4.03E-07	4.55E-07
1,2,3,4,7,8,9-HpCDF	2.72E-10	3.52E-13	2.54E-13	NA	NA	3.02E-14	2.33E-13	4.53E-09	3.49E-08	3.94E-08
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:			
	Child	**Adult**	**Total**
Total PCB RME Cancer Risk	**2E-05**	**1E-04**	**1E-04**
Dioxin-like PCB congeners	2.4E-05	1.8E-04	2.1E-04
Dioxins	1.9E-06	1.4E-05	1.6E-05
Furans	6.0E-06	4.6E-05	5.2E-05
Total TEQ RME Cancer Risk	**3E-05**	**2E-04**	**3E-04**
Total RME Hazard Index	**4E+00**	**3E+00**	

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Poultry Risk (2 ppm) (F) P5

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR POULTRY (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE poultry concentration (mg total PCB/kg poultry; mg congener TEQ/kg poultry)	CTE $ADD_{poultry}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{poultry}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.71E-02	3.92E-05	2.70E-05	1.96E+00	1.35E+00	3.36E-06	3.47E-06	3.36E-06	3.47E-06	6.83E-06
PCB-77	6.44E-10	6.80E-13	4.69E-13	NA	NA	5.83E-14	6.03E-14	8.75E-09	9.05E-09	1.78E-08
PCB-81	1.75E-11	1.85E-14	1.28E-14	NA	NA	1.59E-15	1.64E-15	2.38E-10	2.46E-10	4.84E-10
PCB-105	9.36E-09	9.90E-12	6.82E-12	NA	NA	8.49E-13	8.77E-13	1.27E-07	1.32E-07	2.59E-07
PCB-114	1.76E-09	1.86E-12	1.28E-12	NA	NA	1.59E-13	1.65E-13	2.39E-08	2.47E-08	4.86E-08
PCB-118	1.82E-08	1.92E-11	1.32E-11	NA	NA	1.65E-12	1.70E-12	2.47E-07	2.55E-07	5.02E-07
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	6.78E-07	7.17E-10	4.94E-10	NA	NA	6.14E-11	6.35E-11	9.21E-06	9.53E-06	1.87E-05
PCB-156	4.59E-08	4.86E-11	3.35E-11	NA	NA	4.16E-12	4.31E-12	6.25E-07	6.46E-07	1.27E-06
PCB-157	1.77E-08	1.87E-11	1.29E-11	NA	NA	1.60E-12	1.66E-12	2.41E-07	2.49E-07	4.89E-07
PCB-167	6.24E-10	6.59E-13	4.54E-13	NA	NA	5.65E-14	5.84E-14	8.48E-09	8.76E-09	1.72E-08
PCB-169	9.54E-09	1.01E-11	6.95E-12	NA	NA	8.65E-13	8.94E-13	1.30E-07	1.34E-07	2.64E-07
PCB-189	3.01E-09	3.18E-12	2.19E-12	NA	NA	2.73E-13	2.82E-13	4.09E-08	4.23E-08	8.32E-08
2,3,7,8-TCDD	1.61E-08	1.71E-11	1.18E-11	NA	NA	1.46E-12	1.51E-12	2.19E-07	2.27E-07	4.46E-07
1,2,3,7,8-PeCDD	2.94E-08	3.10E-11	2.14E-11	NA	NA	2.66E-12	2.75E-12	3.99E-07	4.13E-07	8.12E-07
1,2,3,4,7,8-HxCDD	2.22E-09	2.35E-12	1.62E-12	NA	NA	2.01E-13	2.08E-13	3.02E-08	3.12E-08	6.14E-08
1,2,3,6,7,8-HxCDD	1.02E-08	1.07E-11	7.40E-12	NA	NA	9.20E-13	9.52E-13	1.38E-07	1.43E-07	2.81E-07
1,2,3,7,8,9-HxCDD	2.57E-09	2.72E-12	1.87E-12	NA	NA	2.33E-13	2.41E-13	3.49E-08	3.61E-08	7.11E-08
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	3.48E-10	3.68E-13	2.54E-13	NA	NA	3.15E-14	3.26E-14	4.73E-09	4.89E-09	9.63E-09
2,3,7,8-TCDF	3.38E-08	3.58E-11	2.47E-11	NA	NA	3.07E-12	3.17E-12	4.60E-07	4.76E-07	9.36E-07
1,2,3,7,8-PeCDF	8.90E-09	9.41E-12	6.49E-12	NA	NA	8.07E-13	8.34E-13	1.21E-07	1.25E-07	2.46E-07
2,3,4,7,8-PeCDF	1.24E-07	1.31E-10	9.05E-11	NA	NA	1.13E-11	1.16E-11	1.69E-06	1.75E-06	3.43E-06
1,2,3,4,7,8-HxCDF	1.32E-08	1.40E-11	9.65E-12	NA	NA	1.20E-12	1.24E-12	1.80E-07	1.86E-07	3.66E-07
1,2,3,6,7,8-HXCDF	8.06E-09	8.52E-12	5.87E-12	NA	NA	7.30E-13	7.55E-13	1.10E-07	1.13E-07	2.23E-07
2,3,4,6,7,8-HxCDF	5.91E-09	6.25E-12	4.31E-12	NA	NA	5.36E-13	5.54E-13	8.04E-08	8.31E-08	1.64E-07
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	1.71E-09	1.81E-12	1.25E-12	NA	NA	1.55E-13	1.60E-13	2.32E-08	2.40E-08	4.72E-08
1,2,3,4,7,8,9-HpCDF	1.48E-10	1.57E-13	1.08E-13	NA	NA	1.34E-14	1.39E-14	2.01E-09	2.08E-09	4.09E-09
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:			
	Child	**Adult**	**Total**
Total PCB CTE Cancer Risk	**3E-06**	**3E-06**	**7E-06**
Dioxin-like PCB congeners	1.1E-05	1.1E-05	2.2E-05
Dioxins	8.3E-07	8.5E-07	1.7E-06
Furans	2.7E-06	2.8E-06	5.4E-06
Total TEQ CTE Cancer Risk	**1E-05**	**1E-05**	**3E-05**
Total CTE Hazard Index	**2E+00**	**1E+00**	

O:\20123001.096\HHRA_FNL_AG\AG_FNL_ATD-3a Ag risks (wo farms) for comp to scripts.xls
Poultry Risk (2 ppm) (R) P6

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR POULTRY (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Poultry Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME $ADD_{poultry}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{poultry}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.80E-02	8.81E-05	5.29E-05	4.41E+00	2.65E+00	7.55E-06	2.95E-05	1.51E-05	5.90E-05	7.41E-05
PCB-77	1.18E-09	1.53E-12	9.19E-13	NA	NA	1.31E-13	5.12E-13	1.97E-08	7.68E-08	9.65E-08
PCB-81	3.21E-11	4.16E-14	2.50E-14	NA	NA	3.57E-15	1.39E-14	5.35E-10	2.09E-09	2.62E-09
PCB-105	1.72E-08	2.23E-11	1.34E-11	NA	NA	1.91E-12	7.45E-12	2.86E-07	1.12E-06	1.40E-06
PCB-114	3.23E-09	4.18E-12	2.51E-12	NA	NA	3.59E-13	1.40E-12	5.38E-08	2.10E-07	2.64E-07
PCB-118	3.33E-08	4.32E-11	2.59E-11	NA	NA	3.70E-12	1.45E-11	5.55E-07	2.17E-06	2.72E-06
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	1.24E-06	1.61E-09	9.68E-10	NA	NA	1.38E-10	5.39E-10	2.07E-05	8.09E-05	1.02E-04
PCB-156	8.43E-08	1.09E-10	6.56E-11	NA	NA	9.37E-12	3.66E-11	1.40E-06	5.49E-06	6.89E-06
PCB-157	3.25E-08	4.21E-11	2.53E-11	NA	NA	3.61E-12	1.41E-11	5.41E-07	2.11E-06	2.65E-06
PCB-167	1.14E-09	1.48E-12	8.91E-13	NA	NA	1.27E-13	4.96E-13	1.91E-08	7.44E-08	9.35E-08
PCB-169	1.75E-08	2.27E-11	1.36E-11	NA	NA	1.94E-12	7.59E-12	2.92E-07	1.14E-06	1.43E-06
PCB-189	5.52E-09	7.16E-12	4.30E-12	NA	NA	6.13E-13	2.39E-12	9.20E-08	3.59E-07	4.51E-07
2,3,7,8-TCDD	2.96E-08	3.84E-11	2.30E-11	NA	NA	3.29E-12	1.28E-11	4.93E-07	1.93E-06	2.42E-06
1,2,3,7,8-PeCDD	5.39E-08	6.98E-11	4.19E-11	NA	NA	5.98E-12	2.34E-11	8.97E-07	3.50E-06	4.40E-06
1,2,3,4,7,8-HxCDD	4.08E-09	5.28E-12	3.17E-12	NA	NA	4.53E-13	1.77E-12	6.79E-08	2.65E-07	3.33E-07
1,2,3,6,7,8-HxCDD	1.86E-08	2.42E-11	1.45E-11	NA	NA	2.07E-12	8.08E-12	3.11E-07	1.21E-06	1.52E-06
1,2,3,7,8,9-HxCDD	4.72E-09	6.11E-12	3.67E-12	NA	NA	5.24E-13	2.05E-12	7.86E-08	3.07E-07	3.85E-07
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	6.39E-10	8.28E-13	4.97E-13	NA	NA	7.10E-14	2.77E-13	1.06E-08	4.16E-08	5.22E-08
2,3,7,8-TCDF	6.21E-08	8.05E-11	4.83E-11	NA	NA	6.90E-12	2.69E-11	1.03E-06	4.04E-06	5.07E-06
1,2,3,7,8-PeCDF	1.63E-08	2.12E-11	1.27E-11	NA	NA	1.81E-12	7.09E-12	2.72E-07	1.06E-06	1.33E-06
2,3,4,7,8-PeCDF	2.28E-07	2.95E-10	1.77E-10	NA	NA	2.53E-11	9.88E-11	3.80E-06	1.48E-05	1.86E-05
1,2,3,4,7,8-HxCDF	2.43E-08	3.15E-11	1.89E-11	NA	NA	2.70E-12	1.05E-11	4.05E-07	1.58E-06	1.99E-06
1,2,3,6,7,8-HXCDF	1.48E-08	1.92E-11	1.15E-11	NA	NA	1.64E-12	6.41E-12	2.46E-07	9.62E-07	1.21E-06
2,3,4,6,7,8-HxCDF	1.09E-08	1.41E-11	8.45E-12	NA	NA	1.21E-12	4.71E-12	1.81E-07	7.06E-07	8.87E-07
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	3.14E-09	4.06E-12	2.44E-12	NA	NA	3.48E-13	1.36E-12	5.22E-08	2.04E-07	2.56E-07
1,2,3,4,7,8,9-HpCDF	2.72E-10	3.52E-13	2.12E-13	NA	NA	3.02E-14	1.18E-13	4.53E-09	1.77E-08	2.22E-08
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:

	Child	Adult	Total
Total PCB RME Cancer Risk	**2E-05**	**6E-05**	**7E-05**
Dioxin-like PCB congeners	2.4E-05	9.4E-05	1.2E-04
Dioxins	1.9E-06	7.3E-06	9.1E-06
Furans	6.0E-06	2.3E-05	2.9E-05
Total TEQ RME Cancer Risk	**3E-05**	**1E-04**	**2E-04**
Total RME Hazard Index	**4E+00**	**3E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EGG (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE egg concentration (mg total PCB/kg egg; mg congener TEQ/kg egg)	CTE ADD_{egg} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{egg}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	1.80E-01	2.74E-04	1.16E-04	1.37E+01	5.80E+00	2.35E-05	4.81E-05	2.35E-05	4.81E-05	7.16E-05
PCB-77	5.43E-09	8.28E-12	3.50E-12	NA	NA	7.09E-13	1.45E-12	1.06E-07	2.17E-07	3.24E-07
PCB-81	1.18E-10	1.80E-13	7.61E-14	NA	NA	1.54E-14	3.15E-14	2.31E-09	4.73E-09	7.04E-09
PCB-105	7.58E-08	1.16E-10	4.89E-11	NA	NA	9.91E-12	2.02E-11	1.49E-06	3.04E-06	4.52E-06
PCB-114	1.66E-08	2.53E-11	1.07E-11	NA	NA	2.17E-12	4.44E-12	3.26E-07	6.65E-07	9.91E-07
PCB-118	1.63E-07	2.49E-10	1.05E-10	NA	NA	2.14E-11	4.36E-11	3.20E-06	6.54E-06	9.75E-06
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	4.44E-06	6.77E-09	2.86E-09	NA	NA	5.81E-10	1.19E-09	8.71E-05	1.78E-04	2.65E-04
PCB-156	3.77E-07	5.75E-10	2.43E-10	NA	NA	4.93E-11	1.01E-10	7.40E-06	1.51E-05	2.25E-05
PCB-157	1.33E-07	2.02E-10	8.55E-11	NA	NA	1.73E-11	3.54E-11	2.60E-06	5.31E-06	7.91E-06
PCB-167	5.05E-09	7.70E-12	3.25E-12	NA	NA	6.60E-13	1.35E-12	9.90E-08	2.02E-07	3.01E-07
PCB-169	7.15E-08	1.09E-10	4.61E-11	NA	NA	9.35E-12	1.91E-11	1.40E-06	2.86E-06	4.27E-06
PCB-189	2.99E-08	4.56E-11	1.93E-11	NA	NA	3.91E-12	7.99E-12	5.87E-07	1.20E-06	1.78E-06
2,3,7,8-TCDD	1.40E-07	2.13E-10	9.02E-11	NA	NA	1.83E-11	3.74E-11	2.74E-06	5.60E-06	8.35E-06
1,2,3,7,8-PeCDD	2.24E-07	3.41E-10	1.44E-10	NA	NA	2.93E-11	5.98E-11	4.39E-06	8.97E-06	1.34E-05
1,2,3,4,7,8-HxCDD	2.16E-08	3.30E-11	1.39E-11	NA	NA	2.83E-12	5.78E-12	4.24E-07	8.67E-07	1.29E-06
1,2,3,6,7,8-HxCDD	7.07E-08	1.08E-10	4.56E-11	NA	NA	9.25E-12	1.89E-11	1.39E-06	2.83E-06	4.22E-06
1,2,3,7,8,9-HxCDD	3.18E-08	4.85E-11	2.05E-11	NA	NA	4.15E-12	8.49E-12	6.23E-07	1.27E-06	1.90E-06
1,2,3,4,6,7,8-HpCDD	7.44E-08	1.13E-10	4.79E-11	NA	NA	9.72E-12	1.99E-11	1.46E-06	2.98E-06	4.44E-06
OCDD	3.76E-09	5.73E-12	2.42E-12	NA	NA	4.91E-13	1.00E-12	7.37E-08	1.50E-07	2.24E-07
2,3,7,8-TCDF	9.51E-08	1.45E-10	6.13E-11	NA	NA	1.24E-11	2.54E-11	1.87E-06	3.81E-06	5.68E-06
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.52E-06	2.31E-09	9.77E-10	NA	NA	1.98E-10	4.05E-10	2.97E-05	6.07E-05	9.04E-05
1,2,3,4,7,8-HxCDF	2.43E-07	3.70E-10	1.56E-10	NA	NA	3.17E-11	6.48E-11	4.75E-06	9.71E-06	1.45E-05
1,2,3,6,7,8-HXCDF	1.32E-07	2.01E-10	8.51E-11	NA	NA	1.73E-11	3.53E-11	2.59E-06	5.29E-06	7.88E-06
2,3,4,6,7,8-HxCDF	7.98E-08	1.22E-10	5.14E-11	NA	NA	1.04E-11	2.13E-11	1.56E-06	3.20E-06	4.76E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	6.92E-08	1.05E-10	4.46E-11	NA	NA	9.04E-12	1.85E-11	1.36E-06	2.77E-06	4.13E-06
1,2,3,4,7,8,9-HpCDF	5.50E-09	8.38E-12	3.54E-12	NA	NA	7.18E-13	1.47E-12	1.08E-07	2.20E-07	3.28E-07
OCDF	2.94E-10	4.49E-13	1.90E-13	NA	NA	3.85E-14	7.86E-14	5.77E-09	1.18E-08	1.76E-08

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**2E-05**	**5E-05**	**7E-05**
Dioxin-like PCB congeners	1.0E-04	2.1E-04	3.2E-04
Dioxins	1.1E-05	2.3E-05	3.4E-05
Furans	4.2E-05	8.6E-05	1.3E-04
Total TEQ CTE Cancer Risk	**2E-04**	**3E-04**	**5E-04**
Total CTE Hazard Index	**1E+01**	**6E+00**	

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Egg Risk (2 ppm) (F) P7

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EGG (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Egg Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME ADD_{egg} (mg/kg-day)		RME Hazard Index		RME $LADD_{egg}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	1.80E-01	3.30E-04	1.46E-04	1.65E+01	7.30E+00	2.83E-05	1.34E-04	5.65E-05	2.67E-04	3.24E-04
PCB-77	5.43E-09	9.94E-12	4.40E-12	NA	NA	8.52E-13	4.03E-12	1.28E-07	6.04E-07	7.32E-07
PCB-81	1.18E-10	2.16E-13	9.58E-14	NA	NA	1.85E-14	8.76E-14	2.78E-09	1.31E-08	1.59E-08
PCB-105	7.58E-08	1.39E-10	6.15E-11	NA	NA	1.19E-11	5.62E-11	1.79E-06	8.44E-06	1.02E-05
PCB-114	1.66E-08	3.04E-11	1.35E-11	NA	NA	2.61E-12	1.23E-11	3.91E-07	1.85E-06	2.24E-06
PCB-118	1.63E-07	2.99E-10	1.33E-10	NA	NA	2.57E-11	1.21E-10	3.85E-06	1.82E-05	2.20E-05
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	4.44E-06	8.14E-09	3.60E-09	NA	NA	6.97E-10	3.29E-09	1.05E-04	4.94E-04	5.99E-04
PCB-156	3.77E-07	6.91E-10	3.06E-10	NA	NA	5.92E-11	2.80E-10	8.89E-06	4.20E-05	5.09E-05
PCB-157	1.33E-07	2.43E-10	1.08E-10	NA	NA	2.08E-11	9.84E-11	3.12E-06	1.48E-05	1.79E-05
PCB-167	5.05E-09	9.25E-12	4.10E-12	NA	NA	7.93E-13	3.74E-12	1.19E-07	5.62E-07	6.81E-07
PCB-169	7.15E-08	1.31E-10	5.80E-11	NA	NA	1.12E-11	5.31E-11	1.68E-06	7.96E-06	9.64E-06
PCB-189	2.99E-08	5.48E-11	2.43E-11	NA	NA	4.70E-12	2.22E-11	7.05E-07	3.33E-06	4.03E-06
2,3,7,8-TCDD	1.40E-07	2.56E-10	1.14E-10	NA	NA	2.20E-11	1.04E-10	3.30E-06	1.56E-05	1.89E-05
1,2,3,7,8-PeCDD	2.24E-07	4.10E-10	1.82E-10	NA	NA	3.51E-11	1.66E-10	5.27E-06	2.49E-05	3.02E-05
1,2,3,4,7,8-HxCDD	2.16E-08	3.96E-11	1.76E-11	NA	NA	3.40E-12	1.61E-11	5.10E-07	2.41E-06	2.92E-06
1,2,3,6,7,8-HxCDD	7.07E-08	1.30E-10	5.74E-11	NA	NA	1.11E-11	5.25E-11	1.67E-06	7.87E-06	9.54E-06
1,2,3,7,8,9-HxCDD	3.18E-08	5.82E-11	2.58E-11	NA	NA	4.99E-12	2.36E-11	7.49E-07	3.54E-06	4.29E-06
1,2,3,4,6,7,8-HpCDD	7.44E-08	1.36E-10	6.04E-11	NA	NA	1.17E-11	5.52E-11	1.75E-06	8.28E-06	1.00E-05
OCDD	3.76E-09	6.88E-12	3.05E-12	NA	NA	5.90E-13	2.79E-12	8.85E-08	4.18E-07	5.07E-07
2,3,7,8-TCDF	9.51E-08	1.74E-10	7.72E-11	NA	NA	1.49E-11	7.06E-11	2.24E-06	1.06E-05	1.28E-05
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.52E-06	2.78E-09	1.23E-09	NA	NA	2.38E-10	1.12E-09	3.57E-05	1.69E-04	2.04E-04
1,2,3,4,7,8-HxCDF	2.43E-07	4.44E-10	1.97E-10	NA	NA	3.81E-11	1.80E-10	5.71E-06	2.70E-05	3.27E-05
1,2,3,6,7,8-HXCDF	1.32E-07	2.42E-10	1.07E-10	NA	NA	2.07E-11	9.79E-11	3.11E-06	1.47E-05	1.78E-05
2,3,4,6,7,8-HxCDF	7.98E-08	1.46E-10	6.47E-11	NA	NA	1.25E-11	5.92E-11	1.88E-06	8.88E-06	1.08E-05
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	6.92E-08	1.27E-10	5.61E-11	NA	NA	1.09E-11	5.13E-11	1.63E-06	7.70E-06	9.33E-06
1,2,3,4,7,8,9-HpCDF	5.50E-09	1.01E-11	4.46E-12	NA	NA	8.63E-13	4.08E-12	1.29E-07	6.11E-07	7.41E-07
OCDF	2.94E-10	5.39E-13	2.39E-13	NA	NA	4.62E-14	2.18E-13	6.93E-09	3.27E-08	3.97E-08

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**6E-05**	**3E-04**	**3E-04**
Dioxin-like PCB congeners	1.3E-04	5.9E-04	7.2E-04
Dioxins	1.3E-05	6.3E-05	7.6E-05
Furans	5.0E-05	2.4E-04	2.9E-04
Total TEQ RME Cancer Risk	**2E-04**	**9E-04**	**1E-03**
Total RME Hazard Index	**2E+01**	**7E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EGG (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE egg concentration (mg total PCB/kg egg; mg congener TEQ/kg egg)	CTE ADD_{egg} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{egg}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	1.80E-01	2.74E-04	1.36E-04	1.37E+01	6.81E+00	2.35E-05	1.75E-05	2.35E-05	1.75E-05	4.10E-05
PCB-77	5.43E-09	8.28E-12	4.11E-12	NA	NA	7.09E-13	5.28E-13	1.06E-07	7.92E-08	1.86E-07
PCB-81	1.18E-10	1.80E-13	8.93E-14	NA	NA	1.54E-14	1.15E-14	2.31E-09	1.72E-09	4.04E-09
PCB-105	7.58E-08	1.16E-10	5.74E-11	NA	NA	9.91E-12	7.38E-12	1.49E-06	1.11E-06	2.59E-06
PCB-114	1.66E-08	2.53E-11	1.26E-11	NA	NA	2.17E-12	1.62E-12	3.26E-07	2.42E-07	5.68E-07
PCB-118	1.63E-07	2.49E-10	1.24E-10	NA	NA	2.14E-11	1.59E-11	3.20E-06	2.38E-06	5.59E-06
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	4.44E-06	6.77E-09	3.36E-09	NA	NA	5.81E-10	4.32E-10	8.71E-05	6.48E-05	1.52E-04
PCB-156	3.77E-07	5.75E-10	2.86E-10	NA	NA	4.93E-11	3.67E-11	7.40E-06	5.51E-06	1.29E-05
PCB-157	1.33E-07	2.02E-10	1.00E-10	NA	NA	1.73E-11	1.29E-11	2.60E-06	1.94E-06	4.54E-06
PCB-167	5.05E-09	7.70E-12	3.82E-12	NA	NA	6.60E-13	4.91E-13	9.90E-08	7.37E-08	1.73E-07
PCB-169	7.15E-08	1.09E-10	5.41E-11	NA	NA	9.35E-12	6.96E-12	1.40E-06	1.04E-06	2.45E-06
PCB-189	2.99E-08	4.56E-11	2.26E-11	NA	NA	3.91E-12	2.91E-12	5.87E-07	4.37E-07	1.02E-06
2,3,7,8-TCDD	1.40E-07	2.13E-10	1.06E-10	NA	NA	1.83E-11	1.36E-11	2.74E-06	2.04E-06	4.79E-06
1,2,3,7,8-PeCDD	2.24E-07	3.41E-10	1.69E-10	NA	NA	2.93E-11	2.18E-11	4.39E-06	3.27E-06	7.66E-06
1,2,3,4,7,8-HxCDD	2.16E-08	3.30E-11	1.64E-11	NA	NA	2.83E-12	2.11E-12	4.24E-07	3.16E-07	7.40E-07
1,2,3,6,7,8-HxCDD	7.07E-08	1.08E-10	5.35E-11	NA	NA	9.25E-12	6.88E-12	1.39E-06	1.03E-06	2.42E-06
1,2,3,7,8,9-HxCDD	3.18E-08	4.85E-11	2.41E-11	NA	NA	4.15E-12	3.09E-12	6.23E-07	4.64E-07	1.09E-06
1,2,3,4,6,7,8-HpCDD	7.44E-08	1.13E-10	5.63E-11	NA	NA	9.72E-12	7.24E-12	1.46E-06	1.09E-06	2.54E-06
OCDD	3.76E-09	5.73E-12	2.84E-12	NA	NA	4.91E-13	3.66E-13	7.37E-08	5.48E-08	1.29E-07
2,3,7,8-TCDF	9.51E-08	1.45E-10	7.20E-11	NA	NA	1.24E-11	9.26E-12	1.87E-06	1.39E-06	3.25E-06
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.52E-06	2.31E-09	1.15E-09	NA	NA	1.98E-10	1.47E-10	2.97E-05	2.21E-05	5.18E-05
1,2,3,4,7,8-HxCDF	2.43E-07	3.70E-10	1.84E-10	NA	NA	3.17E-11	2.36E-11	4.75E-06	3.54E-06	8.29E-06
1,2,3,6,7,8-HXCDF	1.32E-07	2.01E-10	9.99E-11	NA	NA	1.73E-11	1.28E-11	2.59E-06	1.93E-06	4.52E-06
2,3,4,6,7,8-HxCDF	7.98E-08	1.22E-10	6.04E-11	NA	NA	1.04E-11	7.76E-12	1.56E-06	1.16E-06	2.73E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	6.92E-08	1.05E-10	5.23E-11	NA	NA	9.04E-12	6.73E-12	1.36E-06	1.01E-06	2.37E-06
1,2,3,4,7,8,9-HpCDF	5.50E-09	8.38E-12	4.16E-12	NA	NA	7.18E-13	5.35E-13	1.08E-07	8.02E-08	1.88E-07
OCDF	2.94E-10	4.49E-13	2.23E-13	NA	NA	3.85E-14	2.86E-14	5.77E-09	4.30E-09	1.01E-08

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**2E-05**	**2E-05**	**4E-05**
Dioxin-like PCB congeners	1.0E-04	7.8E-05	1.8E-04
Dioxins	1.1E-05	8.3E-06	1.9E-05
Furans	4.2E-05	3.1E-05	7.3E-05
Total TEQ CTE Cancer Risk	**2E-04**	**1E-04**	**3E-04**
Total CTE Hazard Index	**1E+01**	**7E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EGG (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Egg Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME ADD_{egg} (mg/kg-day)		RME Hazard Index		RME $LADD_{egg}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	1.80E-01	3.30E-04	1.47E-04	1.65E+01	7.36E+00	2.83E-05	8.20E-05	5.65E-05	1.64E-04	2.21E-04
PCB-77	5.43E-09	9.94E-12	4.44E-12	NA	NA	8.52E-13	2.47E-12	1.28E-07	3.71E-07	4.99E-07
PCB-81	1.18E-10	2.16E-13	9.66E-14	NA	NA	1.85E-14	5.38E-14	2.78E-09	8.07E-09	1.08E-08
PCB-105	7.58E-08	1.39E-10	6.20E-11	NA	NA	1.19E-11	3.46E-11	1.79E-06	5.18E-06	6.97E-06
PCB-114	1.66E-08	3.04E-11	1.36E-11	NA	NA	2.61E-12	7.57E-12	3.91E-07	1.14E-06	1.53E-06
PCB-118	1.63E-07	2.99E-10	1.34E-10	NA	NA	2.57E-11	7.45E-11	3.85E-06	1.12E-05	1.50E-05
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	4.44E-06	8.14E-09	3.63E-09	NA	NA	6.97E-10	2.02E-09	1.05E-04	3.04E-04	4.08E-04
PCB-156	3.77E-07	6.91E-10	3.09E-10	NA	NA	5.92E-11	1.72E-10	8.89E-06	2.58E-05	3.47E-05
PCB-157	1.33E-07	2.43E-10	1.08E-10	NA	NA	2.08E-11	6.04E-11	3.12E-06	9.07E-06	1.22E-05
PCB-167	5.05E-09	9.25E-12	4.13E-12	NA	NA	7.93E-13	2.30E-12	1.19E-07	3.45E-07	4.64E-07
PCB-169	7.15E-08	1.31E-10	5.85E-11	NA	NA	1.12E-11	3.26E-11	1.68E-06	4.89E-06	6.57E-06
PCB-189	2.99E-08	5.48E-11	2.45E-11	NA	NA	4.70E-12	1.36E-11	7.05E-07	2.05E-06	2.75E-06
2,3,7,8-TCDD	1.40E-07	2.56E-10	1.14E-10	NA	NA	2.20E-11	6.38E-11	3.30E-06	9.57E-06	1.29E-05
1,2,3,7,8-PeCDD	2.24E-07	4.10E-10	1.83E-10	NA	NA	3.51E-11	1.02E-10	5.27E-06	1.53E-05	2.06E-05
1,2,3,4,7,8-HxCDD	2.16E-08	3.96E-11	1.77E-11	NA	NA	3.40E-12	9.86E-12	5.10E-07	1.48E-06	1.99E-06
1,2,3,6,7,8-HxCDD	7.07E-08	1.30E-10	5.79E-11	NA	NA	1.11E-11	3.22E-11	1.67E-06	4.84E-06	6.50E-06
1,2,3,7,8,9-HxCDD	3.18E-08	5.82E-11	2.60E-11	NA	NA	4.99E-12	1.45E-11	7.49E-07	2.17E-06	2.92E-06
1,2,3,4,6,7,8-HpCDD	7.44E-08	1.36E-10	6.09E-11	NA	NA	1.17E-11	3.39E-11	1.75E-06	5.09E-06	6.84E-06
OCDD	3.76E-09	6.88E-12	3.07E-12	NA	NA	5.90E-13	1.71E-12	8.85E-08	2.57E-07	3.45E-07
2,3,7,8-TCDF	9.51E-08	1.74E-10	7.78E-11	NA	NA	1.49E-11	4.34E-11	2.24E-06	6.50E-06	8.74E-06
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.52E-06	2.78E-09	1.24E-09	NA	NA	2.38E-10	6.91E-10	3.57E-05	1.04E-04	1.39E-04
1,2,3,4,7,8-HxCDF	2.43E-07	4.44E-10	1.98E-10	NA	NA	3.81E-11	1.11E-10	5.71E-06	1.66E-05	2.23E-05
1,2,3,6,7,8-HXCDF	1.32E-07	2.42E-10	1.08E-10	NA	NA	2.07E-11	6.02E-11	3.11E-06	9.03E-06	1.21E-05
2,3,4,6,7,8-HxCDF	7.98E-08	1.46E-10	6.53E-11	NA	NA	1.25E-11	3.64E-11	1.88E-06	5.45E-06	7.33E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	6.92E-08	1.27E-10	5.66E-11	NA	NA	1.09E-11	3.15E-11	1.63E-06	4.73E-06	6.36E-06
1,2,3,4,7,8,9-HpCDF	5.50E-09	1.01E-11	4.49E-12	NA	NA	8.63E-13	2.50E-12	1.29E-07	3.76E-07	5.05E-07
OCDF	2.94E-10	5.39E-13	2.41E-13	NA	NA	4.62E-14	1.34E-13	6.93E-09	2.01E-08	2.71E-08

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**6E-05**	**2E-04**	**2E-04**
Dioxin-like PCB congeners	1.3E-04	3.6E-04	4.9E-04
Dioxins	1.3E-05	3.9E-05	5.2E-05
Furans	5.0E-05	1.5E-04	2.0E-04
Total TEQ RME Cancer Risk	**2E-04**	**5E-04**	**7E-04**
Total RME Hazard Index	**2E+01**	**7E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED FRUIT (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE exposed fruit concentration (mg total PCB/kg exposed fruit; mg congener TEQ/kg exposed fruit)	CTE $ADD_{exposed\ fruit}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{exposed\ fruit}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	4.69E-07	2.54E-07	2.35E-02	1.27E-02	4.02E-08	1.05E-07	4.02E-08	1.05E-07	1.45E-07
PCB-77	3.43E-10	4.47E-14	2.42E-14	NA	NA	3.83E-15	1.00E-14	5.75E-10	1.50E-09	2.08E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	1.56E-13	8.41E-14	NA	NA	1.33E-14	3.48E-14	2.00E-09	5.22E-09	7.22E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	4.45E-13	2.40E-13	NA	NA	3.81E-14	9.96E-14	5.72E-09	1.49E-08	2.07E-08
PCB-123	8.27E-11	1.08E-14	5.83E-15	NA	NA	9.25E-16	2.42E-15	1.39E-10	3.62E-10	5.01E-10
PCB-126	3.22E-07	4.20E-11	2.27E-11	NA	NA	3.60E-12	9.39E-12	5.39E-07	1.41E-06	1.95E-06
PCB-156	4.47E-09	5.83E-13	3.15E-13	NA	NA	5.00E-14	1.31E-13	7.50E-09	1.96E-08	2.71E-08
PCB-157	1.26E-09	1.64E-13	8.87E-14	NA	NA	1.41E-14	3.68E-14	2.11E-09	5.51E-09	7.63E-09
PCB-167	6.86E-11	8.94E-15	4.83E-15	NA	NA	7.67E-16	2.00E-15	1.15E-10	3.00E-10	4.15E-10
PCB-169	3.01E-08	3.93E-12	2.12E-12	NA	NA	3.37E-13	8.80E-13	5.05E-08	1.32E-07	1.83E-07
PCB-189	4.20E-10	5.48E-14	2.96E-14	NA	NA	4.70E-15	1.23E-14	7.05E-10	1.84E-09	2.55E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**4E-08**	**1E-07**	**1E-07**
Dioxin-like PCB congeners	6.1E-07	1.6E-06	2.2E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**6E-07**	**2E-06**	**2E-06**
Total CTE Hazard Index	**2E-02**	**1E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED FRUIT (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Exposed Fruit Concentration (mg total PCB /kg exposed fruit; mg congener TEQ/kg exposed fruit)	RME ADD$_{exposed\ fruit}$ (mg/kg-day)		RME Hazard Index		RME LADD$_{exposed\ fruit}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	6.50E-07	3.70E-07	3.25E-02	1.85E-02	5.57E-08	3.38E-07	1.11E-07	6.76E-07	7.87E-07
PCB-77	3.43E-10	6.19E-14	3.52E-14	NA	NA	5.30E-15	3.22E-14	7.96E-10	4.83E-09	5.62E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	2.15E-13	1.23E-13	NA	NA	1.85E-14	1.12E-13	2.77E-09	1.68E-08	1.96E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	6.16E-13	3.50E-13	NA	NA	5.28E-14	3.20E-13	7.92E-09	4.80E-08	5.60E-08
PCB-123	8.27E-11	1.49E-14	8.50E-15	NA	NA	1.28E-15	7.77E-15	1.92E-10	1.17E-09	1.36E-09
PCB-126	3.22E-07	5.81E-11	3.30E-11	NA	NA	4.98E-12	3.02E-11	7.47E-07	4.53E-06	5.28E-06
PCB-156	4.47E-09	8.08E-13	4.60E-13	NA	NA	6.93E-14	4.20E-13	1.04E-08	6.30E-08	7.34E-08
PCB-157	1.26E-09	2.27E-13	1.29E-13	NA	NA	1.95E-14	1.18E-13	2.92E-09	1.77E-08	2.07E-08
PCB-167	6.86E-11	1.24E-14	7.04E-15	NA	NA	1.06E-15	6.44E-15	1.59E-10	9.66E-10	1.13E-09
PCB-169	3.01E-08	5.44E-12	3.10E-12	NA	NA	4.66E-13	2.83E-12	7.00E-08	4.24E-07	4.94E-07
PCB-189	4.20E-10	7.59E-14	4.32E-14	NA	NA	6.51E-15	3.95E-14	9.76E-10	5.92E-09	6.90E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**1E-07**	**7E-07**	**8E-07**
Dioxin-like PCB congeners	8.4E-07	5.1E-06	6.0E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ RME Cancer Risk	**8E-07**	**5E-06**	**6E-06**
Total RME Hazard Index	**3E-02**	**2E-02**	

O:\20123001.096\HHRA_FNL_AG\AG_FNL_ATD-3a Ag risks (wo farms) for comp to scripts.xls
Exposed Fruit (2 ppm) (F) P9

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED FRUIT (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE exposed fruit concentration (mg total PCB/kg exposed fruit; mg congener TEQ/kg exposed fruit)	CTE ADD$_{exposed fruit}$ (mg/kg-day)		CTE Hazard Index		CTE LADD$_{exposed fruit}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	4.69E-07	3.61E-07	2.35E-02	1.80E-02	4.02E-08	4.64E-08	4.02E-08	4.64E-08	8.66E-08
PCB-77	3.43E-10	4.47E-14	3.43E-14	NA	NA	3.83E-15	4.41E-15	5.75E-10	6.62E-10	1.24E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	1.56E-13	1.20E-13	NA	NA	1.33E-14	1.54E-14	2.00E-09	2.30E-09	4.30E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	4.45E-13	3.42E-13	NA	NA	3.81E-14	4.39E-14	5.72E-09	6.59E-09	1.23E-08
PCB-123	8.27E-11	1.08E-14	8.29E-15	NA	NA	9.25E-16	1.07E-15	1.39E-10	1.60E-10	2.99E-10
PCB-126	3.22E-07	4.20E-11	3.22E-11	NA	NA	3.60E-12	4.14E-12	5.39E-07	6.22E-07	1.16E-06
PCB-156	4.47E-09	5.83E-13	4.48E-13	NA	NA	5.00E-14	5.76E-14	7.50E-09	8.65E-09	1.61E-08
PCB-157	1.26E-09	1.64E-13	1.26E-13	NA	NA	1.41E-14	1.62E-14	2.11E-09	2.43E-09	4.54E-09
PCB-167	6.86E-11	8.94E-15	6.87E-15	NA	NA	7.67E-16	8.84E-16	1.15E-10	1.33E-10	2.48E-10
PCB-169	3.01E-08	3.93E-12	3.02E-12	NA	NA	3.37E-13	3.88E-13	5.05E-08	5.82E-08	1.09E-07
PCB-189	4.20E-10	5.48E-14	4.21E-14	NA	NA	4.70E-15	5.42E-15	7.05E-10	8.12E-10	1.52E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**4E-08**	**5E-08**	**9E-08**
Dioxin-like PCB congeners	6.1E-07	7.0E-07	1.3E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**6E-07**	**7E-07**	**1E-06**
Total CTE Hazard Index	**2E-02**	**2E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED FRUIT (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Exposed Fruit Concentration (mg total PCB /kg exposed fruit; mg congener TEQ/kg exposed fruit)	RME $ADD_{exposed\ fruit}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{exposed\ fruit}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	6.50E-07	3.87E-07	3.25E-02	1.93E-02	5.57E-08	2.15E-07	1.11E-07	4.31E-07	5.42E-07
PCB-77	3.43E-10	6.19E-14	3.68E-14	NA	NA	5.30E-15	2.05E-14	7.96E-10	3.08E-09	3.87E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	2.15E-13	1.28E-13	NA	NA	1.85E-14	7.14E-14	2.77E-09	1.07E-08	1.35E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	6.16E-13	3.66E-13	NA	NA	5.28E-14	2.04E-13	7.92E-09	3.06E-08	3.85E-08
PCB-123	8.27E-11	1.49E-14	8.89E-15	NA	NA	1.28E-15	4.95E-15	1.92E-10	7.43E-10	9.35E-10
PCB-126	3.22E-07	5.81E-11	3.46E-11	NA	NA	4.98E-12	1.93E-11	7.47E-07	2.89E-06	3.63E-06
PCB-156	4.47E-09	8.08E-13	4.81E-13	NA	NA	6.93E-14	2.68E-13	1.04E-08	4.02E-08	5.05E-08
PCB-157	1.26E-09	2.27E-13	1.35E-13	NA	NA	1.95E-14	7.53E-14	2.92E-09	1.13E-08	1.42E-08
PCB-167	6.86E-11	1.24E-14	7.37E-15	NA	NA	1.06E-15	4.10E-15	1.59E-10	6.16E-10	7.75E-10
PCB-169	3.01E-08	5.44E-12	3.24E-12	NA	NA	4.66E-13	1.80E-12	7.00E-08	2.71E-07	3.40E-07
PCB-189	4.20E-10	7.59E-14	4.52E-14	NA	NA	6.51E-15	2.52E-14	9.76E-10	3.77E-09	4.75E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**1E-07**	**4E-07**	**5E-07**
Dioxin-like PCB congeners	8.4E-07	3.3E-06	4.1E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ RME Cancer Risk	**8E-07**	**3E-06**	**4E-06**
Total RME Hazard Index	**3E-02**	**2E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED VEGETABLE (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE exposed vegetable concentration (mg total PCB/kg exposed vegetable; mg congener TEQ/kg exposed vegetable)	CTE $ADD_{exposed\ vegetable}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{exposed\ vegetable}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	1.97E-06	9.66E-07	9.83E-02	4.83E-02	1.69E-07	4.00E-07	1.69E-07	4.00E-07	5.69E-07
PCB-77	3.43E-10	1.87E-13	9.19E-14	NA	NA	1.60E-14	3.81E-14	2.41E-09	5.71E-09	8.12E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	6.51E-13	3.20E-13	NA	NA	5.58E-14	1.33E-13	8.38E-09	1.99E-08	2.83E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	1.86E-12	9.15E-13	NA	NA	1.60E-13	3.79E-13	2.39E-08	5.68E-08	8.08E-08
PCB-123	8.27E-11	4.52E-14	2.22E-14	NA	NA	3.87E-15	9.19E-15	5.81E-10	1.38E-09	1.96E-09
PCB-126	3.22E-07	1.76E-10	8.63E-11	NA	NA	1.51E-11	3.58E-11	2.26E-06	5.36E-06	7.62E-06
PCB-156	4.47E-09	2.44E-12	1.20E-12	NA	NA	2.09E-13	4.97E-13	3.14E-08	7.46E-08	1.06E-07
PCB-157	1.26E-09	6.88E-13	3.38E-13	NA	NA	5.89E-14	1.40E-13	8.84E-09	2.10E-08	2.98E-08
PCB-167	6.86E-11	3.75E-14	1.84E-14	NA	NA	3.21E-15	7.62E-15	4.82E-10	1.14E-09	1.62E-09
PCB-169	3.01E-08	1.65E-11	8.08E-12	NA	NA	1.41E-12	3.35E-12	2.12E-07	5.02E-07	7.14E-07
PCB-189	4.20E-10	2.30E-13	1.13E-13	NA	NA	1.97E-14	4.67E-14	2.95E-09	7.01E-09	9.96E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**2E-07**	**4E-07**	**6E-07**
Dioxin-like PCB congeners	2.5E-06	6.1E-06	8.6E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**3E-06**	**6E-06**	**9E-06**
Total CTE Hazard Index	**1E-01**	**5E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED VEGETABLE (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME exposed vegetable Concentration (mg total PCB /kg exposed vegetable; mg congener TEQ/kg exposed vegetable)	RME $ADD_{exposed\ vegetable}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{exposed\ vegetable}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	3.04E-06	1.70E-06	1.52E-01	8.49E-02	2.61E-07	1.55E-06	5.22E-07	3.11E-06	3.63E-06
PCB-77	3.43E-10	2.90E-13	1.62E-13	NA	NA	2.48E-14	1.48E-13	3.73E-09	2.22E-08	2.59E-08
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	1.01E-12	5.63E-13	NA	NA	8.65E-14	5.15E-13	1.30E-08	7.72E-08	9.01E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	2.88E-12	1.61E-12	NA	NA	2.47E-13	1.47E-12	3.71E-08	2.21E-07	2.58E-07
PCB-123	8.27E-11	7.00E-14	3.90E-14	NA	NA	6.00E-15	3.57E-14	9.00E-10	5.35E-09	6.25E-09
PCB-126	3.22E-07	2.72E-10	1.52E-10	NA	NA	2.33E-11	1.39E-10	3.50E-06	2.08E-05	2.43E-05
PCB-156	4.47E-09	3.78E-12	2.11E-12	NA	NA	3.24E-13	1.93E-12	4.87E-08	2.90E-07	3.38E-07
PCB-157	1.26E-09	1.06E-12	5.94E-13	NA	NA	9.13E-14	5.43E-13	1.37E-08	8.15E-08	9.52E-08
PCB-167	6.86E-11	5.80E-14	3.24E-14	NA	NA	4.97E-15	2.96E-14	7.46E-10	4.44E-09	5.18E-09
PCB-169	3.01E-08	2.55E-11	1.42E-11	NA	NA	2.18E-12	1.30E-11	3.28E-07	1.95E-06	2.28E-06
PCB-189	4.20E-10	3.56E-13	1.98E-13	NA	NA	3.05E-14	1.81E-13	4.57E-09	2.72E-08	3.18E-08
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**5E-07**	**3E-06**	**4E-06**
Dioxin-like PCB congeners	3.9E-06	2.3E-05	2.7E-05
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ RME Cancer Risk	**4E-06**	**2E-05**	**3E-05**
Total RME Hazard Index	**2E-01**	**8E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED VEGETABLE (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE exposed vegetable concentration (mg total PCB/kg exposed vegetable; mg congener TEQ/kg exposed vegetable)	CTE $ADD_{exposed\ vegetable}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{exposed\ vegetable}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	1.97E-06	1.09E-06	9.83E-02	5.44E-02	1.69E-07	1.40E-07	1.69E-07	1.40E-07	3.08E-07
PCB-77	3.43E-10	1.87E-13	1.04E-13	NA	NA	1.60E-14	1.33E-14	2.41E-09	2.00E-09	4.40E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	6.51E-13	3.60E-13	NA	NA	5.58E-14	4.63E-14	8.38E-09	6.95E-09	1.53E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	1.86E-12	1.03E-12	NA	NA	1.60E-13	1.32E-13	2.39E-08	1.99E-08	4.38E-08
PCB-123	8.27E-11	4.52E-14	2.50E-14	NA	NA	3.87E-15	3.21E-15	5.81E-10	4.82E-10	1.06E-09
PCB-126	3.22E-07	1.76E-10	9.72E-11	NA	NA	1.51E-11	1.25E-11	2.26E-06	1.87E-06	4.13E-06
PCB-156	4.47E-09	2.44E-12	1.35E-12	NA	NA	2.09E-13	1.74E-13	3.14E-08	2.61E-08	5.75E-08
PCB-157	1.26E-09	6.88E-13	3.80E-13	NA	NA	5.89E-14	4.89E-14	8.84E-09	7.33E-09	1.62E-08
PCB-167	6.86E-11	3.75E-14	2.07E-14	NA	NA	3.21E-15	2.66E-15	4.82E-10	4.00E-10	8.81E-10
PCB-169	3.01E-08	1.65E-11	9.10E-12	NA	NA	1.41E-12	1.17E-12	2.12E-07	1.76E-07	3.87E-07
PCB-189	4.20E-10	2.30E-13	1.27E-13	NA	NA	1.97E-14	1.63E-14	2.95E-09	2.45E-09	5.40E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**2E-07**	**1E-07**	**3E-07**
Dioxin-like PCB congeners	2.5E-06	2.1E-06	4.7E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**3E-06**	**2E-06**	**5E-06**
Total CTE Hazard Index	**1E-01**	**5E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED VEGETABLE (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME exposed vegetable Concentration (mg total PCB /kg exposed vegetable; mg congener TEQ/kg exposed vegetable)	RME $ADD_{exposed\ vegetable}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{exposed\ vegetable}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	3.04E-06	1.50E-06	1.52E-01	7.51E-02	2.61E-07	8.37E-07	5.22E-07	1.67E-06	2.20E-06
PCB-77	3.43E-10	2.90E-13	1.43E-13	NA	NA	2.48E-14	7.97E-14	3.73E-09	1.19E-08	1.57E-08
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	1.01E-12	4.98E-13	NA	NA	8.65E-14	2.77E-13	1.30E-08	4.16E-08	5.46E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	2.88E-12	1.42E-12	NA	NA	2.47E-13	7.93E-13	3.71E-08	1.19E-07	1.56E-07
PCB-123	8.27E-11	7.00E-14	3.45E-14	NA	NA	6.00E-15	1.92E-14	9.00E-10	2.88E-09	3.78E-09
PCB-126	3.22E-07	2.72E-10	1.34E-10	NA	NA	2.33E-11	7.48E-11	3.50E-06	1.12E-05	1.47E-05
PCB-156	4.47E-09	3.78E-12	1.87E-12	NA	NA	3.24E-13	1.04E-12	4.87E-08	1.56E-07	2.05E-07
PCB-157	1.26E-09	1.06E-12	5.25E-13	NA	NA	9.13E-14	2.93E-13	1.37E-08	4.39E-08	5.76E-08
PCB-167	6.86E-11	5.80E-14	2.86E-14	NA	NA	4.97E-15	1.59E-14	7.46E-10	2.39E-09	3.14E-09
PCB-169	3.01E-08	2.55E-11	1.26E-11	NA	NA	2.18E-12	7.00E-12	3.28E-07	1.05E-06	1.38E-06
PCB-189	4.20E-10	3.56E-13	1.75E-13	NA	NA	3.05E-14	9.77E-14	4.57E-09	1.47E-08	1.92E-08
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**5E-07**	**2E-06**	**2E-06**
Dioxin-like PCB congeners	3.9E-06	1.3E-05	1.7E-05
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ RME Cancer Risk	**4E-06**	**1E-05**	**2E-05**
Total RME Hazard Index	**2E-01**	**8E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR ROOT VEGETABLES (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE root vegetable concentration (mg total PCB/kg root vegetable; mg congener TEQ/kg root vegetable)	CTE $ADD_{root\ vegetable}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{root\ vegetable}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.00E-04	2.44E-07	1.39E-07	1.22E-02	6.93E-03	2.09E-08	5.75E-08	2.09E-08	5.75E-08	7.83E-08
PCB-77	5.71E-11	2.32E-14	1.32E-14	NA	NA	1.99E-15	5.47E-15	2.98E-10	8.20E-10	1.12E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.99E-10	8.07E-14	4.59E-14	NA	NA	6.92E-15	1.90E-14	1.04E-09	2.86E-09	3.89E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	5.68E-10	2.31E-13	1.31E-13	NA	NA	1.98E-14	5.44E-14	2.97E-09	8.16E-09	1.11E-08
PCB-123	1.38E-11	5.60E-15	3.19E-15	NA	NA	4.80E-16	1.32E-15	7.20E-11	1.98E-10	2.70E-10
PCB-126	5.36E-08	2.18E-11	1.24E-11	NA	NA	1.87E-12	5.13E-12	2.80E-07	7.70E-07	1.05E-06
PCB-156	7.46E-10	3.03E-13	1.72E-13	NA	NA	2.59E-14	7.14E-14	3.89E-09	1.07E-08	1.46E-08
PCB-157	2.10E-10	8.52E-14	4.85E-14	NA	NA	7.30E-15	2.01E-14	1.10E-09	3.01E-09	4.11E-09
PCB-167	1.14E-11	4.64E-15	2.64E-15	NA	NA	3.98E-16	1.09E-15	5.97E-11	1.64E-10	2.24E-10
PCB-169	5.02E-09	2.04E-12	1.16E-12	NA	NA	1.75E-13	4.81E-13	2.62E-08	7.21E-08	9.84E-08
PCB-189	7.01E-11	2.84E-14	1.62E-14	NA	NA	2.44E-15	6.71E-15	3.66E-10	1.01E-09	1.37E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**2E-08**	**6E-08**	**8E-08**
Dioxin-like PCB congeners	3.2E-07	8.7E-07	1.2E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**3E-07**	**9E-07**	**1E-06**
Total CTE Hazard Index	**1E-02**	**7E-03**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR ROOT VEGETABLES (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME root vegetable Concentration (mg total PCB /kg root vegetable; mg congener TEQ/kg root vegetable)	RME $ADD_{root\ vegetable}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{root\ vegetable}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.00E-04	4.04E-07	2.26E-07	2.02E-02	1.13E-02	3.46E-08	2.07E-07	6.92E-08	4.13E-07	4.83E-07
PCB-77	5.71E-11	3.85E-14	2.15E-14	NA	NA	3.30E-15	1.97E-14	4.94E-10	2.95E-09	3.45E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.99E-10	1.34E-13	7.49E-14	NA	NA	1.15E-14	6.85E-14	1.72E-09	1.03E-08	1.20E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	5.68E-10	3.83E-13	2.14E-13	NA	NA	3.28E-14	1.96E-13	4.92E-09	2.94E-08	3.43E-08
PCB-123	1.38E-11	9.28E-15	5.20E-15	NA	NA	7.96E-16	4.75E-15	1.19E-10	7.13E-10	8.32E-10
PCB-126	5.36E-08	3.61E-11	2.02E-11	NA	NA	3.09E-12	1.85E-11	4.64E-07	2.77E-06	3.24E-06
PCB-156	7.46E-10	5.02E-13	2.81E-13	NA	NA	4.30E-14	2.57E-13	6.45E-09	3.85E-08	4.50E-08
PCB-157	2.10E-10	1.41E-13	7.91E-14	NA	NA	1.21E-14	7.23E-14	1.82E-09	1.08E-08	1.27E-08
PCB-167	1.14E-11	7.70E-15	4.31E-15	NA	NA	6.60E-16	3.94E-15	9.89E-11	5.91E-10	6.90E-10
PCB-169	5.02E-09	3.38E-12	1.89E-12	NA	NA	2.90E-13	1.73E-12	4.35E-08	2.60E-07	3.03E-07
PCB-189	7.01E-11	4.72E-14	2.64E-14	NA	NA	4.04E-15	2.41E-14	6.07E-10	3.62E-09	4.23E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**7E-08**	**4E-07**	**5E-07**
Dioxin-like PCB congeners	5.2E-07	3.1E-06	3.7E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ RME Cancer Risk	**5E-07**	**3E-06**	**4E-06**
Total RME Hazard Index	**2E-02**	**1E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR ROOT VEGETABLES (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE root vegetable concentration (mg total PCB/kg root vegetable; mg congener TEQ/kg root vegetable)	CTE $ADD_{root\ vegetable}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{root\ vegetable}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.00E-04	2.44E-07	1.65E-07	1.22E-02	8.24E-03	2.09E-08	2.12E-08	2.09E-08	2.12E-08	4.21E-08
PCB-77	5.71E-11	2.32E-14	1.57E-14	NA	NA	1.99E-15	2.02E-15	2.98E-10	3.03E-10	6.01E-10
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.99E-10	8.07E-14	5.46E-14	NA	NA	6.92E-15	7.02E-15	1.04E-09	1.05E-09	2.09E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	5.68E-10	2.31E-13	1.56E-13	NA	NA	1.98E-14	2.01E-14	2.97E-09	3.01E-09	5.98E-09
PCB-123	1.38E-11	5.60E-15	3.79E-15	NA	NA	4.80E-16	4.87E-16	7.20E-11	7.30E-11	1.45E-10
PCB-126	5.36E-08	2.18E-11	1.47E-11	NA	NA	1.87E-12	1.89E-12	2.80E-07	2.84E-07	5.64E-07
PCB-156	7.46E-10	3.03E-13	2.05E-13	NA	NA	2.59E-14	2.63E-14	3.89E-09	3.95E-09	7.84E-09
PCB-157	2.10E-10	8.52E-14	5.76E-14	NA	NA	7.30E-15	7.41E-15	1.10E-09	1.11E-09	2.21E-09
PCB-167	1.14E-11	4.64E-15	3.14E-15	NA	NA	3.98E-16	4.04E-16	5.97E-11	6.05E-11	1.20E-10
PCB-169	5.02E-09	2.04E-12	1.38E-12	NA	NA	1.75E-13	1.77E-13	2.62E-08	2.66E-08	5.28E-08
PCB-189	7.01E-11	2.84E-14	1.92E-14	NA	NA	2.44E-15	2.47E-15	3.66E-10	3.71E-10	7.37E-10
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**2E-08**	**2E-08**	**4E-08**
Dioxin-like PCB congeners	3.2E-07	3.2E-07	6.4E-07
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**3E-07**	**3E-07**	**6E-07**
Total CTE Hazard Index	**1E-02**	**8E-03**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR ROOT VEGETABLES (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME root vegetable Concentration (mg total PCB /kg root vegetable; mg congener TEQ/kg root vegetable)	RME $ADD_{root\ vegetable}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{root\ vegetable}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.00E-04	4.04E-07	2.28E-07	2.02E-02	1.14E-02	3.46E-08	1.27E-07	6.92E-08	2.54E-07	3.23E-07
PCB-77	5.71E-11	3.85E-14	2.17E-14	NA	NA	3.30E-15	1.21E-14	4.94E-10	1.81E-09	2.31E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.99E-10	1.34E-13	7.55E-14	NA	NA	1.15E-14	4.21E-14	1.72E-09	6.31E-09	8.03E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	5.68E-10	3.83E-13	2.16E-13	NA	NA	3.28E-14	1.20E-13	4.92E-09	1.80E-08	2.30E-08
PCB-123	1.38E-11	9.28E-15	5.24E-15	NA	NA	7.96E-16	2.92E-15	1.19E-10	4.38E-10	5.57E-10
PCB-126	5.36E-08	3.61E-11	2.04E-11	NA	NA	3.09E-12	1.13E-11	4.64E-07	1.70E-06	2.17E-06
PCB-156	7.46E-10	5.02E-13	2.83E-13	NA	NA	4.30E-14	1.58E-13	6.45E-09	2.37E-08	3.01E-08
PCB-157	2.10E-10	1.41E-13	7.97E-14	NA	NA	1.21E-14	4.44E-14	1.82E-09	6.66E-09	8.48E-09
PCB-167	1.14E-11	7.70E-15	4.34E-15	NA	NA	6.60E-16	2.42E-15	9.89E-11	3.63E-10	4.62E-10
PCB-169	5.02E-09	3.38E-12	1.91E-12	NA	NA	2.90E-13	1.06E-12	4.35E-08	1.59E-07	2.03E-07
PCB-189	7.01E-11	4.72E-14	2.66E-14	NA	NA	4.04E-15	1.48E-14	6.07E-10	2.22E-09	2.83E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**7E-08**	**3E-07**	**3E-07**
Dioxin-like PCB congeners	5.2E-07	1.9E-06	2.4E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ RME Cancer Risk	**5E-07**	**2E-06**	**2E-06**
Total RME Hazard Index	**2E-02**	**1E-02**	

ATTACHMENT D.3B

PREDICTED FOOD CONCENTRATIONS, LADDs, AND CANCER RISKS FROM TEQ USING BIOCONCENTRATION FACTORS FOR UNDETECTED CONGENERS

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR COMMERCIAL DAIRY AT 2 MG/KG TOTAL PCBS IN SOIL

	Milk concentration (mg total PCBs/kg whole milk; mg congener TEQ/kg whole milk) [a]	CTE ADD_{milk} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{milk}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	3.70E-11	1.56E-12	4.40E-13	NA	NA	1.34E-13	1.82E-13	2.01E-08	2.73E-08	4.75E-08
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-10	5.02E-12	1.41E-12	NA	NA	4.30E-13	5.85E-13	6.45E-08	8.77E-08	1.52E-07
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	6.44E-10	2.72E-11	7.66E-12	NA	NA	2.34E-12	3.17E-12	3.50E-07	4.76E-07	8.26E-07
PCB-123	1.54E-11	6.49E-13	1.83E-13	NA	NA	5.56E-14	7.56E-14	8.35E-09	1.13E-08	1.97E-08
PCB-126	6.23E-08	2.64E-09	7.41E-10	NA	NA	2.26E-10	3.07E-10	3.39E-05	4.61E-05	8.00E-05
PCB-156	7.02E-10	2.97E-11	8.35E-12	NA	NA	2.54E-12	3.46E-12	3.82E-07	5.19E-07	9.00E-07
PCB-157	1.89E-10	7.99E-12	2.25E-12	NA	NA	6.85E-13	9.31E-13	1.03E-07	1.40E-07	2.42E-07
PCB-167	1.02E-11	4.31E-13	1.21E-13	NA	NA	3.69E-14	5.02E-14	5.54E-09	7.52E-09	1.31E-08
PCB-169	4.27E-09	1.81E-10	5.08E-11	NA	NA	1.55E-11	2.10E-11	2.32E-06	3.16E-06	5.48E-06
PCB-189	5.25E-11	2.22E-12	6.24E-13	NA	NA	1.90E-13	2.59E-13	2.85E-08	3.88E-08	6.73E-08
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	3.7E-05	5.1E-05	8.8E-05
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**4E-05**	**5E-05**	**9E-05**

Notes:

a Modeled from corn and based on fat content of Jersey cow milk.

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR COMMERCIAL DAIRY AT 2 MG/KG TOTAL PCBS IN SOIL

	RME ADD_{milk} (mg/kg-day)		RME Hazard Index		RME $LADD_{milk}$ (mg/kg-day)		RME Cancer Risk		
	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	2.49E-12	5.36E-13	NA	NA	2.14E-13	4.90E-13	3.21E-08	7.35E-08	1.06E-07
PCB-81	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	8.00E-12	1.72E-12	NA	NA	6.86E-13	1.57E-12	1.03E-07	2.36E-07	3.39E-07
PCB-114	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	4.34E-11	9.33E-12	NA	NA	3.72E-12	8.53E-12	5.58E-07	1.28E-06	1.84E-06
PCB-123	1.03E-12	2.22E-13	NA	NA	8.87E-14	2.03E-13	1.33E-08	3.05E-08	4.38E-08
PCB-126	4.20E-09	9.03E-10	NA	NA	3.60E-10	8.25E-10	5.40E-05	1.24E-04	1.78E-04
PCB-156	4.73E-11	1.02E-11	NA	NA	4.06E-12	9.29E-12	6.08E-07	1.39E-06	2.00E-06
PCB-157	1.27E-11	2.74E-12	NA	NA	1.09E-12	2.50E-12	1.64E-07	3.75E-07	5.39E-07
PCB-167	6.86E-13	1.47E-13	NA	NA	5.88E-14	1.35E-13	8.82E-09	2.02E-08	2.90E-08
PCB-169	2.88E-10	6.18E-11	NA	NA	2.47E-11	5.65E-11	3.70E-06	8.48E-06	1.22E-05
PCB-189	3.54E-12	7.60E-13	NA	NA	3.03E-13	6.95E-13	4.55E-08	1.04E-07	1.50E-07
2,3,7,8-TCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
					REASONABLE MAXIMUM EXPOSURE:				
							Child	**Adult**	**Total**
						Dioxin-like PCB congeners	5.9E-05	1.4E-04	2.0E-04
						Dioxins	0.0E+00	0.0E+00	0.0E+00
						Furans	0.0E+00	0.0E+00	0.0E+00
						Total TEQ RME Cancer Risk	**6E-05**	**1E-04**	**2E-04**

O:\20123001.096\HHRA_FNL_AG\AG_FNL_ATD-3b Ag risks (wo farms) (BCFs bo RL).xls
Dairy Risk - Comm (2ppm) P1

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR COMMERCIAL BEEF AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE beef concentration (mg total PCB/kg beef; mg congener TEQ/kg beef)	CTE ADD_{beef} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{beef}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	2.43E-09	4.82E-12	2.93E-12	NA	NA	4.13E-13	1.21E-12	6.19E-08	1.82E-07	2.44E-07
PCB-81	9.35E-12	1.85E-14	1.12E-14	NA	NA	1.59E-15	4.66E-15	2.38E-10	6.99E-10	9.36E-10
PCB-105	1.22E-08	2.42E-11	1.47E-11	NA	NA	2.08E-12	6.10E-12	3.11E-07	9.15E-07	1.23E-06
PCB-114	1.29E-09	2.56E-12	1.55E-12	NA	NA	2.19E-13	6.44E-13	3.29E-08	9.66E-08	1.29E-07
PCB-118	6.03E-08	1.19E-10	7.25E-11	NA	NA	1.02E-11	3.00E-11	1.53E-06	4.50E-06	6.04E-06
PCB-123	1.98E-09	3.92E-12	2.38E-12	NA	NA	3.36E-13	9.86E-13	5.04E-08	1.48E-07	1.98E-07
PCB-126	3.93E-06	7.77E-09	4.72E-09	NA	NA	6.66E-10	1.96E-09	9.99E-05	2.93E-04	3.93E-04
PCB-156	8.71E-08	1.72E-10	1.05E-10	NA	NA	1.48E-11	4.34E-11	2.22E-06	6.51E-06	8.72E-06
PCB-157	2.57E-08	5.08E-11	3.09E-11	NA	NA	4.35E-12	1.28E-11	6.53E-07	1.92E-06	2.57E-06
PCB-167	1.13E-09	2.24E-12	1.36E-12	NA	NA	1.92E-13	5.63E-13	2.87E-08	8.44E-08	1.13E-07
PCB-169	2.36E-07	4.67E-10	2.84E-10	NA	NA	4.00E-11	1.17E-10	6.00E-06	1.76E-05	2.36E-05
PCB-189	5.93E-09	1.17E-11	7.13E-12	NA	NA	1.01E-12	2.95E-12	1.51E-07	4.43E-07	5.94E-07
2,3,7,8-TCDD	9.39E-09	1.86E-11	1.13E-11	NA	NA	1.59E-12	4.68E-12	2.39E-07	7.02E-07	9.41E-07
1,2,3,7,8-PeCDD	1.81E-08	3.58E-11	2.17E-11	NA	NA	3.07E-12	9.00E-12	4.60E-07	1.35E-06	1.81E-06
1,2,3,4,7,8-HxCDD	1.19E-09	2.35E-12	1.43E-12	NA	NA	2.01E-13	5.91E-13	3.02E-08	8.87E-08	1.19E-07
1,2,3,6,7,8-HxCDD	3.15E-09	6.24E-12	3.79E-12	NA	NA	5.35E-13	1.57E-12	8.02E-08	2.35E-07	3.16E-07
1,2,3,7,8,9-HxCDD	1.49E-09	2.94E-12	1.79E-12	NA	NA	2.52E-13	7.41E-13	3.79E-08	1.11E-07	1.49E-07
1,2,3,4,6,7,8-HpCDD	6.80E-10	1.35E-12	8.18E-13	NA	NA	1.15E-13	3.39E-13	1.73E-08	5.08E-08	6.81E-08
OCDD	9.30E-12	1.84E-14	1.12E-14	NA	NA	1.58E-15	4.63E-15	2.37E-10	6.95E-10	9.32E-10
2,3,7,8-TCDF	4.14E-10	8.20E-13	4.98E-13	NA	NA	7.03E-14	2.06E-13	1.05E-08	3.10E-08	4.15E-08
1,2,3,7,8-PeCDF	3.35E-10	6.63E-13	4.03E-13	NA	NA	5.69E-14	1.67E-13	8.53E-09	2.50E-08	3.36E-08
2,3,4,7,8-PeCDF	6.95E-08	1.38E-10	8.36E-11	NA	NA	1.18E-11	3.46E-11	1.77E-06	5.19E-06	6.96E-06
1,2,3,4,7,8-HxCDF	8.09E-09	1.60E-11	9.73E-12	NA	NA	1.37E-12	4.03E-12	2.06E-07	6.04E-07	8.10E-07
1,2,3,6,7,8-HXCDF	4.31E-09	8.52E-12	5.18E-12	NA	NA	7.31E-13	2.15E-12	1.10E-07	3.22E-07	4.31E-07
2,3,4,6,7,8-HxCDF	4.04E-09	7.99E-12	4.85E-12	NA	NA	6.85E-13	2.01E-12	1.03E-07	3.02E-07	4.04E-07
1,2,3,7,8,9-HxCDF	1.37E-10	2.71E-13	1.65E-13	NA	NA	2.32E-14	6.82E-14	3.48E-09	1.02E-08	1.37E-08
1,2,3,4,6,7,8-HpCDF	9.13E-10	1.81E-12	1.10E-12	NA	NA	1.55E-13	4.55E-13	2.32E-08	6.82E-08	9.15E-08
1,2,3,4,7,8,9-HpCDF	1.09E-10	2.15E-13	1.31E-13	NA	NA	1.85E-14	5.42E-14	2.77E-09	8.13E-09	1.09E-08
OCDF	1.46E-12	2.88E-15	1.75E-15	NA	NA	2.47E-16	7.26E-16	3.71E-11	1.09E-10	1.46E-10

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	1.1E-04	3.3E-04	4.4E-04
Dioxins	8.6E-07	2.5E-06	3.4E-06
Furans	2.2E-06	6.6E-06	8.8E-06
Total TEQ CTE Cancer Risk	**1E-04**	**3E-04**	**4E-04**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR COMMERCIAL BEEF AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Beef Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME ADD_{beef} (mg/kg-day)		RME Hazard Index		RME $LADD_{beef}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	3.59E-09	9.28E-12	5.06E-12	NA	NA	7.95E-13	4.63E-12	1.19E-07	6.94E-07	8.13E-07
PCB-81	1.38E-11	3.56E-14	1.94E-14	NA	NA	3.06E-15	1.78E-14	4.58E-10	2.67E-09	3.12E-09
PCB-105	1.81E-08	4.67E-11	2.54E-11	NA	NA	4.00E-12	2.33E-11	6.00E-07	3.49E-06	4.09E-06
PCB-114	1.91E-09	4.93E-12	2.69E-12	NA	NA	4.22E-13	2.46E-12	6.34E-08	3.69E-07	4.32E-07
PCB-118	8.89E-08	2.30E-10	1.25E-10	NA	NA	1.97E-11	1.15E-10	2.95E-06	1.72E-05	2.01E-05
PCB-123	2.92E-09	7.55E-12	4.12E-12	NA	NA	6.47E-13	3.76E-12	9.71E-08	5.64E-07	6.62E-07
PCB-126	5.79E-06	1.50E-08	8.16E-09	NA	NA	1.28E-09	7.46E-09	1.92E-04	1.12E-03	1.31E-03
PCB-156	1.28E-07	3.32E-10	1.81E-10	NA	NA	2.85E-11	1.66E-10	4.27E-06	2.48E-05	2.91E-05
PCB-157	3.79E-08	9.79E-11	5.34E-11	NA	NA	8.39E-12	4.88E-11	1.26E-06	7.32E-06	8.58E-06
PCB-167	1.67E-09	4.31E-12	2.35E-12	NA	NA	3.69E-13	2.15E-12	5.54E-08	3.22E-07	3.78E-07
PCB-169	3.48E-07	8.99E-10	4.90E-10	NA	NA	7.71E-11	4.48E-10	1.16E-05	6.72E-05	7.88E-05
PCB-189	8.75E-09	2.26E-11	1.23E-11	NA	NA	1.94E-12	1.13E-11	2.91E-07	1.69E-06	1.98E-06
2,3,7,8-TCDD	1.38E-08	3.58E-11	1.95E-11	NA	NA	3.07E-12	1.79E-11	4.60E-07	2.68E-06	3.14E-06
1,2,3,7,8-PeCDD	2.67E-08	6.89E-11	3.76E-11	NA	NA	5.91E-12	3.44E-11	8.86E-07	5.15E-06	6.04E-06
1,2,3,4,7,8-HxCDD	1.75E-09	4.53E-12	2.47E-12	NA	NA	3.88E-13	2.26E-12	5.82E-08	3.38E-07	3.97E-07
1,2,3,6,7,8-HxCDD	4.65E-09	1.20E-11	6.55E-12	NA	NA	1.03E-12	5.99E-12	1.55E-07	8.99E-07	1.05E-06
1,2,3,7,8,9-HxCDD	2.19E-09	5.67E-12	3.09E-12	NA	NA	4.86E-13	2.83E-12	7.29E-08	4.24E-07	4.97E-07
1,2,3,4,6,7,8-HpCDD	1.00E-09	2.59E-12	1.41E-12	NA	NA	2.22E-13	1.29E-12	3.33E-08	1.94E-07	2.27E-07
OCDD	1.37E-11	3.55E-14	1.93E-14	NA	NA	3.04E-15	1.77E-14	4.56E-10	2.65E-09	3.11E-09
2,3,7,8-TCDF	6.11E-10	1.58E-12	8.62E-13	NA	NA	1.35E-13	7.88E-13	2.03E-08	1.18E-07	1.38E-07
1,2,3,7,8-PeCDF	4.94E-10	1.28E-12	6.97E-13	NA	NA	1.10E-13	6.37E-13	1.64E-08	9.56E-08	1.12E-07
2,3,4,7,8-PeCDF	1.03E-07	2.65E-10	1.45E-10	NA	NA	2.27E-11	1.32E-10	3.41E-06	1.98E-05	2.32E-05
1,2,3,4,7,8-HxCDF	1.19E-08	3.08E-11	1.68E-11	NA	NA	2.64E-12	1.54E-11	3.97E-07	2.31E-06	2.70E-06
1,2,3,6,7,8-HXCDF	6.35E-09	1.64E-11	8.95E-12	NA	NA	1.41E-12	8.19E-12	2.11E-07	1.23E-06	1.44E-06
2,3,4,6,7,8-HxCDF	5.95E-09	1.54E-11	8.40E-12	NA	NA	1.32E-12	7.68E-12	1.98E-07	1.15E-06	1.35E-06
1,2,3,7,8,9-HxCDF	2.02E-10	5.22E-13	2.85E-13	NA	NA	4.47E-14	2.60E-13	6.71E-09	3.90E-08	4.57E-08
1,2,3,4,6,7,8-HpCDF	1.35E-09	3.48E-12	1.90E-12	NA	NA	2.98E-13	1.74E-12	4.48E-08	2.60E-07	3.05E-07
1,2,3,4,7,8,9-HpCDF	1.60E-10	4.15E-13	2.26E-13	NA	NA	3.56E-14	2.07E-13	5.33E-09	3.10E-08	3.64E-08
OCDF	2.15E-12	5.56E-15	3.03E-15	NA	NA	4.76E-16	2.77E-15	7.14E-11	4.15E-10	4.87E-10

REASONABLE MAXIMUM EXPOSURE:

	Child	Adult	Total
Dioxin-like PCB congeners	2.1E-04	1.2E-03	1.5E-03
Dioxins	1.7E-06	9.7E-06	1.1E-05
Furans	4.3E-06	2.5E-05	2.9E-05
Total TEQ RME Cancer Risk	**2E-04**	**1E-03**	**1E-03**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR BACKYARD DAIRY AT 2 MG/KG TOTAL PCBS IN SOIL

	Milk concentration (mg total PCBs/kg whole milk; mg congener TEQ/kg whole milk) [a]	CTE ADD_{milk} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{milk}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	1.30E-09	5.49E-11	2.60E-11	NA	NA	4.70E-12	3.34E-12	7.05E-07	5.01E-07	1.21E-06
PCB-81	2.17E-12	9.18E-14	4.35E-14	NA	NA	7.87E-15	5.60E-15	1.18E-09	8.39E-10	2.02E-09
PCB-105	5.19E-09	2.20E-10	1.04E-10	NA	NA	1.88E-11	1.34E-11	2.82E-06	2.01E-06	4.83E-06
PCB-114	3.00E-10	1.27E-11	6.02E-12	NA	NA	1.09E-12	7.74E-13	1.63E-07	1.16E-07	2.79E-07
PCB-118	2.67E-08	1.13E-09	5.36E-10	NA	NA	9.70E-11	6.89E-11	1.45E-05	1.03E-05	2.49E-05
PCB-123	7.64E-10	3.23E-11	1.53E-11	NA	NA	2.77E-12	1.97E-12	4.15E-07	2.95E-07	7.10E-07
PCB-126	2.15E-06	9.08E-08	4.30E-08	NA	NA	7.78E-09	5.53E-09	1.17E-03	8.30E-04	2.00E-03
PCB-156	3.41E-08	1.44E-09	6.84E-10	NA	NA	1.24E-10	8.79E-11	1.86E-05	1.32E-05	3.17E-05
PCB-157	9.70E-09	4.10E-10	1.94E-10	NA	NA	3.52E-11	2.50E-11	5.28E-06	3.75E-06	9.03E-06
PCB-167	4.64E-10	1.96E-11	9.30E-12	NA	NA	1.68E-12	1.20E-12	2.52E-07	1.79E-07	4.32E-07
PCB-169	1.39E-07	5.89E-09	2.79E-09	NA	NA	5.05E-10	3.59E-10	7.57E-05	5.38E-05	1.30E-04
PCB-189	2.42E-09	1.02E-10	4.84E-11	NA	NA	8.76E-12	6.23E-12	1.31E-06	9.34E-07	2.25E-06
2,3,7,8-TCDD	2.18E-09	9.23E-11	4.37E-11	NA	NA	7.91E-12	5.62E-12	1.19E-06	8.43E-07	2.03E-06
1,2,3,7,8-PeCDD	4.20E-09	1.78E-10	8.41E-11	NA	NA	1.52E-11	1.08E-11	2.28E-06	1.62E-06	3.91E-06
1,2,3,4,7,8-HxCDD	2.76E-10	1.17E-11	5.53E-12	NA	NA	9.99E-13	7.10E-13	1.50E-07	1.07E-07	2.56E-07
1,2,3,6,7,8-HxCDD	7.32E-10	3.10E-11	1.47E-11	NA	NA	2.65E-12	1.89E-12	3.98E-07	2.83E-07	6.81E-07
1,2,3,7,8,9-HxCDD	3.46E-10	1.46E-11	6.93E-12	NA	NA	1.25E-12	8.91E-13	1.88E-07	1.34E-07	3.22E-07
1,2,3,4,6,7,8-HpCDD	1.58E-10	6.68E-12	3.17E-12	NA	NA	5.73E-13	4.07E-13	8.59E-08	6.11E-08	1.47E-07
OCDD	2.16E-12	9.14E-14	4.33E-14	NA	NA	7.83E-15	5.57E-15	1.17E-09	8.35E-10	2.01E-09
2,3,7,8-TCDF	9.63E-11	4.07E-12	1.93E-12	NA	NA	3.49E-13	2.48E-13	5.24E-08	3.72E-08	8.96E-08
1,2,3,7,8-PeCDF	7.79E-11	3.29E-12	1.56E-12	NA	NA	2.82E-13	2.01E-13	4.23E-08	3.01E-08	7.24E-08
2,3,4,7,8-PeCDF	1.62E-08	6.83E-10	3.24E-10	NA	NA	5.85E-11	4.16E-11	8.78E-06	6.24E-06	1.50E-05
1,2,3,4,7,8-HxCDF	1.88E-09	7.95E-11	3.77E-11	NA	NA	6.81E-12	4.84E-12	1.02E-06	7.26E-07	1.75E-06
1,2,3,6,7,8-HXCDF	1.00E-09	4.23E-11	2.01E-11	NA	NA	3.63E-12	2.58E-12	5.44E-07	3.87E-07	9.31E-07
2,3,4,6,7,8-HxCDF	9.38E-10	3.97E-11	1.88E-11	NA	NA	3.40E-12	2.42E-12	5.10E-07	3.63E-07	8.73E-07
1,2,3,7,8,9-HxCDF	3.18E-11	1.34E-12	6.37E-13	NA	NA	1.15E-13	8.19E-14	1.73E-08	1.23E-08	2.96E-08
1,2,3,4,6,7,8-HpCDF	2.12E-10	8.97E-12	4.25E-12	NA	NA	7.69E-13	5.47E-13	1.15E-07	8.20E-08	1.97E-07
1,2,3,4,7,8,9-HpCDF	2.53E-11	1.07E-12	5.07E-13	NA	NA	9.16E-14	6.51E-14	1.37E-08	9.77E-09	2.35E-08
OCDF	3.39E-13	1.43E-14	6.78E-15	NA	NA	1.23E-15	8.72E-16	1.84E-10	1.31E-10	3.15E-10

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	1.3E-03	9.1E-04	2.2E-03
Dioxins	4.3E-06	3.1E-06	7.3E-06
Furans	1.1E-05	7.9E-06	1.9E-05
Total TEQ CTE Cancer Risk	**1E-03**	**9E-04**	**2E-03**

Notes:

a Modeled from corn and based on fat content of Jersey cow milk.

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR BACKYARD DAIRY AT 2 MG/KG TOTAL PCBS IN SOIL

	RME ADD_{milk} (mg/kg-day)		RME Hazard Index		RME $LADD_{milk}$ (mg/kg-day)		RME Cancer Risk		
	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	8.74E-11	2.25E-11	NA	NA	7.50E-12	1.25E-11	1.12E-06	1.88E-06	3.01E-06
PCB-81	1.46E-13	3.77E-14	NA	NA	1.25E-14	2.10E-14	1.88E-09	3.15E-09	5.03E-09
PCB-105	3.50E-10	9.01E-11	NA	NA	3.00E-11	5.02E-11	4.50E-06	7.53E-06	1.20E-05
PCB-114	2.02E-11	5.21E-12	NA	NA	1.74E-12	2.90E-12	2.60E-07	4.36E-07	6.96E-07
PCB-118	1.80E-09	4.64E-10	NA	NA	1.55E-10	2.59E-10	2.32E-05	3.88E-05	6.20E-05
PCB-123	5.15E-11	1.33E-11	NA	NA	4.41E-12	7.38E-12	6.62E-07	1.11E-06	1.77E-06
PCB-126	1.45E-07	3.73E-08	NA	NA	1.24E-08	2.08E-08	1.86E-03	3.11E-03	4.97E-03
PCB-156	2.30E-09	5.92E-10	NA	NA	1.97E-10	3.30E-10	2.96E-05	4.95E-05	7.91E-05
PCB-157	6.54E-10	1.68E-10	NA	NA	5.61E-11	9.38E-11	8.41E-06	1.41E-05	2.25E-05
PCB-167	3.13E-11	8.05E-12	NA	NA	2.68E-12	4.49E-12	4.02E-07	6.73E-07	1.07E-06
PCB-169	9.39E-09	2.42E-09	NA	NA	8.05E-10	1.35E-09	1.21E-04	2.02E-04	3.23E-04
PCB-189	1.63E-10	4.19E-11	NA	NA	1.40E-11	2.34E-11	2.09E-06	3.50E-06	5.60E-06
2,3,7,8-TCDD	1.47E-10	3.79E-11	NA	NA	1.26E-11	2.11E-11	1.89E-06	3.16E-06	5.06E-06
1,2,3,7,8-PeCDD	2.83E-10	7.29E-11	NA	NA	2.43E-11	4.06E-11	3.64E-06	6.09E-06	9.73E-06
1,2,3,4,7,8-HxCDD	1.86E-11	4.79E-12	NA	NA	1.59E-12	2.67E-12	2.39E-07	4.00E-07	6.39E-07
1,2,3,6,7,8-HxCDD	4.94E-11	1.27E-11	NA	NA	4.23E-12	7.08E-12	6.35E-07	1.06E-06	1.70E-06
1,2,3,7,8,9-HxCDD	2.33E-11	6.00E-12	NA	NA	2.00E-12	3.34E-12	3.00E-07	5.01E-07	8.01E-07
1,2,3,4,6,7,8-HpCDD	1.06E-11	2.74E-12	NA	NA	9.13E-13	1.53E-12	1.37E-07	2.29E-07	3.66E-07
OCDD	1.46E-13	3.75E-14	NA	NA	1.25E-14	2.09E-14	1.87E-09	3.13E-09	5.01E-09
2,3,7,8-TCDF	6.49E-12	1.67E-12	NA	NA	5.56E-13	9.31E-13	8.35E-08	1.40E-07	2.23E-07
1,2,3,7,8-PeCDF	5.25E-12	1.35E-12	NA	NA	4.50E-13	7.53E-13	6.75E-08	1.13E-07	1.80E-07
2,3,4,7,8-PeCDF	1.09E-09	2.80E-10	NA	NA	9.33E-11	1.56E-10	1.40E-05	2.34E-05	3.74E-05
1,2,3,4,7,8-HxCDF	1.27E-10	3.26E-11	NA	NA	1.09E-11	1.82E-11	1.63E-06	2.73E-06	4.35E-06
1,2,3,6,7,8-HXCDF	6.74E-11	1.74E-11	NA	NA	5.78E-12	9.67E-12	8.67E-07	1.45E-06	2.32E-06
2,3,4,6,7,8-HxCDF	6.32E-11	1.63E-11	NA	NA	5.42E-12	9.07E-12	8.13E-07	1.36E-06	2.17E-06
1,2,3,7,8,9-HxCDF	2.14E-12	5.52E-13	NA	NA	1.84E-13	3.07E-13	2.76E-08	4.61E-08	7.37E-08
1,2,3,4,6,7,8-HpCDF	1.43E-11	3.68E-12	NA	NA	1.23E-12	2.05E-12	1.84E-07	3.08E-07	4.92E-07
1,2,3,4,7,8,9-HpCDF	1.70E-12	4.39E-13	NA	NA	1.46E-13	2.44E-13	2.19E-08	3.67E-08	5.86E-08
OCDF	2.28E-14	5.88E-15	NA	NA	1.96E-15	3.27E-15	2.93E-10	4.91E-10	7.84E-10

REASONABLE MAXIMUM EXPOSURE:

	Child	Adult	Total
Dioxin-like PCB congeners	2.1E-03	3.4E-03	5.5E-03
Dioxins	6.8E-06	1.1E-05	1.8E-05
Furans	1.8E-05	3.0E-05	4.7E-05
Total TEQ RME Cancer Risk	**2E-03**	**3E-03**	**6E-03**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR BACKYARD BEEF AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE beef concentration (mg total PCB/kg beef; mg congener TEQ/kg beef)	CTE ADD_{beef} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{beef}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	4.72E-09	9.33E-12	7.17E-12	NA	NA	8.00E-13	9.22E-13	1.20E-07	1.38E-07	2.58E-07
PCB-81	9.35E-12	1.85E-14	1.42E-14	NA	NA	1.59E-15	1.83E-15	2.38E-10	2.74E-10	5.12E-10
PCB-105	1.96E-08	3.87E-11	2.98E-11	NA	NA	3.32E-12	3.83E-12	4.98E-07	5.74E-07	1.07E-06
PCB-114	1.29E-09	2.56E-12	1.97E-12	NA	NA	2.19E-13	2.53E-13	3.29E-08	3.79E-08	7.08E-08
PCB-118	1.00E-07	1.98E-10	1.52E-10	NA	NA	1.70E-11	1.96E-11	2.54E-06	2.93E-06	5.48E-06
PCB-123	2.93E-09	5.79E-12	4.45E-12	NA	NA	4.96E-13	5.72E-13	7.45E-08	8.59E-08	1.60E-07
PCB-126	7.77E-06	1.54E-08	1.18E-08	NA	NA	1.32E-09	1.52E-09	1.98E-04	2.28E-04	4.26E-04
PCB-156	1.30E-07	2.58E-10	1.98E-10	NA	NA	2.21E-11	2.55E-11	3.32E-06	3.83E-06	7.14E-06
PCB-157	3.73E-08	7.39E-11	5.68E-11	NA	NA	6.33E-12	7.30E-12	9.50E-07	1.10E-06	2.05E-06
PCB-167	1.76E-09	3.48E-12	2.67E-12	NA	NA	2.98E-13	3.44E-13	4.47E-08	5.16E-08	9.63E-08
PCB-169	4.99E-07	9.88E-10	7.60E-10	NA	NA	8.47E-11	9.77E-11	1.27E-05	1.46E-05	2.73E-05
PCB-189	9.17E-09	1.81E-11	1.40E-11	NA	NA	1.56E-12	1.79E-12	2.33E-07	2.69E-07	5.02E-07
2,3,7,8-TCDD	9.39E-09	1.86E-11	1.43E-11	NA	NA	1.59E-12	1.84E-12	2.39E-07	2.76E-07	5.14E-07
1,2,3,7,8-PeCDD	1.81E-08	3.58E-11	2.75E-11	NA	NA	3.07E-12	3.54E-12	4.60E-07	5.30E-07	9.90E-07
1,2,3,4,7,8-HxCDD	1.19E-09	2.35E-12	1.81E-12	NA	NA	2.01E-13	2.32E-13	3.02E-08	3.48E-08	6.50E-08
1,2,3,6,7,8-HxCDD	3.15E-09	6.24E-12	4.80E-12	NA	NA	5.35E-13	6.17E-13	8.02E-08	9.25E-08	1.73E-07
1,2,3,7,8,9-HxCDD	1.49E-09	2.94E-12	2.26E-12	NA	NA	2.52E-13	2.91E-13	3.79E-08	4.37E-08	8.15E-08
1,2,3,4,6,7,8-HpCDD	6.80E-10	1.35E-12	1.03E-12	NA	NA	1.15E-13	1.33E-13	1.73E-08	2.00E-08	3.73E-08
OCDD	9.30E-12	1.84E-14	1.42E-14	NA	NA	1.58E-15	1.82E-15	2.37E-10	2.73E-10	5.10E-10
2,3,7,8-TCDF	4.14E-10	8.20E-13	6.31E-13	NA	NA	7.03E-14	8.11E-14	1.05E-08	1.22E-08	2.27E-08
1,2,3,7,8-PeCDF	3.35E-10	6.63E-13	5.10E-13	NA	NA	5.69E-14	6.56E-14	8.53E-09	9.84E-09	1.84E-08
2,3,4,7,8-PeCDF	6.95E-08	1.38E-10	1.06E-10	NA	NA	1.18E-11	1.36E-11	1.77E-06	2.04E-06	3.81E-06
1,2,3,4,7,8-HxCDF	8.09E-09	1.60E-11	1.23E-11	NA	NA	1.37E-12	1.58E-12	2.06E-07	2.37E-07	4.43E-07
1,2,3,6,7,8-HXCDF	4.31E-09	8.52E-12	6.55E-12	NA	NA	7.31E-13	8.42E-13	1.10E-07	1.26E-07	2.36E-07
2,3,4,6,7,8-HxCDF	4.04E-09	7.99E-12	6.14E-12	NA	NA	6.85E-13	7.90E-13	1.03E-07	1.18E-07	2.21E-07
1,2,3,7,8,9-HxCDF	1.37E-10	2.71E-13	2.08E-13	NA	NA	2.32E-14	2.68E-14	3.48E-09	4.02E-09	7.50E-09
1,2,3,4,6,7,8-HpCDF	9.13E-10	1.81E-12	1.39E-12	NA	NA	1.55E-13	1.79E-13	2.32E-08	2.68E-08	5.00E-08
1,2,3,4,7,8,9-HpCDF	1.09E-10	2.15E-13	1.66E-13	NA	NA	1.85E-14	2.13E-14	2.77E-09	3.19E-09	5.96E-09
OCDF	1.46E-12	2.88E-15	2.22E-15	NA	NA	2.47E-16	2.85E-16	3.71E-11	4.28E-11	7.98E-11

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	2.2E-04	2.5E-04	4.7E-04
Dioxins	8.6E-07	1.0E-06	1.9E-06
Furans	2.2E-06	2.6E-06	4.8E-06
Total TEQ CTE Cancer Risk	**2E-04**	**3E-04**	**5E-04**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR BACKYARD BEEF AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Beef Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME ADD_{beef} (mg/kg-day)		RME Hazard Index		RME $LADD_{beef}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	6.95E-09	1.80E-11	1.05E-11	NA	NA	1.54E-12	5.83E-12	2.31E-07	8.75E-07	1.11E-06
PCB-81	1.38E-11	3.56E-14	2.08E-14	NA	NA	3.06E-15	1.16E-14	4.58E-10	1.73E-09	2.19E-09
PCB-105	2.88E-08	7.46E-11	4.34E-11	NA	NA	6.39E-12	2.42E-11	9.59E-07	3.63E-06	4.59E-06
PCB-114	1.91E-09	4.93E-12	2.87E-12	NA	NA	4.22E-13	1.60E-12	6.34E-08	2.40E-07	3.03E-07
PCB-118	1.47E-07	3.81E-10	2.22E-10	NA	NA	3.27E-11	1.24E-10	4.90E-06	1.86E-05	2.35E-05
PCB-123	4.32E-09	1.12E-11	6.50E-12	NA	NA	9.56E-13	3.62E-12	1.43E-07	5.43E-07	6.86E-07
PCB-126	1.15E-05	2.96E-08	1.73E-08	NA	NA	2.54E-09	9.62E-09	3.81E-04	1.44E-03	1.82E-03
PCB-156	1.92E-07	4.97E-10	2.90E-10	NA	NA	4.26E-11	1.61E-10	6.39E-06	2.42E-05	3.06E-05
PCB-157	5.50E-08	1.42E-10	8.29E-11	NA	NA	1.22E-11	4.62E-11	1.83E-06	6.93E-06	8.76E-06
PCB-167	2.59E-09	6.70E-12	3.90E-12	NA	NA	5.74E-13	2.17E-12	8.62E-08	3.26E-07	4.12E-07
PCB-169	7.36E-07	1.90E-09	1.11E-09	NA	NA	1.63E-10	6.18E-10	2.45E-05	9.26E-05	1.17E-04
PCB-189	1.35E-08	3.50E-11	2.04E-11	NA	NA	3.00E-12	1.13E-11	4.50E-07	1.70E-06	2.15E-06
2,3,7,8-TCDD	1.38E-08	3.58E-11	2.08E-11	NA	NA	3.07E-12	1.16E-11	4.60E-07	1.74E-06	2.20E-06
1,2,3,7,8-PeCDD	2.67E-08	6.89E-11	4.01E-11	NA	NA	5.91E-12	2.24E-11	8.86E-07	3.35E-06	4.24E-06
1,2,3,4,7,8-HxCDD	1.75E-09	4.53E-12	2.64E-12	NA	NA	3.88E-13	1.47E-12	5.82E-08	2.20E-07	2.78E-07
1,2,3,6,7,8-HxCDD	4.65E-09	1.20E-11	7.00E-12	NA	NA	1.03E-12	3.90E-12	1.55E-07	5.85E-07	7.39E-07
1,2,3,7,8,9-HxCDD	2.19E-09	5.67E-12	3.30E-12	NA	NA	4.86E-13	1.84E-12	7.29E-08	2.76E-07	3.49E-07
1,2,3,4,6,7,8-HpCDD	1.00E-09	2.59E-12	1.51E-12	NA	NA	2.22E-13	8.41E-13	3.33E-08	1.26E-07	1.60E-07
OCDD	1.37E-11	3.55E-14	2.07E-14	NA	NA	3.04E-15	1.15E-14	4.56E-10	1.73E-09	2.18E-09
2,3,7,8-TCDF	6.11E-10	1.58E-12	9.20E-13	NA	NA	1.35E-13	5.13E-13	2.03E-08	7.69E-08	9.72E-08
1,2,3,7,8-PeCDF	4.94E-10	1.28E-12	7.44E-13	NA	NA	1.10E-13	4.15E-13	1.64E-08	6.22E-08	7.86E-08
2,3,4,7,8-PeCDF	1.03E-07	2.65E-10	1.54E-10	NA	NA	2.27E-11	8.60E-11	3.41E-06	1.29E-05	1.63E-05
1,2,3,4,7,8-HxCDF	1.19E-08	3.08E-11	1.80E-11	NA	NA	2.64E-12	1.00E-11	3.97E-07	1.50E-06	1.90E-06
1,2,3,6,7,8-HXCDF	6.35E-09	1.64E-11	9.56E-12	NA	NA	1.41E-12	5.33E-12	2.11E-07	7.99E-07	1.01E-06
2,3,4,6,7,8-HxCDF	5.95E-09	1.54E-11	8.97E-12	NA	NA	1.32E-12	5.00E-12	1.98E-07	7.49E-07	9.47E-07
1,2,3,7,8,9-HxCDF	2.02E-10	5.22E-13	3.04E-13	NA	NA	4.47E-14	1.69E-13	6.71E-09	2.54E-08	3.21E-08
1,2,3,4,6,7,8-HpCDF	1.35E-09	3.48E-12	2.03E-12	NA	NA	2.98E-13	1.13E-12	4.48E-08	1.69E-07	2.14E-07
1,2,3,4,7,8,9-HpCDF	1.60E-10	4.15E-13	2.42E-13	NA	NA	3.56E-14	1.35E-13	5.33E-09	2.02E-08	2.55E-08
OCDF	2.15E-12	5.56E-15	3.24E-15	NA	NA	4.76E-16	1.80E-15	7.14E-11	2.70E-10	3.42E-10

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	4.2E-04	1.6E-03	2.0E-03
Dioxins	1.7E-06	6.3E-06	8.0E-06
Furans	4.3E-06	1.6E-05	2.1E-05
Total TEQ RME Cancer Risk	**5E-04**	**2E-03**	**2E-03**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR POULTRY (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE poultry concentration (mg total PCB/kg poultry; mg congener TEQ/kg poultry)	CTE ADD$_{poultry}$ (mg/kg-day)		CTE Hazard Index		CTE LADD$_{poultry}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	6.44E-10	6.80E-13	3.82E-13	NA	NA	5.83E-14	1.58E-13	8.75E-09	2.38E-08	3.25E-08
PCB-81	1.75E-11	1.85E-14	1.04E-14	NA	NA	1.59E-15	4.30E-15	2.38E-10	6.46E-10	8.83E-10
PCB-105	9.36E-09	9.90E-12	5.56E-12	NA	NA	8.49E-13	2.30E-12	1.27E-07	3.46E-07	4.73E-07
PCB-114	1.76E-09	1.86E-12	1.04E-12	NA	NA	1.59E-13	4.33E-13	2.39E-08	6.49E-08	8.88E-08
PCB-118	1.82E-08	1.92E-11	1.08E-11	NA	NA	1.65E-12	4.47E-12	2.47E-07	6.70E-07	9.17E-07
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	6.78E-07	7.17E-10	4.02E-10	NA	NA	6.14E-11	1.67E-10	9.21E-06	2.50E-05	3.42E-05
PCB-156	4.59E-08	4.86E-11	2.73E-11	NA	NA	4.16E-12	1.13E-11	6.25E-07	1.70E-06	2.32E-06
PCB-157	1.77E-08	1.87E-11	1.05E-11	NA	NA	1.60E-12	4.35E-12	2.41E-07	6.53E-07	8.93E-07
PCB-167	6.24E-10	6.59E-13	3.70E-13	NA	NA	5.65E-14	1.53E-13	8.48E-09	2.30E-08	3.15E-08
PCB-169	9.54E-09	1.01E-11	5.67E-12	NA	NA	8.65E-13	2.35E-12	1.30E-07	3.52E-07	4.82E-07
PCB-189	3.01E-09	3.18E-12	1.79E-12	NA	NA	2.73E-13	7.40E-13	4.09E-08	1.11E-07	1.52E-07
2,3,7,8-TCDD	1.61E-08	1.71E-11	9.58E-12	NA	NA	1.46E-12	3.97E-12	2.19E-07	5.95E-07	8.15E-07
1,2,3,7,8-PeCDD	2.94E-08	3.10E-11	1.74E-11	NA	NA	2.66E-12	7.22E-12	3.99E-07	1.08E-06	1.48E-06
1,2,3,4,7,8-HxCDD	2.22E-09	2.35E-12	1.32E-12	NA	NA	2.01E-13	5.46E-13	3.02E-08	8.20E-08	1.12E-07
1,2,3,6,7,8-HxCDD	1.02E-08	1.07E-11	6.03E-12	NA	NA	9.20E-13	2.50E-12	1.38E-07	3.75E-07	5.13E-07
1,2,3,7,8,9-HxCDD	2.57E-09	2.72E-12	1.53E-12	NA	NA	2.33E-13	6.32E-13	3.49E-08	9.48E-08	1.30E-07
1,2,3,4,6,7,8-HpCDD	1.27E-10	1.35E-13	7.56E-14	NA	NA	1.15E-14	3.13E-14	1.73E-09	4.70E-09	6.43E-09
OCDD	3.48E-10	3.68E-13	2.07E-13	NA	NA	3.15E-14	8.56E-14	4.73E-09	1.28E-08	1.76E-08
2,3,7,8-TCDF	3.38E-08	3.58E-11	2.01E-11	NA	NA	3.07E-12	8.33E-12	4.60E-07	1.25E-06	1.71E-06
1,2,3,7,8-PeCDF	8.90E-09	9.41E-12	5.29E-12	NA	NA	8.07E-13	2.19E-12	1.21E-07	3.29E-07	4.50E-07
2,3,4,7,8-PeCDF	1.24E-07	1.31E-10	7.38E-11	NA	NA	1.13E-11	3.06E-11	1.69E-06	4.58E-06	6.27E-06
1,2,3,4,7,8-HxCDF	1.32E-08	1.40E-11	7.87E-12	NA	NA	1.20E-12	3.26E-12	1.80E-07	4.89E-07	6.69E-07
1,2,3,6,7,8-HXCDF	8.06E-09	8.52E-12	4.79E-12	NA	NA	7.30E-13	1.98E-12	1.10E-07	2.97E-07	4.07E-07
2,3,4,6,7,8-HxCDF	5.91E-09	6.25E-12	3.51E-12	NA	NA	5.36E-13	1.45E-12	8.04E-08	2.18E-07	2.99E-07
1,2,3,7,8,9-HxCDF	7.59E-11	8.02E-14	4.51E-14	NA	NA	6.88E-15	1.87E-14	1.03E-09	2.80E-09	3.83E-09
1,2,3,4,6,7,8-HpCDF	1.71E-09	1.81E-12	1.01E-12	NA	NA	1.55E-13	4.20E-13	2.32E-08	6.31E-08	8.63E-08
1,2,3,4,7,8,9-HpCDF	1.48E-10	1.57E-13	8.79E-14	NA	NA	1.34E-14	3.64E-14	2.01E-09	5.46E-09	7.48E-09
OCDF	2.18E-12	2.31E-15	1.30E-15	NA	NA	1.98E-16	5.37E-16	2.97E-11	8.05E-11	1.10E-10

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	1.1E-05	2.9E-05	4.0E-05
Dioxins	8.3E-07	2.2E-06	3.1E-06
Furans	2.7E-06	7.2E-06	9.9E-06
Total TEQ CTE Cancer Risk	**1E-05**	**4E-05**	**5E-05**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR POULTRY (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Poultry Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME ADD$_{poultry}$ (mg/kg-day)		RME Hazard Index		RME LADD$_{poultry}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	1.18E-09	1.53E-12	1.11E-12	NA	NA	1.31E-13	1.01E-12	1.97E-08	1.52E-07	1.71E-07
PCB-81	3.21E-11	4.16E-14	3.00E-14	NA	NA	3.57E-15	2.75E-14	5.35E-10	4.12E-09	4.66E-09
PCB-105	1.72E-08	2.23E-11	1.61E-11	NA	NA	1.91E-12	1.47E-11	2.86E-07	2.21E-06	2.49E-06
PCB-114	3.23E-09	4.18E-12	3.02E-12	NA	NA	3.59E-13	2.76E-12	5.38E-08	4.14E-07	4.68E-07
PCB-118	3.33E-08	4.32E-11	3.12E-11	NA	NA	3.70E-12	2.85E-11	5.55E-07	4.28E-06	4.83E-06
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	1.24E-06	1.61E-09	1.16E-09	NA	NA	1.38E-10	1.06E-09	2.07E-05	1.60E-04	1.80E-04
PCB-156	8.43E-08	1.09E-10	7.89E-11	NA	NA	9.37E-12	7.21E-11	1.40E-06	1.08E-05	1.22E-05
PCB-157	3.25E-08	4.21E-11	3.04E-11	NA	NA	3.61E-12	2.78E-11	5.41E-07	4.17E-06	4.71E-06
PCB-167	1.14E-09	1.48E-12	1.07E-12	NA	NA	1.27E-13	9.79E-13	1.91E-08	1.47E-07	1.66E-07
PCB-169	1.75E-08	2.27E-11	1.64E-11	NA	NA	1.94E-12	1.50E-11	2.92E-07	2.25E-06	2.54E-06
PCB-189	5.52E-09	7.16E-12	5.17E-12	NA	NA	6.13E-13	4.72E-12	9.20E-08	7.09E-07	8.01E-07
2,3,7,8-TCDD	2.96E-08	3.84E-11	2.77E-11	NA	NA	3.29E-12	2.53E-11	4.93E-07	3.80E-06	4.29E-06
1,2,3,7,8-PeCDD	5.39E-08	6.98E-11	5.04E-11	NA	NA	5.98E-12	4.61E-11	8.97E-07	6.91E-06	7.81E-06
1,2,3,4,7,8-HxCDD	4.08E-09	5.28E-12	3.81E-12	NA	NA	4.53E-13	3.49E-12	6.79E-08	5.23E-07	5.91E-07
1,2,3,6,7,8-HxCDD	1.86E-08	2.42E-11	1.74E-11	NA	NA	2.07E-12	1.59E-11	3.11E-07	2.39E-06	2.70E-06
1,2,3,7,8,9-HxCDD	4.72E-09	6.11E-12	4.41E-12	NA	NA	5.24E-13	4.04E-12	7.86E-08	6.05E-07	6.84E-07
1,2,3,4,6,7,8-HpCDD	2.34E-10	3.03E-13	2.19E-13	NA	NA	2.59E-14	2.00E-13	3.89E-09	3.00E-08	3.39E-08
OCDD	6.39E-10	8.28E-13	5.98E-13	NA	NA	7.10E-14	5.47E-13	1.06E-08	8.20E-08	9.26E-08
2,3,7,8-TCDF	6.21E-08	8.05E-11	5.81E-11	NA	NA	6.90E-12	5.31E-11	1.03E-06	7.97E-06	9.01E-06
1,2,3,7,8-PeCDF	1.63E-08	2.12E-11	1.53E-11	NA	NA	1.81E-12	1.40E-11	2.72E-07	2.10E-06	2.37E-06
2,3,4,7,8-PeCDF	2.28E-07	2.95E-10	2.13E-10	NA	NA	2.53E-11	1.95E-10	3.80E-06	2.93E-05	3.31E-05
1,2,3,4,7,8-HxCDF	2.43E-08	3.15E-11	2.27E-11	NA	NA	2.70E-12	2.08E-11	4.05E-07	3.12E-06	3.52E-06
1,2,3,6,7,8-HXCDF	1.48E-08	1.92E-11	1.38E-11	NA	NA	1.64E-12	1.27E-11	2.46E-07	1.90E-06	2.14E-06
2,3,4,6,7,8-HxCDF	1.09E-08	1.41E-11	1.02E-11	NA	NA	1.21E-12	9.29E-12	1.81E-07	1.39E-06	1.57E-06
1,2,3,7,8,9-HxCDF	1.39E-10	1.80E-13	1.30E-13	NA	NA	1.55E-14	1.19E-13	2.32E-09	1.79E-08	2.02E-08
1,2,3,4,6,7,8-HpCDF	3.14E-09	4.06E-12	2.93E-12	NA	NA	3.48E-13	2.68E-12	5.22E-08	4.03E-07	4.55E-07
1,2,3,4,7,8,9-HpCDF	2.72E-10	3.52E-13	2.54E-13	NA	NA	3.02E-14	2.33E-13	4.53E-09	3.49E-08	3.94E-08
OCDF	4.00E-12	5.19E-15	3.75E-15	NA	NA	4.45E-16	3.43E-15	6.67E-11	5.14E-10	5.80E-10

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	2.4E-05	1.8E-04	2.1E-04
Dioxins	1.9E-06	1.4E-05	1.6E-05
Furans	6.0E-06	4.6E-05	5.2E-05
Total TEQ RME Cancer Risk	**3E-05**	**2E-04**	**3E-04**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR POULTRY (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE poultry concentration (mg total PCB/kg poultry; mg congener TEQ/kg poultry)	CTE $ADD_{poultry}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{poultry}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	6.44E-10	6.80E-13	4.69E-13	NA	NA	5.83E-14	6.03E-14	8.75E-09	9.05E-09	1.78E-08
PCB-81	1.75E-11	1.85E-14	1.28E-14	NA	NA	1.59E-15	1.64E-15	2.38E-10	2.46E-10	4.84E-10
PCB-105	9.36E-09	9.90E-12	6.82E-12	NA	NA	8.49E-13	8.77E-13	1.27E-07	1.32E-07	2.59E-07
PCB-114	1.76E-09	1.86E-12	1.28E-12	NA	NA	1.59E-13	1.65E-13	2.39E-08	2.47E-08	4.86E-08
PCB-118	1.82E-08	1.92E-11	1.32E-11	NA	NA	1.65E-12	1.70E-12	2.47E-07	2.55E-07	5.02E-07
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	6.78E-07	7.17E-10	4.94E-10	NA	NA	6.14E-11	6.35E-11	9.21E-06	9.53E-06	1.87E-05
PCB-156	4.59E-08	4.86E-11	3.35E-11	NA	NA	4.16E-12	4.31E-12	6.25E-07	6.46E-07	1.27E-06
PCB-157	1.77E-08	1.87E-11	1.29E-11	NA	NA	1.60E-12	1.66E-12	2.41E-07	2.49E-07	4.89E-07
PCB-167	6.24E-10	6.59E-13	4.54E-13	NA	NA	5.65E-14	5.84E-14	8.48E-09	8.76E-09	1.72E-08
PCB-169	9.54E-09	1.01E-11	6.95E-12	NA	NA	8.65E-13	8.94E-13	1.30E-07	1.34E-07	2.64E-07
PCB-189	3.01E-09	3.18E-12	2.19E-12	NA	NA	2.73E-13	2.82E-13	4.09E-08	4.23E-08	8.32E-08
2,3,7,8-TCDD	1.61E-08	1.71E-11	1.18E-11	NA	NA	1.46E-12	1.51E-12	2.19E-07	2.27E-07	4.46E-07
1,2,3,7,8-PeCDD	2.94E-08	3.10E-11	2.14E-11	NA	NA	2.66E-12	2.75E-12	3.99E-07	4.13E-07	8.12E-07
1,2,3,4,7,8-HxCDD	2.22E-09	2.35E-12	1.62E-12	NA	NA	2.01E-13	2.08E-13	3.02E-08	3.12E-08	6.14E-08
1,2,3,6,7,8-HxCDD	1.02E-08	1.07E-11	7.40E-12	NA	NA	9.20E-13	9.52E-13	1.38E-07	1.43E-07	2.81E-07
1,2,3,7,8,9-HxCDD	2.57E-09	2.72E-12	1.87E-12	NA	NA	2.33E-13	2.41E-13	3.49E-08	3.61E-08	7.11E-08
1,2,3,4,6,7,8-HpCDD	1.27E-10	1.35E-13	9.27E-14	NA	NA	1.15E-14	1.19E-14	1.73E-09	1.79E-09	3.52E-09
OCDD	3.48E-10	3.68E-13	2.54E-13	NA	NA	3.15E-14	3.26E-14	4.73E-09	4.89E-09	9.63E-09
2,3,7,8-TCDF	3.38E-08	3.58E-11	2.47E-11	NA	NA	3.07E-12	3.17E-12	4.60E-07	4.76E-07	9.36E-07
1,2,3,7,8-PeCDF	8.90E-09	9.41E-12	6.49E-12	NA	NA	8.07E-13	8.34E-13	1.21E-07	1.25E-07	2.46E-07
2,3,4,7,8-PeCDF	1.24E-07	1.31E-10	9.05E-11	NA	NA	1.13E-11	1.16E-11	1.69E-06	1.75E-06	3.43E-06
1,2,3,4,7,8-HxCDF	1.32E-08	1.40E-11	9.65E-12	NA	NA	1.20E-12	1.24E-12	1.80E-07	1.86E-07	3.66E-07
1,2,3,6,7,8-HXCDF	8.06E-09	8.52E-12	5.87E-12	NA	NA	7.30E-13	7.55E-13	1.10E-07	1.13E-07	2.23E-07
2,3,4,6,7,8-HxCDF	5.91E-09	6.25E-12	4.31E-12	NA	NA	5.36E-13	5.54E-13	8.04E-08	8.31E-08	1.64E-07
1,2,3,7,8,9-HxCDF	7.59E-11	8.02E-14	5.53E-14	NA	NA	6.88E-15	7.11E-15	1.03E-09	1.07E-09	2.10E-09
1,2,3,4,6,7,8-HpCDF	1.71E-09	1.81E-12	1.25E-12	NA	NA	1.55E-13	1.60E-13	2.32E-08	2.40E-08	4.72E-08
1,2,3,4,7,8,9-HpCDF	1.48E-10	1.57E-13	1.08E-13	NA	NA	1.34E-14	1.39E-14	2.01E-09	2.08E-09	4.09E-09
OCDF	2.18E-12	2.31E-15	1.59E-15	NA	NA	1.98E-16	2.04E-16	2.97E-11	3.07E-11	6.03E-11

CENTRAL TENDENCY EXPOSURE:	**Child**	**Adult**	**Total**
Dioxin-like PCB congeners	1.1E-05	1.1E-05	2.2E-05
Dioxins	8.3E-07	8.6E-07	1.7E-06
Furans	2.7E-06	2.8E-06	5.4E-06
Total TEQ CTE Cancer Risk	**1E-05**	**1E-05**	**3E-05**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR POULTRY (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Poultry Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME $ADD_{poultry}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{poultry}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	1.18E-09	1.53E-12	9.19E-13	NA	NA	1.31E-13	5.12E-13	1.97E-08	7.68E-08	9.65E-08
PCB-81	3.21E-11	4.16E-14	2.50E-14	NA	NA	3.57E-15	1.39E-14	5.35E-10	2.09E-09	2.62E-09
PCB-105	1.72E-08	2.23E-11	1.34E-11	NA	NA	1.91E-12	7.45E-12	2.86E-07	1.12E-06	1.40E-06
PCB-114	3.23E-09	4.18E-12	2.51E-12	NA	NA	3.59E-13	1.40E-12	5.38E-08	2.10E-07	2.64E-07
PCB-118	3.33E-08	4.32E-11	2.59E-11	NA	NA	3.70E-12	1.45E-11	5.55E-07	2.17E-06	2.72E-06
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	1.24E-06	1.61E-09	9.68E-10	NA	NA	1.38E-10	5.39E-10	2.07E-05	8.09E-05	1.02E-04
PCB-156	8.43E-08	1.09E-10	6.56E-11	NA	NA	9.37E-12	3.66E-11	1.40E-06	5.49E-06	6.89E-06
PCB-157	3.25E-08	4.21E-11	2.53E-11	NA	NA	3.61E-12	1.41E-11	5.41E-07	2.11E-06	2.65E-06
PCB-167	1.14E-09	1.48E-12	8.91E-13	NA	NA	1.27E-13	4.96E-13	1.91E-08	7.44E-08	9.35E-08
PCB-169	1.75E-08	2.27E-11	1.36E-11	NA	NA	1.94E-12	7.59E-12	2.92E-07	1.14E-06	1.43E-06
PCB-189	5.52E-09	7.16E-12	4.30E-12	NA	NA	6.13E-13	2.39E-12	9.20E-08	3.59E-07	4.51E-07
2,3,7,8-TCDD	2.96E-08	3.84E-11	2.30E-11	NA	NA	3.29E-12	1.28E-11	4.93E-07	1.93E-06	2.42E-06
1,2,3,7,8-PeCDD	5.39E-08	6.98E-11	4.19E-11	NA	NA	5.98E-12	2.34E-11	8.97E-07	3.50E-06	4.40E-06
1,2,3,4,7,8-HxCDD	4.08E-09	5.28E-12	3.17E-12	NA	NA	4.53E-13	1.77E-12	6.79E-08	2.65E-07	3.33E-07
1,2,3,6,7,8-HxCDD	1.86E-08	2.42E-11	1.45E-11	NA	NA	2.07E-12	8.08E-12	3.11E-07	1.21E-06	1.52E-06
1,2,3,7,8,9-HxCDD	4.72E-09	6.11E-12	3.67E-12	NA	NA	5.24E-13	2.05E-12	7.86E-08	3.07E-07	3.85E-07
1,2,3,4,6,7,8-HpCDD	2.34E-10	3.03E-13	1.82E-13	NA	NA	2.59E-14	1.01E-13	3.89E-09	1.52E-08	1.91E-08
OCDD	6.39E-10	8.28E-13	4.97E-13	NA	NA	7.10E-14	2.77E-13	1.06E-08	4.16E-08	5.22E-08
2,3,7,8-TCDF	6.21E-08	8.05E-11	4.83E-11	NA	NA	6.90E-12	2.69E-11	1.03E-06	4.04E-06	5.07E-06
1,2,3,7,8-PeCDF	1.63E-08	2.12E-11	1.27E-11	NA	NA	1.81E-12	7.09E-12	2.72E-07	1.06E-06	1.33E-06
2,3,4,7,8-PeCDF	2.28E-07	2.95E-10	1.77E-10	NA	NA	2.53E-11	9.88E-11	3.80E-06	1.48E-05	1.86E-05
1,2,3,4,7,8-HxCDF	2.43E-08	3.15E-11	1.89E-11	NA	NA	2.70E-12	1.05E-11	4.05E-07	1.58E-06	1.99E-06
1,2,3,6,7,8-HXCDF	1.48E-08	1.92E-11	1.15E-11	NA	NA	1.64E-12	6.41E-12	2.46E-07	9.62E-07	1.21E-06
2,3,4,6,7,8-HxCDF	1.09E-08	1.41E-11	8.45E-12	NA	NA	1.21E-12	4.71E-12	1.81E-07	7.06E-07	8.87E-07
1,2,3,7,8,9-HxCDF	1.39E-10	1.80E-13	1.08E-13	NA	NA	1.55E-14	6.04E-14	2.32E-09	9.06E-09	1.14E-08
1,2,3,4,6,7,8-HpCDF	3.14E-09	4.06E-12	2.44E-12	NA	NA	3.48E-13	1.36E-12	5.22E-08	2.04E-07	2.56E-07
1,2,3,4,7,8,9-HpCDF	2.72E-10	3.52E-13	2.12E-13	NA	NA	3.02E-14	1.18E-13	4.53E-09	1.77E-08	2.22E-08
OCDF	4.00E-12	5.19E-15	3.12E-15	NA	NA	4.45E-16	1.74E-15	6.67E-11	2.60E-10	3.27E-10

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	2.4E-05	9.4E-05	1.2E-04
Dioxins	1.9E-06	7.3E-06	9.1E-06
Furans	6.0E-06	2.3E-05	2.9E-05
Total TEQ RME Cancer Risk	**3E-05**	**1E-04**	**2E-04**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EGG (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE egg concentration (mg total PCB/kg egg; mg congener TEQ/kg egg)	CTE ADD_{egg} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{egg}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	5.43E-09	8.28E-12	3.50E-12	NA	NA	7.09E-13	1.45E-12	1.06E-07	2.17E-07	3.24E-07
PCB-81	1.18E-10	1.80E-13	7.61E-14	NA	NA	1.54E-14	3.15E-14	2.31E-09	4.73E-09	7.04E-09
PCB-105	7.58E-08	1.16E-10	4.89E-11	NA	NA	9.91E-12	2.02E-11	1.49E-06	3.04E-06	4.52E-06
PCB-114	1.66E-08	2.53E-11	1.07E-11	NA	NA	2.17E-12	4.44E-12	3.26E-07	6.65E-07	9.91E-07
PCB-118	1.63E-07	2.49E-10	1.05E-10	NA	NA	2.14E-11	4.36E-11	3.20E-06	6.54E-06	9.75E-06
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	4.44E-06	6.77E-09	2.86E-09	NA	NA	5.81E-10	1.19E-09	8.71E-05	1.78E-04	2.65E-04
PCB-156	3.77E-07	5.75E-10	2.43E-10	NA	NA	4.93E-11	1.01E-10	7.40E-06	1.51E-05	2.25E-05
PCB-157	1.33E-07	2.02E-10	8.55E-11	NA	NA	1.73E-11	3.54E-11	2.60E-06	5.31E-06	7.91E-06
PCB-167	5.05E-09	7.70E-12	3.25E-12	NA	NA	6.60E-13	1.35E-12	9.90E-08	2.02E-07	3.01E-07
PCB-169	7.15E-08	1.09E-10	4.61E-11	NA	NA	9.35E-12	1.91E-11	1.40E-06	2.86E-06	4.27E-06
PCB-189	2.99E-08	4.56E-11	1.93E-11	NA	NA	3.91E-12	7.99E-12	5.87E-07	1.20E-06	1.78E-06
2,3,7,8-TCDD	1.40E-07	2.13E-10	9.02E-11	NA	NA	1.83E-11	3.74E-11	2.74E-06	5.60E-06	8.35E-06
1,2,3,7,8-PeCDD	2.24E-07	3.41E-10	1.44E-10	NA	NA	2.93E-11	5.98E-11	4.39E-06	8.97E-06	1.34E-05
1,2,3,4,7,8-HxCDD	2.16E-08	3.30E-11	1.39E-11	NA	NA	2.83E-12	5.78E-12	4.24E-07	8.67E-07	1.29E-06
1,2,3,6,7,8-HxCDD	7.07E-08	1.08E-10	4.56E-11	NA	NA	9.25E-12	1.89E-11	1.39E-06	2.83E-06	4.22E-06
1,2,3,7,8,9-HxCDD	3.18E-08	4.85E-11	2.05E-11	NA	NA	4.15E-12	8.49E-12	6.23E-07	1.27E-06	1.90E-06
1,2,3,4,6,7,8-HpCDD	7.44E-08	1.13E-10	4.79E-11	NA	NA	9.72E-12	1.99E-11	1.46E-06	2.98E-06	4.44E-06
OCDD	3.76E-09	5.73E-12	2.42E-12	NA	NA	4.91E-13	1.00E-12	7.37E-08	1.50E-07	2.24E-07
2,3,7,8-TCDF	9.51E-08	1.45E-10	6.13E-11	NA	NA	1.24E-11	2.54E-11	1.87E-06	3.81E-06	5.68E-06
1,2,3,7,8-PeCDF	2.44E-07	3.72E-10	1.57E-10	NA	NA	3.19E-11	6.52E-11	4.78E-06	9.77E-06	1.46E-05
2,3,4,7,8-PeCDF	1.52E-06	2.31E-09	9.77E-10	NA	NA	1.98E-10	4.05E-10	2.97E-05	6.07E-05	9.04E-05
1,2,3,4,7,8-HxCDF	2.43E-07	3.70E-10	1.56E-10	NA	NA	3.17E-11	6.48E-11	4.75E-06	9.71E-06	1.45E-05
1,2,3,6,7,8-HXCDF	1.32E-07	2.01E-10	8.51E-11	NA	NA	1.73E-11	3.53E-11	2.59E-06	5.29E-06	7.88E-06
2,3,4,6,7,8-HxCDF	7.98E-08	1.22E-10	5.14E-11	NA	NA	1.04E-11	2.13E-11	1.56E-06	3.20E-06	4.76E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	6.92E-08	1.05E-10	4.46E-11	NA	NA	9.04E-12	1.85E-11	1.36E-06	2.77E-06	4.13E-06
1,2,3,4,7,8,9-HpCDF	5.50E-09	8.38E-12	3.54E-12	NA	NA	7.18E-13	1.47E-12	1.08E-07	2.20E-07	3.28E-07
OCDF	2.94E-10	4.49E-13	1.90E-13	NA	NA	3.85E-14	7.86E-14	5.77E-09	1.18E-08	1.76E-08

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	1.0E-04	2.1E-04	3.2E-04
Dioxins	1.1E-05	2.3E-05	3.4E-05
Furans	4.7E-05	9.6E-05	1.4E-04
Total TEQ CTE Cancer Risk	**2E-04**	**3E-04**	**5E-04**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EGG (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Egg Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME ADD_{egg} (mg/kg-day)		RME Hazard Index		RME $LADD_{egg}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	5.43E-09	9.94E-12	4.40E-12	NA	NA	8.52E-13	4.03E-12	1.28E-07	6.04E-07	7.32E-07
PCB-81	1.18E-10	2.16E-13	9.58E-14	NA	NA	1.85E-14	8.76E-14	2.78E-09	1.31E-08	1.59E-08
PCB-105	7.58E-08	1.39E-10	6.15E-11	NA	NA	1.19E-11	5.62E-11	1.79E-06	8.44E-06	1.02E-05
PCB-114	1.66E-08	3.04E-11	1.35E-11	NA	NA	2.61E-12	1.23E-11	3.91E-07	1.85E-06	2.24E-06
PCB-118	1.63E-07	2.99E-10	1.33E-10	NA	NA	2.57E-11	1.21E-10	3.85E-06	1.82E-05	2.20E-05
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	4.44E-06	8.14E-09	3.60E-09	NA	NA	6.97E-10	3.29E-09	1.05E-04	4.94E-04	5.99E-04
PCB-156	3.77E-07	6.91E-10	3.06E-10	NA	NA	5.92E-11	2.80E-10	8.89E-06	4.20E-05	5.09E-05
PCB-157	1.33E-07	2.43E-10	1.08E-10	NA	NA	2.08E-11	9.84E-11	3.12E-06	1.48E-05	1.79E-05
PCB-167	5.05E-09	9.25E-12	4.10E-12	NA	NA	7.93E-13	3.74E-12	1.19E-07	5.62E-07	6.81E-07
PCB-169	7.15E-08	1.31E-10	5.80E-11	NA	NA	1.12E-11	5.31E-11	1.68E-06	7.96E-06	9.64E-06
PCB-189	2.99E-08	5.48E-11	2.43E-11	NA	NA	4.70E-12	2.22E-11	7.05E-07	3.33E-06	4.03E-06
2,3,7,8-TCDD	1.40E-07	2.56E-10	1.14E-10	NA	NA	2.20E-11	1.04E-10	3.30E-06	1.56E-05	1.89E-05
1,2,3,7,8-PeCDD	2.24E-07	4.10E-10	1.82E-10	NA	NA	3.51E-11	1.66E-10	5.27E-06	2.49E-05	3.02E-05
1,2,3,4,7,8-HxCDD	2.16E-08	3.96E-11	1.76E-11	NA	NA	3.40E-12	1.61E-11	5.10E-07	2.41E-06	2.92E-06
1,2,3,6,7,8-HxCDD	7.07E-08	1.30E-10	5.74E-11	NA	NA	1.11E-11	5.25E-11	1.67E-06	7.87E-06	9.54E-06
1,2,3,7,8,9-HxCDD	3.18E-08	5.82E-11	2.58E-11	NA	NA	4.99E-12	2.36E-11	7.49E-07	3.54E-06	4.29E-06
1,2,3,4,6,7,8-HpCDD	7.44E-08	1.36E-10	6.04E-11	NA	NA	1.17E-11	5.52E-11	1.75E-06	8.28E-06	1.00E-05
OCDD	3.76E-09	6.88E-12	3.05E-12	NA	NA	5.90E-13	2.79E-12	8.85E-08	4.18E-07	5.07E-07
2,3,7,8-TCDF	9.51E-08	1.74E-10	7.72E-11	NA	NA	1.49E-11	7.06E-11	2.24E-06	1.06E-05	1.28E-05
1,2,3,7,8-PeCDF	2.44E-07	4.47E-10	1.98E-10	NA	NA	3.83E-11	1.81E-10	5.75E-06	2.72E-05	3.29E-05
2,3,4,7,8-PeCDF	1.52E-06	2.78E-09	1.23E-09	NA	NA	2.38E-10	1.12E-09	3.57E-05	1.69E-04	2.04E-04
1,2,3,4,7,8-HxCDF	2.43E-07	4.44E-10	1.97E-10	NA	NA	3.81E-11	1.80E-10	5.71E-06	2.70E-05	3.27E-05
1,2,3,6,7,8-HXCDF	1.32E-07	2.42E-10	1.07E-10	NA	NA	2.07E-11	9.79E-11	3.11E-06	1.47E-05	1.78E-05
2,3,4,6,7,8-HxCDF	7.98E-08	1.46E-10	6.47E-11	NA	NA	1.25E-11	5.92E-11	1.88E-06	8.88E-06	1.08E-05
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	6.92E-08	1.27E-10	5.61E-11	NA	NA	1.09E-11	5.13E-11	1.63E-06	7.70E-06	9.33E-06
1,2,3,4,7,8,9-HpCDF	5.50E-09	1.01E-11	4.46E-12	NA	NA	8.63E-13	4.08E-12	1.29E-07	6.11E-07	7.41E-07
OCDF	2.94E-10	5.39E-13	2.39E-13	NA	NA	4.62E-14	2.18E-13	6.93E-09	3.27E-08	3.97E-08

REASONABLE MAXIMUM EXPOSURE:

	Child	Adult	Total
Dioxin-like PCB congeners	1.3E-04	5.9E-04	7.2E-04
Dioxins	1.3E-05	6.3E-05	7.6E-05
Furans	5.6E-05	2.7E-04	3.2E-04
Total TEQ RME Cancer Risk	**2E-04**	**9E-04**	**1E-03**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EGG (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE egg concentration (mg total PCB/kg egg; mg congener TEQ/kg egg)	CTE ADD_{egg} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{egg}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	5.43E-09	8.28E-12	4.11E-12	NA	NA	7.09E-13	5.28E-13	1.06E-07	7.92E-08	1.86E-07
PCB-81	1.18E-10	1.80E-13	8.93E-14	NA	NA	1.54E-14	1.15E-14	2.31E-09	1.72E-09	4.04E-09
PCB-105	7.58E-08	1.16E-10	5.74E-11	NA	NA	9.91E-12	7.38E-12	1.49E-06	1.11E-06	2.59E-06
PCB-114	1.66E-08	2.53E-11	1.26E-11	NA	NA	2.17E-12	1.62E-12	3.26E-07	2.42E-07	5.68E-07
PCB-118	1.63E-07	2.49E-10	1.24E-10	NA	NA	2.14E-11	1.59E-11	3.20E-06	2.38E-06	5.59E-06
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	4.44E-06	6.77E-09	3.36E-09	NA	NA	5.81E-10	4.32E-10	8.71E-05	6.48E-05	1.52E-04
PCB-156	3.77E-07	5.75E-10	2.86E-10	NA	NA	4.93E-11	3.67E-11	7.40E-06	5.51E-06	1.29E-05
PCB-157	1.33E-07	2.02E-10	1.00E-10	NA	NA	1.73E-11	1.29E-11	2.60E-06	1.94E-06	4.54E-06
PCB-167	5.05E-09	7.70E-12	3.82E-12	NA	NA	6.60E-13	4.91E-13	9.90E-08	7.37E-08	1.73E-07
PCB-169	7.15E-08	1.09E-10	5.41E-11	NA	NA	9.35E-12	6.96E-12	1.40E-06	1.04E-06	2.45E-06
PCB-189	2.99E-08	4.56E-11	2.26E-11	NA	NA	3.91E-12	2.91E-12	5.87E-07	4.37E-07	1.02E-06
2,3,7,8-TCDD	1.40E-07	2.13E-10	1.06E-10	NA	NA	1.83E-11	1.36E-11	2.74E-06	2.04E-06	4.79E-06
1,2,3,7,8-PeCDD	2.24E-07	3.41E-10	1.69E-10	NA	NA	2.93E-11	2.18E-11	4.39E-06	3.27E-06	7.66E-06
1,2,3,4,7,8-HxCDD	2.16E-08	3.30E-11	1.64E-11	NA	NA	2.83E-12	2.11E-12	4.24E-07	3.16E-07	7.40E-07
1,2,3,6,7,8-HxCDD	7.07E-08	1.08E-10	5.35E-11	NA	NA	9.25E-12	6.88E-12	1.39E-06	1.03E-06	2.42E-06
1,2,3,7,8,9-HxCDD	3.18E-08	4.85E-11	2.41E-11	NA	NA	4.15E-12	3.09E-12	6.23E-07	4.64E-07	1.09E-06
1,2,3,4,6,7,8-HpCDD	7.44E-08	1.13E-10	5.63E-11	NA	NA	9.72E-12	7.24E-12	1.46E-06	1.09E-06	2.54E-06
OCDD	3.76E-09	5.73E-12	2.84E-12	NA	NA	4.91E-13	3.66E-13	7.37E-08	5.48E-08	1.29E-07
2,3,7,8-TCDF	9.51E-08	1.45E-10	7.20E-11	NA	NA	1.24E-11	9.26E-12	1.87E-06	1.39E-06	3.25E-06
1,2,3,7,8-PeCDF	2.44E-07	3.72E-10	1.85E-10	NA	NA	3.19E-11	2.37E-11	4.78E-06	3.56E-06	8.35E-06
2,3,4,7,8-PeCDF	1.52E-06	2.31E-09	1.15E-09	NA	NA	1.98E-10	1.47E-10	2.97E-05	2.21E-05	5.18E-05
1,2,3,4,7,8-HxCDF	2.43E-07	3.70E-10	1.84E-10	NA	NA	3.17E-11	2.36E-11	4.75E-06	3.54E-06	8.29E-06
1,2,3,6,7,8-HXCDF	1.32E-07	2.01E-10	9.99E-11	NA	NA	1.73E-11	1.28E-11	2.59E-06	1.93E-06	4.52E-06
2,3,4,6,7,8-HxCDF	7.98E-08	1.22E-10	6.04E-11	NA	NA	1.04E-11	7.76E-12	1.56E-06	1.16E-06	2.73E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	6.92E-08	1.05E-10	5.23E-11	NA	NA	9.04E-12	6.73E-12	1.36E-06	1.01E-06	2.37E-06
1,2,3,4,7,8,9-HpCDF	5.50E-09	8.38E-12	4.16E-12	NA	NA	7.18E-13	5.35E-13	1.08E-07	8.02E-08	1.88E-07
OCDF	2.94E-10	4.49E-13	2.23E-13	NA	NA	3.85E-14	2.86E-14	5.77E-09	4.30E-09	1.01E-08

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	1.0E-04	7.8E-05	1.8E-04
Dioxins	1.1E-05	8.3E-06	1.9E-05
Furans	4.7E-05	3.5E-05	8.2E-05
Total TEQ CTE Cancer Risk	**2E-04**	**1E-04**	**3E-04**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EGG (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Egg Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME ADD_{egg} (mg/kg-day)		RME Hazard Index		RME $LADD_{egg}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	5.43E-09	9.94E-12	4.44E-12	NA	NA	8.52E-13	2.47E-12	1.28E-07	3.71E-07	4.99E-07
PCB-81	1.18E-10	2.16E-13	9.66E-14	NA	NA	1.85E-14	5.38E-14	2.78E-09	8.07E-09	1.08E-08
PCB-105	7.58E-08	1.39E-10	6.20E-11	NA	NA	1.19E-11	3.46E-11	1.79E-06	5.18E-06	6.97E-06
PCB-114	1.66E-08	3.04E-11	1.36E-11	NA	NA	2.61E-12	7.57E-12	3.91E-07	1.14E-06	1.53E-06
PCB-118	1.63E-07	2.99E-10	1.34E-10	NA	NA	2.57E-11	7.45E-11	3.85E-06	1.12E-05	1.50E-05
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	4.44E-06	8.14E-09	3.63E-09	NA	NA	6.97E-10	2.02E-09	1.05E-04	3.04E-04	4.08E-04
PCB-156	3.77E-07	6.91E-10	3.09E-10	NA	NA	5.92E-11	1.72E-10	8.89E-06	2.58E-05	3.47E-05
PCB-157	1.33E-07	2.43E-10	1.08E-10	NA	NA	2.08E-11	6.04E-11	3.12E-06	9.07E-06	1.22E-05
PCB-167	5.05E-09	9.25E-12	4.13E-12	NA	NA	7.93E-13	2.30E-12	1.19E-07	3.45E-07	4.64E-07
PCB-169	7.15E-08	1.31E-10	5.85E-11	NA	NA	1.12E-11	3.26E-11	1.68E-06	4.89E-06	6.57E-06
PCB-189	2.99E-08	5.48E-11	2.45E-11	NA	NA	4.70E-12	1.36E-11	7.05E-07	2.05E-06	2.75E-06
2,3,7,8-TCDD	1.40E-07	2.56E-10	1.14E-10	NA	NA	2.20E-11	6.38E-11	3.30E-06	9.57E-06	1.29E-05
1,2,3,7,8-PeCDD	2.24E-07	4.10E-10	1.83E-10	NA	NA	3.51E-11	1.02E-10	5.27E-06	1.53E-05	2.06E-05
1,2,3,4,7,8-HxCDD	2.16E-08	3.96E-11	1.77E-11	NA	NA	3.40E-12	9.86E-12	5.10E-07	1.48E-06	1.99E-06
1,2,3,6,7,8-HxCDD	7.07E-08	1.30E-10	5.79E-11	NA	NA	1.11E-11	3.22E-11	1.67E-06	4.84E-06	6.50E-06
1,2,3,7,8,9-HxCDD	3.18E-08	5.82E-11	2.60E-11	NA	NA	4.99E-12	1.45E-11	7.49E-07	2.17E-06	2.92E-06
1,2,3,4,6,7,8-HpCDD	7.44E-08	1.36E-10	6.09E-11	NA	NA	1.17E-11	3.39E-11	1.75E-06	5.09E-06	6.84E-06
OCDD	3.76E-09	6.88E-12	3.07E-12	NA	NA	5.90E-13	1.71E-12	8.85E-08	2.57E-07	3.45E-07
2,3,7,8-TCDF	9.51E-08	1.74E-10	7.78E-11	NA	NA	1.49E-11	4.34E-11	2.24E-06	6.50E-06	8.74E-06
1,2,3,7,8-PeCDF	2.44E-07	4.47E-10	2.00E-10	NA	NA	3.83E-11	1.11E-10	5.75E-06	1.67E-05	2.24E-05
2,3,4,7,8-PeCDF	1.52E-06	2.78E-09	1.24E-09	NA	NA	2.38E-10	6.91E-10	3.57E-05	1.04E-04	1.39E-04
1,2,3,4,7,8-HxCDF	2.43E-07	4.44E-10	1.98E-10	NA	NA	3.81E-11	1.11E-10	5.71E-06	1.66E-05	2.23E-05
1,2,3,6,7,8-HXCDF	1.32E-07	2.42E-10	1.08E-10	NA	NA	2.07E-11	6.02E-11	3.11E-06	9.03E-06	1.21E-05
2,3,4,6,7,8-HxCDF	7.98E-08	1.46E-10	6.53E-11	NA	NA	1.25E-11	3.64E-11	1.88E-06	5.45E-06	7.33E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	6.92E-08	1.27E-10	5.66E-11	NA	NA	1.09E-11	3.15E-11	1.63E-06	4.73E-06	6.36E-06
1,2,3,4,7,8,9-HpCDF	5.50E-09	1.01E-11	4.49E-12	NA	NA	8.63E-13	2.50E-12	1.29E-07	3.76E-07	5.05E-07
OCDF	2.94E-10	5.39E-13	2.41E-13	NA	NA	4.62E-14	1.34E-13	6.93E-09	2.01E-08	2.71E-08

REASONABLE MAXIMUM EXPOSURE:

	Child	Adult	Total
Dioxin-like PCB congeners	1.3E-04	3.6E-04	4.9E-04
Dioxins	1.3E-05	3.9E-05	5.2E-05
Furans	5.6E-05	1.6E-04	2.2E-04
Total TEQ RME Cancer Risk	**2E-04**	**6E-04**	**8E-04**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED FRUIT (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE exposed fruit concentration (mg total PCB/kg exposed fruit; mg congener TEQ/kg exposed fruit)	CTE $ADD_{exposed\ fruit}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{exposed\ fruit}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	3.43E-10	4.47E-14	2.42E-14	NA	NA	3.83E-15	1.00E-14	5.75E-10	1.50E-09	2.08E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	1.56E-13	8.41E-14	NA	NA	1.33E-14	3.48E-14	2.00E-09	5.22E-09	7.22E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	4.45E-13	2.40E-13	NA	NA	3.81E-14	9.96E-14	5.72E-09	1.49E-08	2.07E-08
PCB-123	8.27E-11	1.08E-14	5.83E-15	NA	NA	9.25E-16	2.42E-15	1.39E-10	3.62E-10	5.01E-10
PCB-126	3.22E-07	4.20E-11	2.27E-11	NA	NA	3.60E-12	9.39E-12	5.39E-07	1.41E-06	1.95E-06
PCB-156	4.47E-09	5.83E-13	3.15E-13	NA	NA	5.00E-14	1.31E-13	7.50E-09	1.96E-08	2.71E-08
PCB-157	1.26E-09	1.64E-13	8.87E-14	NA	NA	1.41E-14	3.68E-14	2.11E-09	5.51E-09	7.63E-09
PCB-167	6.86E-11	8.94E-15	4.83E-15	NA	NA	7.67E-16	2.00E-15	1.15E-10	3.00E-10	4.15E-10
PCB-169	3.01E-08	3.93E-12	2.12E-12	NA	NA	3.37E-13	8.80E-13	5.05E-08	1.32E-07	1.83E-07
PCB-189	4.20E-10	5.48E-14	2.96E-14	NA	NA	4.70E-15	1.23E-14	7.05E-10	1.84E-09	2.55E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	6.1E-07	1.6E-06	2.2E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**6E-07**	**2E-06**	**2E-06**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED FRUIT (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Exposed Fruit Concentration (mg total PCB /kg exposed fruit; mg congener TEQ/kg exposed fruit)	RME ADD$_{exposed\ fruit}$ (mg/kg-day)		RME Hazard Index		RME LADD$_{exposed\ fruit}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	3.43E-10	6.19E-14	3.52E-14	NA	NA	5.30E-15	3.22E-14	7.96E-10	4.83E-09	5.62E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	2.15E-13	1.23E-13	NA	NA	1.85E-14	1.12E-13	2.77E-09	1.68E-08	1.96E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	6.16E-13	3.50E-13	NA	NA	5.28E-14	3.20E-13	7.92E-09	4.80E-08	5.60E-08
PCB-123	8.27E-11	1.49E-14	8.50E-15	NA	NA	1.28E-15	7.77E-15	1.92E-10	1.17E-09	1.36E-09
PCB-126	3.22E-07	5.81E-11	3.30E-11	NA	NA	4.98E-12	3.02E-11	7.47E-07	4.53E-06	5.28E-06
PCB-156	4.47E-09	8.08E-13	4.60E-13	NA	NA	6.93E-14	4.20E-13	1.04E-08	6.30E-08	7.34E-08
PCB-157	1.26E-09	2.27E-13	1.29E-13	NA	NA	1.95E-14	1.18E-13	2.92E-09	1.77E-08	2.07E-08
PCB-167	6.86E-11	1.24E-14	7.04E-15	NA	NA	1.06E-15	6.44E-15	1.59E-10	9.66E-10	1.13E-09
PCB-169	3.01E-08	5.44E-12	3.10E-12	NA	NA	4.66E-13	2.83E-12	7.00E-08	4.24E-07	4.94E-07
PCB-189	4.20E-10	7.59E-14	4.32E-14	NA	NA	6.51E-15	3.95E-14	9.76E-10	5.92E-09	6.90E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:

	Child	Adult	Total
Dioxin-like PCB congeners	8.4E-07	5.1E-06	6.0E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ RME Cancer Risk	**8E-07**	**5E-06**	**6E-06**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED FRUIT (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE exposed fruit concentration (mg total PCB/kg exposed fruit; mg congener TEQ/kg exposed fruit)	CTE ADD$_{exposed\ fruit}$ (mg/kg-day)		CTE Hazard Index		CTE LADD$_{exposed\ fruit}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	3.43E-10	4.47E-14	3.43E-14	NA	NA	3.83E-15	4.41E-15	5.75E-10	6.62E-10	1.24E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	1.56E-13	1.20E-13	NA	NA	1.33E-14	1.54E-14	2.00E-09	2.30E-09	4.30E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	4.45E-13	3.42E-13	NA	NA	3.81E-14	4.39E-14	5.72E-09	6.59E-09	1.23E-08
PCB-123	8.27E-11	1.08E-14	8.29E-15	NA	NA	9.25E-16	1.07E-15	1.39E-10	1.60E-10	2.99E-10
PCB-126	3.22E-07	4.20E-11	3.22E-11	NA	NA	3.60E-12	4.14E-12	5.39E-07	6.22E-07	1.16E-06
PCB-156	4.47E-09	5.83E-13	4.48E-13	NA	NA	5.00E-14	5.76E-14	7.50E-09	8.65E-09	1.61E-08
PCB-157	1.26E-09	1.64E-13	1.26E-13	NA	NA	1.41E-14	1.62E-14	2.11E-09	2.43E-09	4.54E-09
PCB-167	6.86E-11	8.94E-15	6.87E-15	NA	NA	7.67E-16	8.84E-16	1.15E-10	1.33E-10	2.48E-10
PCB-169	3.01E-08	3.93E-12	3.02E-12	NA	NA	3.37E-13	3.88E-13	5.05E-08	5.82E-08	1.09E-07
PCB-189	4.20E-10	5.48E-14	4.21E-14	NA	NA	4.70E-15	5.42E-15	7.05E-10	8.12E-10	1.52E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	6.1E-07	7.0E-07	1.3E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**6E-07**	**7E-07**	**1E-06**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED FRUIT (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Exposed Fruit Concentration (mg total PCB /kg exposed fruit; mg congener TEQ/kg exposed fruit)	RME $ADD_{exposed\ fruit}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{exposed\ fruit}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	3.43E-10	6.19E-14	3.68E-14	NA	NA	5.30E-15	2.05E-14	7.96E-10	3.08E-09	3.87E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	2.15E-13	1.28E-13	NA	NA	1.85E-14	7.14E-14	2.77E-09	1.07E-08	1.35E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	6.16E-13	3.66E-13	NA	NA	5.28E-14	2.04E-13	7.92E-09	3.06E-08	3.85E-08
PCB-123	8.27E-11	1.49E-14	8.89E-15	NA	NA	1.28E-15	4.95E-15	1.92E-10	7.43E-10	9.35E-10
PCB-126	3.22E-07	5.81E-11	3.46E-11	NA	NA	4.98E-12	1.93E-11	7.47E-07	2.89E-06	3.63E-06
PCB-156	4.47E-09	8.08E-13	4.81E-13	NA	NA	6.93E-14	2.68E-13	1.04E-08	4.02E-08	5.05E-08
PCB-157	1.26E-09	2.27E-13	1.35E-13	NA	NA	1.95E-14	7.53E-14	2.92E-09	1.13E-08	1.42E-08
PCB-167	6.86E-11	1.24E-14	7.37E-15	NA	NA	1.06E-15	4.10E-15	1.59E-10	6.16E-10	7.75E-10
PCB-169	3.01E-08	5.44E-12	3.24E-12	NA	NA	4.66E-13	1.80E-12	7.00E-08	2.71E-07	3.40E-07
PCB-189	4.20E-10	7.59E-14	4.52E-14	NA	NA	6.51E-15	2.52E-14	9.76E-10	3.77E-09	4.75E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	8.4E-07	3.3E-06	4.1E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ RME Cancer Risk	**8E-07**	**3E-06**	**4E-06**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED VEGETABLE (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE exposed vegetable concentration (mg total PCB/kg exposed vegetable; mg congener TEQ/kg exposed vegetable)	CTE $ADD_{exposed\ vegetable}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{exposed\ vegetable}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	3.43E-10	1.87E-13	9.19E-14	NA	NA	1.60E-14	3.81E-14	2.41E-09	5.71E-09	8.12E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	6.51E-13	3.20E-13	NA	NA	5.58E-14	1.33E-13	8.38E-09	1.99E-08	2.83E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	1.86E-12	9.15E-13	NA	NA	1.60E-13	3.79E-13	2.39E-08	5.68E-08	8.08E-08
PCB-123	8.27E-11	4.52E-14	2.22E-14	NA	NA	3.87E-15	9.19E-15	5.81E-10	1.38E-09	1.96E-09
PCB-126	3.22E-07	1.76E-10	8.63E-11	NA	NA	1.51E-11	3.58E-11	2.26E-06	5.36E-06	7.62E-06
PCB-156	4.47E-09	2.44E-12	1.20E-12	NA	NA	2.09E-13	4.97E-13	3.14E-08	7.46E-08	1.06E-07
PCB-157	1.26E-09	6.88E-13	3.38E-13	NA	NA	5.89E-14	1.40E-13	8.84E-09	2.10E-08	2.98E-08
PCB-167	6.86E-11	3.75E-14	1.84E-14	NA	NA	3.21E-15	7.62E-15	4.82E-10	1.14E-09	1.62E-09
PCB-169	3.01E-08	1.65E-11	8.08E-12	NA	NA	1.41E-12	3.35E-12	2.12E-07	5.02E-07	7.14E-07
PCB-189	4.20E-10	2.30E-13	1.13E-13	NA	NA	1.97E-14	4.67E-14	2.95E-09	7.01E-09	9.96E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	2.5E-06	6.1E-06	8.6E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**3E-06**	**6E-06**	**9E-06**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED VEGETABLE (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME exposed vegetable Concentration (mg total PCB /kg exposed vegetable; mg congener TEQ/kg exposed vegetable)	RME $ADD_{exposed\ vegetable}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{exposed\ vegetable}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	3.43E-10	2.90E-13	1.62E-13	NA	NA	2.48E-14	1.48E-13	3.73E-09	2.22E-08	2.59E-08
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	1.01E-12	5.63E-13	NA	NA	8.65E-14	5.15E-13	1.30E-08	7.72E-08	9.01E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	2.88E-12	1.61E-12	NA	NA	2.47E-13	1.47E-12	3.71E-08	2.21E-07	2.58E-07
PCB-123	8.27E-11	7.00E-14	3.90E-14	NA	NA	6.00E-15	3.57E-14	9.00E-10	5.35E-09	6.25E-09
PCB-126	3.22E-07	2.72E-10	1.52E-10	NA	NA	2.33E-11	1.39E-10	3.50E-06	2.08E-05	2.43E-05
PCB-156	4.47E-09	3.78E-12	2.11E-12	NA	NA	3.24E-13	1.93E-12	4.87E-08	2.90E-07	3.38E-07
PCB-157	1.26E-09	1.06E-12	5.94E-13	NA	NA	9.13E-14	5.43E-13	1.37E-08	8.15E-08	9.52E-08
PCB-167	6.86E-11	5.80E-14	3.24E-14	NA	NA	4.97E-15	2.96E-14	7.46E-10	4.44E-09	5.18E-09
PCB-169	3.01E-08	2.55E-11	1.42E-11	NA	NA	2.18E-12	1.30E-11	3.28E-07	1.95E-06	2.28E-06
PCB-189	4.20E-10	3.56E-13	1.98E-13	NA	NA	3.05E-14	1.81E-13	4.57E-09	2.72E-08	3.18E-08
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	3.9E-06	2.3E-05	2.7E-05
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ RME Cancer Risk	**4E-06**	**2E-05**	**3E-05**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED VEGETABLE (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE exposed vegetable concentration (mg total PCB/kg exposed vegetable; mg congener TEQ/kg exposed vegetable)	CTE $ADD_{exposed\ vegetable}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{exposed\ vegetable}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	3.43E-10	1.87E-13	1.04E-13	NA	NA	1.60E-14	1.33E-14	2.41E-09	2.00E-09	4.40E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	6.51E-13	3.60E-13	NA	NA	5.58E-14	4.63E-14	8.38E-09	6.95E-09	1.53E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	1.86E-12	1.03E-12	NA	NA	1.60E-13	1.32E-13	2.39E-08	1.99E-08	4.38E-08
PCB-123	8.27E-11	4.52E-14	2.50E-14	NA	NA	3.87E-15	3.21E-15	5.81E-10	4.82E-10	1.06E-09
PCB-126	3.22E-07	1.76E-10	9.72E-11	NA	NA	1.51E-11	1.25E-11	2.26E-06	1.87E-06	4.13E-06
PCB-156	4.47E-09	2.44E-12	1.35E-12	NA	NA	2.09E-13	1.74E-13	3.14E-08	2.61E-08	5.75E-08
PCB-157	1.26E-09	6.88E-13	3.80E-13	NA	NA	5.89E-14	4.89E-14	8.84E-09	7.33E-09	1.62E-08
PCB-167	6.86E-11	3.75E-14	2.07E-14	NA	NA	3.21E-15	2.66E-15	4.82E-10	4.00E-10	8.81E-10
PCB-169	3.01E-08	1.65E-11	9.10E-12	NA	NA	1.41E-12	1.17E-12	2.12E-07	1.76E-07	3.87E-07
PCB-189	4.20E-10	2.30E-13	1.27E-13	NA	NA	1.97E-14	1.63E-14	2.95E-09	2.45E-09	5.40E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	2.5E-06	2.1E-06	4.7E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**3E-06**	**2E-06**	**5E-06**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED VEGETABLE (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME exposed vegetable Concentration (mg total PCB /kg exposed vegetable; mg congener TEQ/kg exposed vegetable)	RME $ADD_{exposed\ vegetable}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{exposed\ vegetable}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	3.43E-10	2.90E-13	1.43E-13	NA	NA	2.48E-14	7.97E-14	3.73E-09	1.19E-08	1.57E-08
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	1.01E-12	4.98E-13	NA	NA	8.65E-14	2.77E-13	1.30E-08	4.16E-08	5.46E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	2.88E-12	1.42E-12	NA	NA	2.47E-13	7.93E-13	3.71E-08	1.19E-07	1.56E-07
PCB-123	8.27E-11	7.00E-14	3.45E-14	NA	NA	6.00E-15	1.92E-14	9.00E-10	2.88E-09	3.78E-09
PCB-126	3.22E-07	2.72E-10	1.34E-10	NA	NA	2.33E-11	7.48E-11	3.50E-06	1.12E-05	1.47E-05
PCB-156	4.47E-09	3.78E-12	1.87E-12	NA	NA	3.24E-13	1.04E-12	4.87E-08	1.56E-07	2.05E-07
PCB-157	1.26E-09	1.06E-12	5.25E-13	NA	NA	9.13E-14	2.93E-13	1.37E-08	4.39E-08	5.76E-08
PCB-167	6.86E-11	5.80E-14	2.86E-14	NA	NA	4.97E-15	1.59E-14	7.46E-10	2.39E-09	3.14E-09
PCB-169	3.01E-08	2.55E-11	1.26E-11	NA	NA	2.18E-12	7.00E-12	3.28E-07	1.05E-06	1.38E-06
PCB-189	4.20E-10	3.56E-13	1.75E-13	NA	NA	3.05E-14	9.77E-14	4.57E-09	1.47E-08	1.92E-08
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:

	Child	Adult	Total
Dioxin-like PCB congeners	3.9E-06	1.3E-05	1.7E-05
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ RME Cancer Risk	**4E-06**	**1E-05**	**2E-05**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR ROOT VEGETABLES (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE root vegetable concentration (mg total PCB/kg root vegetable; mg congener TEQ/kg root vegetable)	CTE $ADD_{root\ vegetable}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{root\ vegetable}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	5.71E-11	2.32E-14	1.32E-14	NA	NA	1.99E-15	5.47E-15	2.98E-10	8.20E-10	1.12E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.99E-10	8.07E-14	4.59E-14	NA	NA	6.92E-15	1.90E-14	1.04E-09	2.86E-09	3.89E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	5.68E-10	2.31E-13	1.31E-13	NA	NA	1.98E-14	5.44E-14	2.97E-09	8.16E-09	1.11E-08
PCB-123	1.38E-11	5.60E-15	3.19E-15	NA	NA	4.80E-16	1.32E-15	7.20E-11	1.98E-10	2.70E-10
PCB-126	5.36E-08	2.18E-11	1.24E-11	NA	NA	1.87E-12	5.13E-12	2.80E-07	7.70E-07	1.05E-06
PCB-156	7.46E-10	3.03E-13	1.72E-13	NA	NA	2.59E-14	7.14E-14	3.89E-09	1.07E-08	1.46E-08
PCB-157	2.10E-10	8.52E-14	4.85E-14	NA	NA	7.30E-15	2.01E-14	1.10E-09	3.01E-09	4.11E-09
PCB-167	1.14E-11	4.64E-15	2.64E-15	NA	NA	3.98E-16	1.09E-15	5.97E-11	1.64E-10	2.24E-10
PCB-169	5.02E-09	2.04E-12	1.16E-12	NA	NA	1.75E-13	4.81E-13	2.62E-08	7.21E-08	9.84E-08
PCB-189	7.01E-11	2.84E-14	1.62E-14	NA	NA	2.44E-15	6.71E-15	3.66E-10	1.01E-09	1.37E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	3.2E-07	8.7E-07	1.2E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**3E-07**	**9E-07**	**1E-06**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR ROOT VEGETABLES (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME root vegetable Concentration (mg total PCB /kg root vegetable; mg congener TEQ/kg root vegetable)	RME $ADD_{root\ vegetable}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{root\ vegetable}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	5.71E-11	3.85E-14	2.15E-14	NA	NA	3.30E-15	1.97E-14	4.94E-10	2.95E-09	3.45E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.99E-10	1.34E-13	7.49E-14	NA	NA	1.15E-14	6.85E-14	1.72E-09	1.03E-08	1.20E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	5.68E-10	3.83E-13	2.14E-13	NA	NA	3.28E-14	1.96E-13	4.92E-09	2.94E-08	3.43E-08
PCB-123	1.38E-11	9.28E-15	5.20E-15	NA	NA	7.96E-16	4.75E-15	1.19E-10	7.13E-10	8.32E-10
PCB-126	5.36E-08	3.61E-11	2.02E-11	NA	NA	3.09E-12	1.85E-11	4.64E-07	2.77E-06	3.24E-06
PCB-156	7.46E-10	5.02E-13	2.81E-13	NA	NA	4.30E-14	2.57E-13	6.45E-09	3.85E-08	4.50E-08
PCB-157	2.10E-10	1.41E-13	7.91E-14	NA	NA	1.21E-14	7.23E-14	1.82E-09	1.08E-08	1.27E-08
PCB-167	1.14E-11	7.70E-15	4.31E-15	NA	NA	6.60E-16	3.94E-15	9.89E-11	5.91E-10	6.90E-10
PCB-169	5.02E-09	3.38E-12	1.89E-12	NA	NA	2.90E-13	1.73E-12	4.35E-08	2.60E-07	3.03E-07
PCB-189	7.01E-11	4.72E-14	2.64E-14	NA	NA	4.04E-15	2.41E-14	6.07E-10	3.62E-09	4.23E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	5.2E-07	3.1E-06	3.7E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ RME Cancer Risk	**5E-07**	**3E-06**	**4E-06**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR ROOT VEGETABLES (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE root vegetable concentration (mg total PCB/kg root vegetable; mg congener TEQ/kg root vegetable)	CTE ADD$_{root\ vegetable}$ (mg/kg-day)		CTE Hazard Index		CTE LADD$_{root\ vegetable}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	5.71E-11	2.32E-14	1.57E-14	NA	NA	1.99E-15	2.02E-15	2.98E-10	3.03E-10	6.01E-10
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.99E-10	8.07E-14	5.46E-14	NA	NA	6.92E-15	7.02E-15	1.04E-09	1.05E-09	2.09E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	5.68E-10	2.31E-13	1.56E-13	NA	NA	1.98E-14	2.01E-14	2.97E-09	3.01E-09	5.98E-09
PCB-123	1.38E-11	5.60E-15	3.79E-15	NA	NA	4.80E-16	4.87E-16	7.20E-11	7.30E-11	1.45E-10
PCB-126	5.36E-08	2.18E-11	1.47E-11	NA	NA	1.87E-12	1.89E-12	2.80E-07	2.84E-07	5.64E-07
PCB-156	7.46E-10	3.03E-13	2.05E-13	NA	NA	2.59E-14	2.63E-14	3.89E-09	3.95E-09	7.84E-09
PCB-157	2.10E-10	8.52E-14	5.76E-14	NA	NA	7.30E-15	7.41E-15	1.10E-09	1.11E-09	2.21E-09
PCB-167	1.14E-11	4.64E-15	3.14E-15	NA	NA	3.98E-16	4.04E-16	5.97E-11	6.05E-11	1.20E-10
PCB-169	5.02E-09	2.04E-12	1.38E-12	NA	NA	1.75E-13	1.77E-13	2.62E-08	2.66E-08	5.28E-08
PCB-189	7.01E-11	2.84E-14	1.92E-14	NA	NA	2.44E-15	2.47E-15	3.66E-10	3.71E-10	7.37E-10
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	3.2E-07	3.2E-07	6.4E-07
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ CTE Cancer Risk	**3E-07**	**3E-07**	**6E-07**

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR ROOT VEGETABLES (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME root vegetable Concentration (mg total PCB /kg root vegetable; mg congener TEQ/kg root vegetable)	RME ADD$_{root\ vegetable}$ (mg/kg-day)		RME Hazard Index		RME LADD$_{root\ vegetable}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
PCB-77	5.71E-11	3.85E-14	2.17E-14	NA	NA	3.30E-15	1.21E-14	4.94E-10	1.81E-09	2.31E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.99E-10	1.34E-13	7.55E-14	NA	NA	1.15E-14	4.21E-14	1.72E-09	6.31E-09	8.03E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	5.68E-10	3.83E-13	2.16E-13	NA	NA	3.28E-14	1.20E-13	4.92E-09	1.80E-08	2.30E-08
PCB-123	1.38E-11	9.28E-15	5.24E-15	NA	NA	7.96E-16	2.92E-15	1.19E-10	4.38E-10	5.57E-10
PCB-126	5.36E-08	3.61E-11	2.04E-11	NA	NA	3.09E-12	1.13E-11	4.64E-07	1.70E-06	2.17E-06
PCB-156	7.46E-10	5.02E-13	2.83E-13	NA	NA	4.30E-14	1.58E-13	6.45E-09	2.37E-08	3.01E-08
PCB-157	2.10E-10	1.41E-13	7.97E-14	NA	NA	1.21E-14	4.44E-14	1.82E-09	6.66E-09	8.48E-09
PCB-167	1.14E-11	7.70E-15	4.34E-15	NA	NA	6.60E-16	2.42E-15	9.89E-11	3.63E-10	4.62E-10
PCB-169	5.02E-09	3.38E-12	1.91E-12	NA	NA	2.90E-13	1.06E-12	4.35E-08	1.59E-07	2.03E-07
PCB-189	7.01E-11	4.72E-14	2.66E-14	NA	NA	4.04E-15	1.48E-14	6.07E-10	2.22E-09	2.83E-09
2,3,7,8-TCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,6,7,8-HXCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,6,7,8-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8,9-HpCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Dioxin-like PCB congeners	5.2E-07	1.9E-06	2.4E-06
Dioxins	0.0E+00	0.0E+00	0.0E+00
Furans	0.0E+00	0.0E+00	0.0E+00
Total TEQ RME Cancer Risk	**5E-07**	**2E-06**	**2E-06**

ATTACHMENT D.3C

PREDICTED FOOD CONCENTRATIONS, LADDs, AND CANCER RISKS FROM TEQ INCORPORATING SOIL-TO-PLANT TFs FOR DIOXIN AND FURAN CONGENERS

ATTACHMENT D.3
SOIL-TO-PLANT TFs FOR DIOXIN AND FURAN CONGENERS

Congener	CAS	K_{ow}	log K_{ow}	Kd_s	Br_{ag} (ug/g DW plant/ ug/g soil)	Br_{ag} [1] (ug/g WW plant/ ug/g soil)	Br_{forage} [2] (ug/g DW plant/ ug/g soil)	Br_{silage} [3] (ug/g DW plant/ ug/g soil)	$Br_{rootveg}$ [4] (ug/g DW plant/ ug/g soil)	Adjusted $Br_{rootveg}$ [2,5] (ug/g WW plant/ ug/g soil)
Dioxins										
2,3,7,8-TCDD	1746-01-6	4.37E+06	6.64	2.69E+04	0.00562	0.00478	0.00562	0.00281	1.12	0.00952
1,2,3,7,8-PeCDD	40321-76-4	4.37E+06	6.64	2.69E+04	0.00562	0.00478	0.00562	0.00281	1.12	0.00952
1,2,3,4,7,8-HxCDD	39227-28-6	6.17E+07	7.79	3.80E+05	0.00122	0.00104	0.00122	0.00061	0.609	0.00518
1,2,3,6,7,8-HxCDD	57653-85-7	1.78E+07	7.25	1.10E+05	0.00250	0.00213	0.00250	0.00125	0.81	0.00689
1,2,3,7,8,9-HxCDD	19408-74-3	1.78E+07	7.25	1.10E+05	0.00250	0.00213	0.00250	0.00125	0.81	0.00689
1,2,3,4,6,7,8-HpCDD	35822-46-9	1.58E+08	8.20	9.77E+05	0.000705	0.00060	0.000705	0.000353	0.49	0.00417
OCDD	3268-87-9	3.89E+07	7.59	2.40E+05	0.00159	0.00135	0.00159	0.000795	0.677	0.00575
Furans										
2,3,7,8-TCDF	51207-31-9	3.39E+06	6.53	2.09E+04	0.00651	0.00553	0.00651	0.00326	1.19	0.0101
1,2,3,7,8-PeCDF	57117-41-6	6.17E+06	6.79	3.80E+04	0.00461	0.00392	0.00461	0.00231	1.03	0.00876
2,3,4,7,8-PeCDF	57117-31-4	8.32E+06	6.92	5.13E+04	0.00387	0.00329	0.00387	0.00194	0.965	0.00820
1,2,3,4,7,8-HxCDF	70648-26-9	1.78E+07	7.25	1.10E+05	0.00250	0.00213	0.00250	0.00125	0.81	0.00689
1,2,3,6,7,8-HxCDF	57117-44-9	1.78E+07	7.25	1.10E+05	0.00250	0.00213	0.00250	0.00125	0.81	0.00689
1,2,3,7,8,9-HxCDF	72918-21-9	1.78E+07	7.25	1.10E+05	0.00250	0.00213	0.00250	0.00125	0.81	0.00689
2,3,4,6,7,8-HxCDF	60851-34-5	1.78E+07	7.25	1.10E+05	0.00250	0.00213	0.00250	0.00125	0.81	0.00689
1,2,3,4,6,7,8-HpCDF	67562-39-4	8.32E+07	7.92	5.13E+05	0.00102	0.00087	0.00102	0.00051	0.568	0.00483
1,2,3,4,7,8,9-HpCDF	55673-89-7	8.32E+07	7.92	5.13E+05	0.00102	0.00087	0.00102	0.00051	0.568	0.00483
OCDF	39001-02-0	6.03E+08	8.78	3.72E+06	0.000326	0.00028	0.000326	0.000163	0.36	0.00306

Notes:
Chemical-specific values for K_{ow}, Kd_s, Br_{ag}, Br_{forage}, Br_{silage} and $Br_{rootveg}$ are from EPA. 1998. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Appendix A. EPA530-D-98-001B.

[1] Plant-soil bioconcentration factor for aboveground produce calculated in EPA (1998) using Travis and Arms (1988). Bioconcentration factors reported on a dry weight/dry weight basis are converted to a wet weight/dry weight basis by multiplying by 0.85 (85% moisture). These transfer factors are used to represent transfer to exposed vegetables and exposed fruits for the sensitivity analysis in Section 7.2.4.2.

[2] Transfer factors for forage were calculated the same way as for aboveground produce. These transfer factors are used to represent transfer to grass/hay for the sensitivity analysis in Section 7.2.4.2.

[3] Aboveground plant-soil bioconcentration factor adjusted (multiplied by 0.5) based on the assumption that there is "insignificant translocation of COPCs deposited on the surface of bulky silage to the inner parts of the vegetation" (EPA, 1998). These transfer factors are used to represent transfer to corn silage for the sensitivity analysis in Section 7.2.4.2.

[4] Plant-soil bioconcentration factor for belowground produce calculated in EPA (1998) using Briggs (1982).

[5] Belowground plant-soil bioconcentration factor adjusted for lipophilicity of COPCs. $Br_{rootveg}$ is multiplied by an empirical correction factor of 0.01 for COPCs with log Kows greater than 4, as recommended in USEPA, 1998 and converted to a wet weight/dry weight TF. These transfer factors are used to represent transfer to root vegetables for the sensitivity analysis in Section 7.2.4.2.

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR COMMERCIAL DAIRY AT 2 MG/KG TOTAL PCBS IN SOIL

	Milk concentration (mg total PCBs/kg whole milk; mg congener TEQ/kg whole milk) [a]	CTE ADD_{milk} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{milk}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	2.19E-04	9.24E-06	2.60E-06	4.62E-01	1.30E-01	7.92E-07	1.08E-06	7.92E-07	1.08E-06	1.87E-06
PCB-77	3.70E-11	1.56E-12	4.40E-13	NA	NA	1.34E-13	1.82E-13	2.01E-08	2.73E-08	4.75E-08
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-10	5.02E-12	1.41E-12	NA	NA	4.30E-13	5.85E-13	6.45E-08	8.77E-08	1.52E-07
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	6.44E-10	2.72E-11	7.66E-12	NA	NA	2.34E-12	3.17E-12	3.50E-07	4.76E-07	8.26E-07
PCB-123	1.54E-11	6.49E-13	1.83E-13	NA	NA	5.56E-14	7.56E-14	8.35E-09	1.13E-08	1.97E-08
PCB-126	6.23E-08	2.64E-09	7.41E-10	NA	NA	2.26E-10	3.07E-10	3.39E-05	4.61E-05	8.00E-05
PCB-156	7.02E-10	2.97E-11	8.35E-12	NA	NA	2.54E-12	3.46E-12	3.82E-07	5.19E-07	9.00E-07
PCB-157	1.89E-10	7.99E-12	2.25E-12	NA	NA	6.85E-13	9.31E-13	1.03E-07	1.40E-07	2.42E-07
PCB-167	1.02E-11	4.31E-13	1.21E-13	NA	NA	3.69E-14	5.02E-14	5.54E-09	7.52E-09	1.31E-08
PCB-169	4.27E-09	1.81E-10	5.08E-11	NA	NA	1.55E-11	2.10E-11	2.32E-06	3.16E-06	5.48E-06
PCB-189	5.25E-11	2.22E-12	6.24E-13	NA	NA	1.90E-13	2.59E-13	2.85E-08	3.88E-08	6.73E-08
2,3,7,8-TCDD	3.37E-10	1.43E-11	4.01E-12	NA	NA	1.22E-12	1.66E-12	1.83E-07	2.49E-07	4.32E-07
1,2,3,7,8-PeCDD	6.49E-10	2.74E-11	7.72E-12	NA	NA	2.35E-12	3.20E-12	3.53E-07	4.79E-07	8.32E-07
1,2,3,4,7,8-HxCDD	9.25E-12	3.91E-13	1.10E-13	NA	NA	3.35E-14	4.56E-14	5.03E-09	6.84E-09	1.19E-08
1,2,3,6,7,8-HxCDD	5.03E-11	2.13E-12	5.99E-13	NA	NA	1.82E-13	2.48E-13	2.74E-08	3.72E-08	6.46E-08
1,2,3,7,8,9-HxCDD	2.38E-11	1.00E-12	2.83E-13	NA	NA	8.61E-14	1.17E-13	1.29E-08	1.76E-08	3.05E-08
1,2,3,4,6,7,8-HpCDD	3.06E-12	1.30E-13	3.64E-14	NA	NA	1.11E-14	1.51E-14	1.67E-09	2.26E-09	3.93E-09
OCDD	9.45E-14	4.00E-15	1.12E-15	NA	NA	3.42E-16	4.65E-16	5.14E-11	6.98E-11	1.21E-10
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.72E-09	7.27E-11	2.04E-11	NA	NA	6.23E-12	8.47E-12	9.35E-07	1.27E-06	2.20E-06
1,2,3,4,7,8-HxCDF	1.29E-10	5.46E-12	1.54E-12	NA	NA	4.68E-13	6.36E-13	7.02E-08	9.55E-08	1.66E-07
1,2,3,6,7,8-HXCDF	6.88E-11	2.91E-12	8.18E-13	NA	NA	2.49E-13	3.39E-13	3.74E-08	5.08E-08	8.82E-08
2,3,4,6,7,8-HxCDF	6.45E-11	2.73E-12	7.67E-13	NA	NA	2.34E-13	3.18E-13	3.51E-08	4.77E-08	8.27E-08
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	5.95E-12	2.52E-13	7.08E-14	NA	NA	2.16E-14	2.93E-14	3.24E-09	4.40E-09	7.63E-09
1,2,3,4,7,8,9-HpCDF	7.09E-13	3.00E-14	8.43E-15	NA	NA	2.57E-15	3.49E-15	3.86E-10	5.24E-10	9.09E-10
OCDF	3.03E-15	1.28E-16	3.61E-17	NA	NA	1.10E-17	1.49E-17	1.65E-12	2.24E-12	3.89E-12

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**8E-07**	**1E-06**	**2E-06**
Dioxin-like PCB congeners	3.7E-05	5.1E-05	8.8E-05
Dioxins	5.8E-07	7.9E-07	1.4E-06
Furans	1.1E-06	1.5E-06	2.6E-06
Total TEQ CTE Cancer Risk	**4E-05**	**5E-05**	**9E-05**
Total CTE Hazard Index	**5E-01**	**1E-01**	

Notes:

a Modeled from corn and based on fat content of Jersey cow milk.

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR COMMERCIAL DAIRY AT 2 MG/KG TOTAL PCBS IN SOIL

	RME ADD_{milk} (mg/kg-day)		RME Hazard Index		RME $LADD_{milk}$ (mg/kg-day)		RME Cancer Risk		
	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	1.47E-05	3.17E-06	7.37E-01	1.58E-01	1.26E-06	2.89E-06	2.53E-06	5.79E-06	8.31E-06
PCB-77	2.49E-12	5.36E-13	NA	NA	2.14E-13	4.90E-13	3.21E-08	7.35E-08	1.06E-07
PCB-81	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	8.00E-12	1.72E-12	NA	NA	6.86E-13	1.57E-12	1.03E-07	2.36E-07	3.39E-07
PCB-114	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	4.34E-11	9.33E-12	NA	NA	3.72E-12	8.53E-12	5.58E-07	1.28E-06	1.84E-06
PCB-123	1.03E-12	2.22E-13	NA	NA	8.87E-14	2.03E-13	1.33E-08	3.05E-08	4.38E-08
PCB-126	4.20E-09	9.03E-10	NA	NA	3.60E-10	8.25E-10	5.40E-05	1.24E-04	1.78E-04
PCB-156	4.73E-11	1.02E-11	NA	NA	4.06E-12	9.29E-12	6.08E-07	1.39E-06	2.00E-06
PCB-157	1.27E-11	2.74E-12	NA	NA	1.09E-12	2.50E-12	1.64E-07	3.75E-07	5.39E-07
PCB-167	6.86E-13	1.47E-13	NA	NA	5.88E-14	1.35E-13	8.82E-09	2.02E-08	2.90E-08
PCB-169	2.88E-10	6.18E-11	NA	NA	2.47E-11	5.65E-11	3.70E-06	8.48E-06	1.22E-05
PCB-189	3.54E-12	7.60E-13	NA	NA	3.03E-13	6.95E-13	4.55E-08	1.04E-07	1.50E-07
2,3,7,8-TCDD	2.27E-11	4.88E-12	NA	NA	1.95E-12	4.46E-12	2.92E-07	6.70E-07	9.62E-07
1,2,3,7,8-PeCDD	4.37E-11	9.40E-12	NA	NA	3.75E-12	8.59E-12	5.62E-07	1.29E-06	1.85E-06
1,2,3,4,7,8-HxCDD	6.24E-13	1.34E-13	NA	NA	5.35E-14	1.22E-13	8.02E-09	1.84E-08	2.64E-08
1,2,3,6,7,8-HxCDD	3.39E-12	7.29E-13	NA	NA	2.91E-13	6.66E-13	4.36E-08	1.00E-07	1.44E-07
1,2,3,7,8,9-HxCDD	1.60E-12	3.44E-13	NA	NA	1.37E-13	3.15E-13	2.06E-08	4.72E-08	6.78E-08
1,2,3,4,6,7,8-HpCDD	2.06E-13	4.43E-14	NA	NA	1.77E-14	4.05E-14	2.65E-09	6.08E-09	8.74E-09
OCDD	6.37E-15	1.37E-15	NA	NA	5.46E-16	1.25E-15	8.19E-11	1.88E-10	2.70E-10
2,3,7,8-TCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.16E-10	2.49E-11	NA	NA	9.93E-12	2.28E-11	1.49E-06	3.41E-06	4.90E-06
1,2,3,4,7,8-HxCDF	8.71E-12	1.87E-12	NA	NA	7.47E-13	1.71E-12	1.12E-07	2.57E-07	3.69E-07
1,2,3,6,7,8-HXCDF	4.64E-12	9.96E-13	NA	NA	3.97E-13	9.11E-13	5.96E-08	1.37E-07	1.96E-07
2,3,4,6,7,8-HxCDF	4.35E-12	9.34E-13	NA	NA	3.73E-13	8.54E-13	5.59E-08	1.28E-07	1.84E-07
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	4.01E-13	8.62E-14	NA	NA	3.44E-14	7.88E-14	5.16E-09	1.18E-08	1.70E-08
1,2,3,4,7,8,9-HpCDF	4.78E-14	1.03E-14	NA	NA	4.10E-15	9.39E-15	6.15E-10	1.41E-09	2.02E-09
OCDF	2.05E-16	4.39E-17	NA	NA	1.75E-17	4.02E-17	2.63E-12	6.03E-12	8.66E-12

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**3E-06**	**6E-06**	**8E-06**
Dioxin-like PCB congeners	5.9E-05	1.4E-04	2.0E-04
Dioxins	9.3E-07	2.1E-06	3.1E-06
Furans	1.7E-06	3.9E-06	5.7E-06
Total TEQ RME Cancer Risk	**6E-05**	**1E-04**	**2E-04**
Total RME Hazard Index	**7E-01**	**2E-01**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR COMMERCIAL BEEF AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE beef concentration (mg total PCB/kg beef; mg congener TEQ/kg beef)	CTE ADD_{beef} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{beef}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	2.59E-02	5.13E-05	3.12E-05	2.57E+00	1.56E+00	4.40E-06	1.29E-05	4.40E-06	1.29E-05	1.73E-05
PCB-77	2.43E-09	4.82E-12	2.93E-12	NA	NA	4.13E-13	1.21E-12	6.19E-08	1.82E-07	2.44E-07
PCB-81	9.35E-12	1.85E-14	1.12E-14	NA	NA	1.59E-15	4.66E-15	2.38E-10	6.99E-10	9.36E-10
PCB-105	1.22E-08	2.42E-11	1.47E-11	NA	NA	2.08E-12	6.10E-12	3.11E-07	9.15E-07	1.23E-06
PCB-114	1.29E-09	2.56E-12	1.55E-12	NA	NA	2.19E-13	6.44E-13	3.29E-08	9.66E-08	1.29E-07
PCB-118	6.03E-08	1.19E-10	7.25E-11	NA	NA	1.02E-11	3.00E-11	1.53E-06	4.50E-06	6.04E-06
PCB-123	1.98E-09	3.92E-12	2.38E-12	NA	NA	3.36E-13	9.86E-13	5.04E-08	1.48E-07	1.98E-07
PCB-126	3.93E-06	7.77E-09	4.72E-09	NA	NA	6.66E-10	1.96E-09	9.99E-05	2.93E-04	3.93E-04
PCB-156	8.71E-08	1.72E-10	1.05E-10	NA	NA	1.48E-11	4.34E-11	2.22E-06	6.51E-06	8.72E-06
PCB-157	2.57E-08	5.08E-11	3.09E-11	NA	NA	4.35E-12	1.28E-11	6.53E-07	1.92E-06	2.57E-06
PCB-167	1.13E-09	2.24E-12	1.36E-12	NA	NA	1.92E-13	5.63E-13	2.87E-08	8.44E-08	1.13E-07
PCB-169	2.36E-07	4.67E-10	2.84E-10	NA	NA	4.00E-11	1.17E-10	6.00E-06	1.76E-05	2.36E-05
PCB-189	5.93E-09	1.17E-11	7.13E-12	NA	NA	1.01E-12	2.95E-12	1.51E-07	4.43E-07	5.94E-07
2,3,7,8-TCDD	1.11E-08	2.20E-11	1.34E-11	NA	NA	1.89E-12	5.54E-12	2.83E-07	8.32E-07	1.11E-06
1,2,3,7,8-PeCDD	2.14E-08	4.24E-11	2.58E-11	NA	NA	3.63E-12	1.07E-11	5.45E-07	1.60E-06	2.15E-06
1,2,3,4,7,8-HxCDD	1.23E-09	2.44E-12	1.48E-12	NA	NA	2.09E-13	6.15E-13	3.14E-08	9.22E-08	1.24E-07
1,2,3,6,7,8-HxCDD	3.41E-09	6.75E-12	4.10E-12	NA	NA	5.79E-13	1.70E-12	8.68E-08	2.55E-07	3.42E-07
1,2,3,7,8,9-HxCDD	1.61E-09	3.19E-12	1.94E-12	NA	NA	2.73E-13	8.02E-13	4.10E-08	1.20E-07	1.61E-07
1,2,3,4,6,7,8-HpCDD	6.96E-10	1.38E-12	8.37E-13	NA	NA	1.18E-13	3.47E-13	1.77E-08	5.20E-08	6.97E-08
OCDD	9.79E-12	1.94E-14	1.18E-14	NA	NA	1.66E-15	4.88E-15	2.49E-10	7.31E-10	9.81E-10
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	7.84E-08	1.55E-10	9.43E-11	NA	NA	1.33E-11	3.91E-11	2.00E-06	5.86E-06	7.85E-06
1,2,3,4,7,8-HxCDF	8.76E-09	1.73E-11	1.05E-11	NA	NA	1.49E-12	4.36E-12	2.23E-07	6.54E-07	8.77E-07
1,2,3,6,7,8-HXCDF	4.66E-09	9.23E-12	5.60E-12	NA	NA	7.91E-13	2.32E-12	1.19E-07	3.48E-07	4.67E-07
2,3,4,6,7,8-HxCDF	4.37E-09	8.65E-12	5.26E-12	NA	NA	7.41E-13	2.18E-12	1.11E-07	3.27E-07	4.38E-07
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	9.44E-10	1.87E-12	1.13E-12	NA	NA	1.60E-13	4.70E-13	2.40E-08	7.05E-08	9.45E-08
1,2,3,4,7,8,9-HpCDF	1.12E-10	2.23E-13	1.35E-13	NA	NA	1.91E-14	5.60E-14	2.86E-09	8.40E-09	1.13E-08
OCDF	1.47E-12	2.91E-15	1.77E-15	NA	NA	2.50E-16	7.34E-16	3.75E-11	1.10E-10	1.48E-10

CENTRAL TENDENCY EXPOSURE:	**Child**	**Adult**	**Total**
Total PCB CTE Cancer Risk	**4E-06**	**1E-05**	**2E-05**
Dioxin-like PCB congeners	1.1E-04	3.3E-04	4.4E-04
Dioxins	1.0E-06	3.0E-06	4.0E-06
Furans	2.5E-06	7.3E-06	9.7E-06
Total TEQ CTE Cancer Risk	**1E-04**	**3E-04**	**5E-04**
Total CTE Hazard Index	**3E+00**	**2E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR COMMERCIAL BEEF AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Beef Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME ADD_{beef} (mg/kg-day)		RME Hazard Index		RME $LADD_{beef}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.82E-02	9.88E-05	5.39E-05	4.94E+00	2.69E+00	8.47E-06	4.93E-05	1.69E-05	9.86E-05	1.15E-04
PCB-77	3.59E-09	9.28E-12	5.06E-12	NA	NA	7.95E-13	4.63E-12	1.19E-07	6.94E-07	8.13E-07
PCB-81	1.38E-11	3.56E-14	1.94E-14	NA	NA	3.06E-15	1.78E-14	4.58E-10	2.67E-09	3.12E-09
PCB-105	1.81E-08	4.67E-11	2.54E-11	NA	NA	4.00E-12	2.33E-11	6.00E-07	3.49E-06	4.09E-06
PCB-114	1.91E-09	4.93E-12	2.69E-12	NA	NA	4.22E-13	2.46E-12	6.34E-08	3.69E-07	4.32E-07
PCB-118	8.89E-08	2.30E-10	1.25E-10	NA	NA	1.97E-11	1.15E-10	2.95E-06	1.72E-05	2.01E-05
PCB-123	2.92E-09	7.55E-12	4.12E-12	NA	NA	6.47E-13	3.76E-12	9.71E-08	5.64E-07	6.62E-07
PCB-126	5.79E-06	1.50E-08	8.16E-09	NA	NA	1.28E-09	7.46E-09	1.92E-04	1.12E-03	1.31E-03
PCB-156	1.28E-07	3.32E-10	1.81E-10	NA	NA	2.85E-11	1.66E-10	4.27E-06	2.48E-05	2.91E-05
PCB-157	3.79E-08	9.79E-11	5.34E-11	NA	NA	8.39E-12	4.88E-11	1.26E-06	7.32E-06	8.58E-06
PCB-167	1.67E-09	4.31E-12	2.35E-12	NA	NA	3.69E-13	2.15E-12	5.54E-08	3.22E-07	3.78E-07
PCB-169	3.48E-07	8.99E-10	4.90E-10	NA	NA	7.71E-11	4.48E-10	1.16E-05	6.72E-05	7.88E-05
PCB-189	8.75E-09	2.26E-11	1.23E-11	NA	NA	1.94E-12	1.13E-11	2.91E-07	1.69E-06	1.98E-06
2,3,7,8-TCDD	1.64E-08	4.24E-11	2.31E-11	NA	NA	3.64E-12	2.12E-11	5.46E-07	3.17E-06	3.72E-06
1,2,3,7,8-PeCDD	3.16E-08	8.17E-11	4.45E-11	NA	NA	7.00E-12	4.07E-11	1.05E-06	6.11E-06	7.16E-06
1,2,3,4,7,8-HxCDD	1.82E-09	4.71E-12	2.57E-12	NA	NA	4.04E-13	2.35E-12	6.05E-08	3.52E-07	4.13E-07
1,2,3,6,7,8-HxCDD	5.03E-09	1.30E-11	7.09E-12	NA	NA	1.12E-12	6.49E-12	1.67E-07	9.73E-07	1.14E-06
1,2,3,7,8,9-HxCDD	2.38E-09	6.14E-12	3.35E-12	NA	NA	5.26E-13	3.06E-12	7.90E-08	4.59E-07	5.38E-07
1,2,3,4,6,7,8-HpCDD	1.03E-09	2.65E-12	1.45E-12	NA	NA	2.27E-13	1.32E-12	3.41E-08	1.98E-07	2.32E-07
OCDD	1.44E-11	3.73E-14	2.04E-14	NA	NA	3.20E-15	1.86E-14	4.80E-10	2.79E-09	3.27E-09
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.16E-07	2.99E-10	1.63E-10	NA	NA	2.56E-11	1.49E-10	3.84E-06	2.24E-05	2.62E-05
1,2,3,4,7,8-HxCDF	1.29E-08	3.34E-11	1.82E-11	NA	NA	2.86E-12	1.66E-11	4.29E-07	2.50E-06	2.93E-06
1,2,3,6,7,8-HXCDF	6.87E-09	1.78E-11	9.69E-12	NA	NA	1.52E-12	8.86E-12	2.29E-07	1.33E-06	1.56E-06
2,3,4,6,7,8-HxCDF	6.45E-09	1.67E-11	9.09E-12	NA	NA	1.43E-12	8.31E-12	2.14E-07	1.25E-06	1.46E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	1.39E-09	3.60E-12	1.96E-12	NA	NA	3.08E-13	1.79E-12	4.63E-08	2.69E-07	3.15E-07
1,2,3,4,7,8,9-HpCDF	1.66E-10	4.29E-13	2.34E-13	NA	NA	3.68E-14	2.14E-13	5.51E-09	3.21E-08	3.76E-08
OCDF	2.17E-12	5.62E-15	3.06E-15	NA	NA	4.81E-16	2.80E-15	7.22E-11	4.20E-10	4.92E-10

REASONABLE MAXIMUM EXPOSURE:

	Child	Adult	Total
Total PCB RME Cancer Risk	**2E-05**	**1E-04**	**1E-04**
Dioxin-like PCB congeners	2.1E-04	1.2E-03	1.5E-03
Dioxins	1.9E-06	1.1E-05	1.3E-05
Furans	4.8E-06	2.8E-05	3.2E-05
Total TEQ RME Cancer Risk	**2E-04**	**1E-03**	**2E-03**
Total RME Hazard Index	**5E+00**	**3E+00**	

O:\20123001.096\HHRA_FNL_AG\AG_FNL_ATD-3c Ag risks (wo farms) (w diox+furan TFs).xls
Beef Risk - Comm (2 ppm) P3

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR BACKYARD DAIRY AT 2 MG/KG TOTAL PCBS IN SOIL

	Milk concentration (mg total PCBs/kg whole milk; mg congener TEQ/kg whole milk) [a]	CTE ADD_{milk} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{milk}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	1.03E-02	4.38E-04	2.07E-04	2.19E+01	1.04E+01	3.75E-05	2.67E-05	3.75E-05	2.67E-05	6.42E-05
PCB-77	1.30E-09	5.49E-11	2.60E-11	NA	NA	4.70E-12	3.34E-12	7.05E-07	5.01E-07	1.21E-06
PCB-81	2.17E-12	9.18E-14	4.35E-14	NA	NA	7.87E-15	5.60E-15	1.18E-09	8.39E-10	2.02E-09
PCB-105	5.19E-09	2.20E-10	1.04E-10	NA	NA	1.88E-11	1.34E-11	2.82E-06	2.01E-06	4.83E-06
PCB-114	3.00E-10	1.27E-11	6.02E-12	NA	NA	1.09E-12	7.74E-13	1.63E-07	1.16E-07	2.79E-07
PCB-118	2.67E-08	1.13E-09	5.36E-10	NA	NA	9.70E-11	6.89E-11	1.45E-05	1.03E-05	2.49E-05
PCB-123	7.64E-10	3.23E-11	1.53E-11	NA	NA	2.77E-12	1.97E-12	4.15E-07	2.95E-07	7.10E-07
PCB-126	2.15E-06	9.08E-08	4.30E-08	NA	NA	7.78E-09	5.53E-09	1.17E-03	8.30E-04	2.00E-03
PCB-156	3.41E-08	1.44E-09	6.84E-10	NA	NA	1.24E-10	8.79E-11	1.86E-05	1.32E-05	3.17E-05
PCB-157	9.70E-09	4.10E-10	1.94E-10	NA	NA	3.52E-11	2.50E-11	5.28E-06	3.75E-06	9.03E-06
PCB-167	4.64E-10	1.96E-11	9.30E-12	NA	NA	1.68E-12	1.20E-12	2.52E-07	1.79E-07	4.32E-07
PCB-169	1.39E-07	5.89E-09	2.79E-09	NA	NA	5.05E-10	3.59E-10	7.57E-05	5.38E-05	1.30E-04
PCB-189	2.42E-09	1.02E-10	4.84E-11	NA	NA	8.76E-12	6.23E-12	1.31E-06	9.34E-07	2.25E-06
2,3,7,8-TCDD	2.91E-09	1.23E-10	5.82E-11	NA	NA	1.05E-11	7.49E-12	1.58E-06	1.12E-06	2.70E-06
1,2,3,7,8-PeCDD	5.59E-09	2.36E-10	1.12E-10	NA	NA	2.03E-11	1.44E-11	3.04E-06	2.16E-06	5.20E-06
1,2,3,4,7,8-HxCDD	2.96E-10	1.25E-11	5.92E-12	NA	NA	1.07E-12	7.62E-13	1.61E-07	1.14E-07	2.75E-07
1,2,3,6,7,8-HxCDD	8.40E-10	3.55E-11	1.68E-11	NA	NA	3.05E-12	2.16E-12	4.57E-07	3.25E-07	7.82E-07
1,2,3,7,8,9-HxCDD	3.97E-10	1.68E-11	7.95E-12	NA	NA	1.44E-12	1.02E-12	2.16E-07	1.53E-07	3.69E-07
1,2,3,4,6,7,8-HpCDD	1.65E-10	6.96E-12	3.30E-12	NA	NA	5.96E-13	4.24E-13	8.95E-08	6.36E-08	1.53E-07
OCDD	2.36E-12	1.00E-13	4.74E-14	NA	NA	8.57E-15	6.09E-15	1.29E-09	9.14E-10	2.20E-09
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.98E-08	8.39E-10	3.98E-10	NA	NA	7.19E-11	5.11E-11	1.08E-05	7.67E-06	1.85E-05
1,2,3,4,7,8-HxCDF	2.16E-09	9.12E-11	4.32E-11	NA	NA	7.82E-12	5.56E-12	1.17E-06	8.33E-07	2.01E-06
1,2,3,6,7,8-HXCDF	1.15E-09	4.85E-11	2.30E-11	NA	NA	4.16E-12	2.96E-12	6.24E-07	4.44E-07	1.07E-06
2,3,4,6,7,8-HxCDF	1.08E-09	4.55E-11	2.16E-11	NA	NA	3.90E-12	2.77E-12	5.85E-07	4.16E-07	1.00E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	2.25E-10	9.51E-12	4.51E-12	NA	NA	8.15E-13	5.80E-13	1.22E-07	8.69E-08	2.09E-07
1,2,3,4,7,8,9-HpCDF	2.68E-11	1.13E-12	5.37E-13	NA	NA	9.71E-14	6.91E-14	1.46E-08	1.04E-08	2.49E-08
OCDF	3.45E-13	1.46E-14	6.91E-15	NA	NA	1.25E-15	8.89E-16	1.88E-10	1.33E-10	3.21E-10

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**4E-05**	**3E-05**	**6E-05**
Dioxin-like PCB congeners	1.3E-03	9.1E-04	2.2E-03
Dioxins	5.5E-06	3.9E-06	9.5E-06
Furans	1.3E-05	9.5E-06	2.3E-05
Total TEQ CTE Cancer Risk	**1E-03**	**9E-04**	**2E-03**
Total CTE Hazard Index	**2E+01**	**1E+01**	

Notes:
a Modeled from corn and based on fat content of Jersey cow milk.

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR BACKYARD DAIRY AT 2 MG/KG TOTAL PCBS IN SOIL

	RME ADD_{milk} (mg/kg-day)		RME Hazard Index		RME $LADD_{milk}$ (mg/kg-day)		RME Cancer Risk		
	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.97E-04	1.80E-04	3.49E+01	8.98E+00	5.98E-05	1.00E-04	1.20E-04	2.00E-04	3.20E-04
PCB-77	8.74E-11	2.25E-11	NA	NA	7.50E-12	1.25E-11	1.12E-06	1.88E-06	3.01E-06
PCB-81	1.46E-13	3.77E-14	NA	NA	1.25E-14	2.10E-14	1.88E-09	3.15E-09	5.03E-09
PCB-105	3.50E-10	9.01E-11	NA	NA	3.00E-11	5.02E-11	4.50E-06	7.53E-06	1.20E-05
PCB-114	2.02E-11	5.21E-12	NA	NA	1.74E-12	2.90E-12	2.60E-07	4.36E-07	6.96E-07
PCB-118	1.80E-09	4.64E-10	NA	NA	1.55E-10	2.59E-10	2.32E-05	3.88E-05	6.20E-05
PCB-123	5.15E-11	1.33E-11	NA	NA	4.41E-12	7.38E-12	6.62E-07	1.11E-06	1.77E-06
PCB-126	1.45E-07	3.73E-08	NA	NA	1.24E-08	2.08E-08	1.86E-03	3.11E-03	4.97E-03
PCB-156	2.30E-09	5.92E-10	NA	NA	1.97E-10	3.30E-10	2.96E-05	4.95E-05	7.91E-05
PCB-157	6.54E-10	1.68E-10	NA	NA	5.61E-11	9.38E-11	8.41E-06	1.41E-05	2.25E-05
PCB-167	3.13E-11	8.05E-12	NA	NA	2.68E-12	4.49E-12	4.02E-07	6.73E-07	1.07E-06
PCB-169	9.39E-09	2.42E-09	NA	NA	8.05E-10	1.35E-09	1.21E-04	2.02E-04	3.23E-04
PCB-189	1.63E-10	4.19E-11	NA	NA	1.40E-11	2.34E-11	2.09E-06	3.50E-06	5.60E-06
2,3,7,8-TCDD	1.96E-10	5.04E-11	NA	NA	1.68E-11	2.81E-11	2.52E-06	4.21E-06	6.73E-06
1,2,3,7,8-PeCDD	3.77E-10	9.70E-11	NA	NA	3.23E-11	5.41E-11	4.85E-06	8.11E-06	1.30E-05
1,2,3,4,7,8-HxCDD	1.99E-11	5.13E-12	NA	NA	1.71E-12	2.86E-12	2.56E-07	4.29E-07	6.85E-07
1,2,3,6,7,8-HxCDD	5.66E-11	1.46E-11	NA	NA	4.85E-12	8.12E-12	7.28E-07	1.22E-06	1.95E-06
1,2,3,7,8,9-HxCDD	2.67E-11	6.88E-12	NA	NA	2.29E-12	3.84E-12	3.44E-07	5.75E-07	9.19E-07
1,2,3,4,6,7,8-HpCDD	1.11E-11	2.86E-12	NA	NA	9.51E-13	1.59E-12	1.43E-07	2.39E-07	3.81E-07
OCDD	1.59E-13	4.10E-14	NA	NA	1.37E-14	2.29E-14	2.05E-09	3.43E-09	5.48E-09
2,3,7,8-TCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.34E-09	3.44E-10	NA	NA	1.15E-10	1.92E-10	1.72E-05	2.88E-05	4.60E-05
1,2,3,4,7,8-HxCDF	1.45E-10	3.74E-11	NA	NA	1.25E-11	2.09E-11	1.87E-06	3.13E-06	5.00E-06
1,2,3,6,7,8-HXCDF	7.74E-11	1.99E-11	NA	NA	6.63E-12	1.11E-11	9.95E-07	1.67E-06	2.66E-06
2,3,4,6,7,8-HxCDF	7.26E-11	1.87E-11	NA	NA	6.22E-12	1.04E-11	9.33E-07	1.56E-06	2.49E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	1.52E-11	3.90E-12	NA	NA	1.30E-12	2.17E-12	1.95E-07	3.26E-07	5.21E-07
1,2,3,4,7,8,9-HpCDF	1.81E-12	4.65E-13	NA	NA	1.55E-13	2.59E-13	2.32E-08	3.89E-08	6.21E-08
OCDF	2.33E-14	5.99E-15	NA	NA	1.99E-15	3.34E-15	2.99E-10	5.00E-10	8.00E-10

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**1E-04**	**2E-04**	**3E-04**
Dioxin-like PCB congeners	2.1E-03	3.4E-03	5.5E-03
Dioxins	8.8E-06	1.5E-05	2.4E-05
Furans	2.1E-05	3.5E-05	5.7E-05
Total TEQ RME Cancer Risk	**2E-03**	**3E-03**	**6E-03**
Total RME Hazard Index	**3E+01**	**9E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR BACKYARD BEEF AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE beef concentration (mg total PCB/kg beef; mg congener TEQ/kg beef)	CTE ADD_{beef} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{beef}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.94E-02	7.80E-05	6.00E-05	3.90E+00	3.00E+00	6.68E-06	7.71E-06	6.68E-06	7.71E-06	1.44E-05
PCB-77	4.72E-09	9.33E-12	7.17E-12	NA	NA	8.00E-13	9.22E-13	1.20E-07	1.38E-07	2.58E-07
PCB-81	9.35E-12	1.85E-14	1.42E-14	NA	NA	1.59E-15	1.83E-15	2.38E-10	2.74E-10	5.12E-10
PCB-105	1.96E-08	3.87E-11	2.98E-11	NA	NA	3.32E-12	3.83E-12	4.98E-07	5.74E-07	1.07E-06
PCB-114	1.29E-09	2.56E-12	1.97E-12	NA	NA	2.19E-13	2.53E-13	3.29E-08	3.79E-08	7.08E-08
PCB-118	1.00E-07	1.98E-10	1.52E-10	NA	NA	1.70E-11	1.96E-11	2.54E-06	2.93E-06	5.48E-06
PCB-123	2.93E-09	5.79E-12	4.45E-12	NA	NA	4.96E-13	5.72E-13	7.45E-08	8.59E-08	1.60E-07
PCB-126	7.77E-06	1.54E-08	1.18E-08	NA	NA	1.32E-09	1.52E-09	1.98E-04	2.28E-04	4.26E-04
PCB-156	1.30E-07	2.58E-10	1.98E-10	NA	NA	2.21E-11	2.55E-11	3.32E-06	3.83E-06	7.14E-06
PCB-157	3.73E-08	7.39E-11	5.68E-11	NA	NA	6.33E-12	7.30E-12	9.50E-07	1.10E-06	2.05E-06
PCB-167	1.76E-09	3.48E-12	2.67E-12	NA	NA	2.98E-13	3.44E-13	4.47E-08	5.16E-08	9.63E-08
PCB-169	4.99E-07	9.88E-10	7.60E-10	NA	NA	8.47E-11	9.77E-11	1.27E-05	1.46E-05	2.73E-05
PCB-189	9.17E-09	1.81E-11	1.40E-11	NA	NA	1.56E-12	1.79E-12	2.33E-07	2.69E-07	5.02E-07
2,3,7,8-TCDD	1.20E-08	2.37E-11	1.82E-11	NA	NA	2.03E-12	2.34E-12	3.05E-07	3.51E-07	6.56E-07
1,2,3,7,8-PeCDD	2.30E-08	4.56E-11	3.51E-11	NA	NA	3.91E-12	4.51E-12	5.86E-07	6.76E-07	1.26E-06
1,2,3,4,7,8-HxCDD	1.26E-09	2.49E-12	1.91E-12	NA	NA	2.13E-13	2.46E-13	3.20E-08	3.69E-08	6.89E-08
1,2,3,6,7,8-HxCDD	3.54E-09	7.00E-12	5.38E-12	NA	NA	6.00E-13	6.92E-13	9.00E-08	1.04E-07	1.94E-07
1,2,3,7,8,9-HxCDD	1.67E-09	3.31E-12	2.54E-12	NA	NA	2.83E-13	3.27E-13	4.25E-08	4.90E-08	9.15E-08
1,2,3,4,6,7,8-HpCDD	7.03E-10	1.39E-12	1.07E-12	NA	NA	1.19E-13	1.38E-13	1.79E-08	2.06E-08	3.85E-08
OCDD	1.00E-11	1.98E-14	1.53E-14	NA	NA	1.70E-15	1.96E-15	2.55E-10	2.94E-10	5.49E-10
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	8.27E-08	1.64E-10	1.26E-10	NA	NA	1.40E-11	1.62E-11	2.10E-06	2.43E-06	4.53E-06
1,2,3,4,7,8-HxCDF	9.08E-09	1.80E-11	1.38E-11	NA	NA	1.54E-12	1.78E-12	2.31E-07	2.66E-07	4.97E-07
1,2,3,6,7,8-HXCDF	4.83E-09	9.57E-12	7.36E-12	NA	NA	8.20E-13	9.46E-13	1.23E-07	1.42E-07	2.65E-07
2,3,4,6,7,8-HxCDF	4.53E-09	8.97E-12	6.90E-12	NA	NA	7.69E-13	8.87E-13	1.15E-07	1.33E-07	2.48E-07
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	9.59E-10	1.90E-12	1.46E-12	NA	NA	1.63E-13	1.88E-13	2.44E-08	2.81E-08	5.25E-08
1,2,3,4,7,8,9-HpCDF	1.14E-10	2.26E-13	1.74E-13	NA	NA	1.94E-14	2.23E-14	2.91E-09	3.35E-09	6.26E-09
OCDF	1.48E-12	2.93E-15	2.25E-15	NA	NA	2.51E-16	2.90E-16	3.77E-11	4.34E-11	8.11E-11

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**7E-06**	**8E-06**	**1E-05**
Dioxin-like PCB congeners	2.2E-04	2.5E-04	4.7E-04
Dioxins	1.1E-06	1.2E-06	2.3E-06
Furans	2.6E-06	3.0E-06	5.6E-06
Total TEQ CTE Cancer Risk	**2E-04**	**3E-04**	**5E-04**
Total CTE Hazard Index	**4E+00**	**3E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR BACKYARD BEEF AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Beef Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME ADD_{beef} (mg/kg-day)		RME Hazard Index		RME $LADD_{beef}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	5.81E-02	1.50E-04	8.75E-05	7.51E+00	4.37E+00	1.29E-05	4.87E-05	2.58E-05	9.75E-05	1.23E-04
PCB-77	6.95E-09	1.80E-11	1.05E-11	NA	NA	1.54E-12	5.83E-12	2.31E-07	8.75E-07	1.11E-06
PCB-81	1.38E-11	3.56E-14	2.08E-14	NA	NA	3.06E-15	1.16E-14	4.58E-10	1.73E-09	2.19E-09
PCB-105	2.88E-08	7.46E-11	4.34E-11	NA	NA	6.39E-12	2.42E-11	9.59E-07	3.63E-06	4.59E-06
PCB-114	1.91E-09	4.93E-12	2.87E-12	NA	NA	4.22E-13	1.60E-12	6.34E-08	2.40E-07	3.03E-07
PCB-118	1.47E-07	3.81E-10	2.22E-10	NA	NA	3.27E-11	1.24E-10	4.90E-06	1.86E-05	2.35E-05
PCB-123	4.32E-09	1.12E-11	6.50E-12	NA	NA	9.56E-13	3.62E-12	1.43E-07	5.43E-07	6.86E-07
PCB-126	1.15E-05	2.96E-08	1.73E-08	NA	NA	2.54E-09	9.62E-09	3.81E-04	1.44E-03	1.82E-03
PCB-156	1.92E-07	4.97E-10	2.90E-10	NA	NA	4.26E-11	1.61E-10	6.39E-06	2.42E-05	3.06E-05
PCB-157	5.50E-08	1.42E-10	8.29E-11	NA	NA	1.22E-11	4.62E-11	1.83E-06	6.93E-06	8.76E-06
PCB-167	2.59E-09	6.70E-12	3.90E-12	NA	NA	5.74E-13	2.17E-12	8.62E-08	3.26E-07	4.12E-07
PCB-169	7.36E-07	1.90E-09	1.11E-09	NA	NA	1.63E-10	6.18E-10	2.45E-05	9.26E-05	1.17E-04
PCB-189	1.35E-08	3.50E-11	2.04E-11	NA	NA	3.00E-12	1.13E-11	4.50E-07	1.70E-06	2.15E-06
2,3,7,8-TCDD	1.77E-08	4.57E-11	2.66E-11	NA	NA	3.91E-12	1.48E-11	5.87E-07	2.22E-06	2.81E-06
1,2,3,7,8-PeCDD	3.40E-08	8.79E-11	5.12E-11	NA	NA	7.53E-12	2.85E-11	1.13E-06	4.28E-06	5.41E-06
1,2,3,4,7,8-HxCDD	1.85E-09	4.80E-12	2.79E-12	NA	NA	4.11E-13	1.56E-12	6.17E-08	2.33E-07	2.95E-07
1,2,3,6,7,8-HxCDD	5.22E-09	1.35E-11	7.85E-12	NA	NA	1.16E-12	4.38E-12	1.73E-07	6.56E-07	8.30E-07
1,2,3,7,8,9-HxCDD	2.46E-09	6.37E-12	3.71E-12	NA	NA	5.46E-13	2.07E-12	8.19E-08	3.10E-07	3.92E-07
1,2,3,4,6,7,8-HpCDD	1.04E-09	2.68E-12	1.56E-12	NA	NA	2.30E-13	8.70E-13	3.45E-08	1.31E-07	1.65E-07
OCDD	1.48E-11	3.82E-14	2.23E-14	NA	NA	3.28E-15	1.24E-14	4.92E-10	1.86E-09	2.35E-09
2,3,7,8-TCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.22E-07	3.15E-10	1.84E-10	NA	NA	2.70E-11	1.02E-10	4.05E-06	1.53E-05	1.94E-05
1,2,3,4,7,8-HxCDF	1.34E-08	3.46E-11	2.02E-11	NA	NA	2.97E-12	1.12E-11	4.45E-07	1.68E-06	2.13E-06
1,2,3,6,7,8-HXCDF	7.13E-09	1.84E-11	1.07E-11	NA	NA	1.58E-12	5.98E-12	2.37E-07	8.97E-07	1.13E-06
2,3,4,6,7,8-HxCDF	6.68E-09	1.73E-11	1.01E-11	NA	NA	1.48E-12	5.61E-12	2.22E-07	8.41E-07	1.06E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	1.41E-09	3.66E-12	2.13E-12	NA	NA	3.13E-13	1.19E-12	4.70E-08	1.78E-07	2.25E-07
1,2,3,4,7,8,9-HpCDF	1.68E-10	4.36E-13	2.54E-13	NA	NA	3.73E-14	1.41E-13	5.60E-09	2.12E-08	2.68E-08
OCDF	2.18E-12	5.64E-15	3.29E-15	NA	NA	4.84E-16	1.83E-15	7.26E-11	2.75E-10	3.47E-10

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**3E-05**	**1E-04**	**1E-04**
Dioxin-like PCB congeners	4.2E-04	1.6E-03	2.0E-03
Dioxins	2.1E-06	7.8E-06	9.9E-06
Furans	5.0E-06	1.9E-05	2.4E-05
Total TEQ RME Cancer Risk	**5E-04**	**2E-03**	**2E-03**
Total RME Hazard Index	**8E+00**	**4E+00**	

O:\20123001.096\HHRA_FNL_AG\AG_FNL_ATD-3c Ag risks (wo farms) (w diox+furan TFs).xls
Beef Risk - Bkyd (2 ppm) P5

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR POULTRY (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE poultry concentration (mg total PCB/kg poultry; mg congener TEQ/kg poultry)	CTE $ADD_{poultry}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{poultry}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.71E-02	3.92E-05	2.20E-05	1.96E+00	1.10E+00	3.36E-06	9.12E-06	3.36E-06	9.12E-06	1.25E-05
PCB-77	6.44E-10	6.80E-13	3.82E-13	NA	NA	5.83E-14	1.58E-13	8.75E-09	2.38E-08	3.25E-08
PCB-81	1.75E-11	1.85E-14	1.04E-14	NA	NA	1.59E-15	4.30E-15	2.38E-10	6.46E-10	8.83E-10
PCB-105	9.36E-09	9.90E-12	5.56E-12	NA	NA	8.49E-13	2.30E-12	1.27E-07	3.46E-07	4.73E-07
PCB-114	1.76E-09	1.86E-12	1.04E-12	NA	NA	1.59E-13	4.33E-13	2.39E-08	6.49E-08	8.88E-08
PCB-118	1.82E-08	1.92E-11	1.08E-11	NA	NA	1.65E-12	4.47E-12	2.47E-07	6.70E-07	9.17E-07
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	6.78E-07	7.17E-10	4.02E-10	NA	NA	6.14E-11	1.67E-10	9.21E-06	2.50E-05	3.42E-05
PCB-156	4.59E-08	4.86E-11	2.73E-11	NA	NA	4.16E-12	1.13E-11	6.25E-07	1.70E-06	2.32E-06
PCB-157	1.77E-08	1.87E-11	1.05E-11	NA	NA	1.60E-12	4.35E-12	2.41E-07	6.53E-07	8.93E-07
PCB-167	6.24E-10	6.59E-13	3.70E-13	NA	NA	5.65E-14	1.53E-13	8.48E-09	2.30E-08	3.15E-08
PCB-169	9.54E-09	1.01E-11	5.67E-12	NA	NA	8.65E-13	2.35E-12	1.30E-07	3.52E-07	4.82E-07
PCB-189	3.01E-09	3.18E-12	1.79E-12	NA	NA	2.73E-13	7.40E-13	4.09E-08	1.11E-07	1.52E-07
2,3,7,8-TCDD	1.61E-08	1.71E-11	9.58E-12	NA	NA	1.46E-12	3.97E-12	2.19E-07	5.95E-07	8.15E-07
1,2,3,7,8-PeCDD	2.94E-08	3.10E-11	1.74E-11	NA	NA	2.66E-12	7.22E-12	3.99E-07	1.08E-06	1.48E-06
1,2,3,4,7,8-HxCDD	2.22E-09	2.35E-12	1.32E-12	NA	NA	2.01E-13	5.46E-13	3.02E-08	8.20E-08	1.12E-07
1,2,3,6,7,8-HxCDD	1.02E-08	1.07E-11	6.03E-12	NA	NA	9.20E-13	2.50E-12	1.38E-07	3.75E-07	5.13E-07
1,2,3,7,8,9-HxCDD	2.57E-09	2.72E-12	1.53E-12	NA	NA	2.33E-13	6.32E-13	3.49E-08	9.48E-08	1.30E-07
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	3.48E-10	3.68E-13	2.07E-13	NA	NA	3.15E-14	8.56E-14	4.73E-09	1.28E-08	1.76E-08
2,3,7,8-TCDF	3.38E-08	3.58E-11	2.01E-11	NA	NA	3.07E-12	8.33E-12	4.60E-07	1.25E-06	1.71E-06
1,2,3,7,8-PeCDF	8.90E-09	9.41E-12	5.29E-12	NA	NA	8.07E-13	2.19E-12	1.21E-07	3.29E-07	4.50E-07
2,3,4,7,8-PeCDF	1.24E-07	1.31E-10	7.38E-11	NA	NA	1.13E-11	3.06E-11	1.69E-06	4.58E-06	6.27E-06
1,2,3,4,7,8-HxCDF	1.32E-08	1.40E-11	7.87E-12	NA	NA	1.20E-12	3.26E-12	1.80E-07	4.89E-07	6.69E-07
1,2,3,6,7,8-HXCDF	8.06E-09	8.52E-12	4.79E-12	NA	NA	7.30E-13	1.98E-12	1.10E-07	2.97E-07	4.07E-07
2,3,4,6,7,8-HxCDF	5.91E-09	6.25E-12	3.51E-12	NA	NA	5.36E-13	1.45E-12	8.04E-08	2.18E-07	2.99E-07
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	1.71E-09	1.81E-12	1.01E-12	NA	NA	1.55E-13	4.20E-13	2.32E-08	6.31E-08	8.63E-08
1,2,3,4,7,8,9-HpCDF	1.48E-10	1.57E-13	8.79E-14	NA	NA	1.34E-14	3.64E-14	2.01E-09	5.46E-09	7.48E-09
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**3E-06**	**9E-06**	**1E-05**
Dioxin-like PCB congeners	1.1E-05	2.9E-05	4.0E-05
Dioxins	8.3E-07	2.2E-06	3.1E-06
Furans	2.7E-06	7.2E-06	9.9E-06
Total TEQ CTE Cancer Risk	**1E-05**	**4E-05**	**5E-05**
Total CTE Hazard Index	**2E+00**	**1E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR POULTRY (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Poultry Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME $ADD_{poultry}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{poultry}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.80E-02	8.81E-05	6.36E-05	4.41E+00	3.18E+00	7.55E-06	5.82E-05	1.51E-05	1.16E-04	1.31E-04
PCB-77	1.18E-09	1.53E-12	1.11E-12	NA	NA	1.31E-13	1.01E-12	1.97E-08	1.52E-07	1.71E-07
PCB-81	3.21E-11	4.16E-14	3.00E-14	NA	NA	3.57E-15	2.75E-14	5.35E-10	4.12E-09	4.66E-09
PCB-105	1.72E-08	2.23E-11	1.61E-11	NA	NA	1.91E-12	1.47E-11	2.86E-07	2.21E-06	2.49E-06
PCB-114	3.23E-09	4.18E-12	3.02E-12	NA	NA	3.59E-13	2.76E-12	5.38E-08	4.14E-07	4.68E-07
PCB-118	3.33E-08	4.32E-11	3.12E-11	NA	NA	3.70E-12	2.85E-11	5.55E-07	4.28E-06	4.83E-06
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	1.24E-06	1.61E-09	1.16E-09	NA	NA	1.38E-10	1.06E-09	2.07E-05	1.60E-04	1.80E-04
PCB-156	8.43E-08	1.09E-10	7.89E-11	NA	NA	9.37E-12	7.21E-11	1.40E-06	1.08E-05	1.22E-05
PCB-157	3.25E-08	4.21E-11	3.04E-11	NA	NA	3.61E-12	2.78E-11	5.41E-07	4.17E-06	4.71E-06
PCB-167	1.14E-09	1.48E-12	1.07E-12	NA	NA	1.27E-13	9.79E-13	1.91E-08	1.47E-07	1.66E-07
PCB-169	1.75E-08	2.27E-11	1.64E-11	NA	NA	1.94E-12	1.50E-11	2.92E-07	2.25E-06	2.54E-06
PCB-189	5.52E-09	7.16E-12	5.17E-12	NA	NA	6.13E-13	4.72E-12	9.20E-08	7.09E-07	8.01E-07
2,3,7,8-TCDD	2.96E-08	3.84E-11	2.77E-11	NA	NA	3.29E-12	2.53E-11	4.93E-07	3.80E-06	4.29E-06
1,2,3,7,8-PeCDD	5.39E-08	6.98E-11	5.04E-11	NA	NA	5.98E-12	4.61E-11	8.97E-07	6.91E-06	7.81E-06
1,2,3,4,7,8-HxCDD	4.08E-09	5.28E-12	3.81E-12	NA	NA	4.53E-13	3.49E-12	6.79E-08	5.23E-07	5.91E-07
1,2,3,6,7,8-HxCDD	1.86E-08	2.42E-11	1.74E-11	NA	NA	2.07E-12	1.59E-11	3.11E-07	2.39E-06	2.70E-06
1,2,3,7,8,9-HxCDD	4.72E-09	6.11E-12	4.41E-12	NA	NA	5.24E-13	4.04E-12	7.86E-08	6.05E-07	6.84E-07
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	6.39E-10	8.28E-13	5.98E-13	NA	NA	7.10E-14	5.47E-13	1.06E-08	8.20E-08	9.26E-08
2,3,7,8-TCDF	6.21E-08	8.05E-11	5.81E-11	NA	NA	6.90E-12	5.31E-11	1.03E-06	7.97E-06	9.01E-06
1,2,3,7,8-PeCDF	1.63E-08	2.12E-11	1.53E-11	NA	NA	1.81E-12	1.40E-11	2.72E-07	2.10E-06	2.37E-06
2,3,4,7,8-PeCDF	2.28E-07	2.95E-10	2.13E-10	NA	NA	2.53E-11	1.95E-10	3.80E-06	2.93E-05	3.31E-05
1,2,3,4,7,8-HxCDF	2.43E-08	3.15E-11	2.27E-11	NA	NA	2.70E-12	2.08E-11	4.05E-07	3.12E-06	3.52E-06
1,2,3,6,7,8-HXCDF	1.48E-08	1.92E-11	1.38E-11	NA	NA	1.64E-12	1.27E-11	2.46E-07	1.90E-06	2.14E-06
2,3,4,6,7,8-HxCDF	1.09E-08	1.41E-11	1.02E-11	NA	NA	1.21E-12	9.29E-12	1.81E-07	1.39E-06	1.57E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	3.14E-09	4.06E-12	2.93E-12	NA	NA	3.48E-13	2.68E-12	5.22E-08	4.03E-07	4.55E-07
1,2,3,4,7,8,9-HpCDF	2.72E-10	3.52E-13	2.54E-13	NA	NA	3.02E-14	2.33E-13	4.53E-09	3.49E-08	3.94E-08
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:			
	Child	**Adult**	**Total**
Total PCB RME Cancer Risk	**2E-05**	**1E-04**	**1E-04**
Dioxin-like PCB congeners	2.4E-05	1.8E-04	2.1E-04
Dioxins	1.9E-06	1.4E-05	1.6E-05
Furans	6.0E-06	4.6E-05	5.2E-05
Total TEQ RME Cancer Risk	**3E-05**	**2E-04**	**3E-04**
Total RME Hazard Index	**4E+00**	**3E+00**	

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Poultry Risk (2 ppm) (F) P6

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR POULTRY (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE poultry concentration (mg total PCB/kg poultry; mg congener TEQ/kg poultry)	CTE $ADD_{poultry}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{poultry}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.71E-02	3.92E-05	2.70E-05	1.96E+00	1.35E+00	3.36E-06	3.47E-06	3.36E-06	3.47E-06	6.83E-06
PCB-77	6.44E-10	6.80E-13	4.69E-13	NA	NA	5.83E-14	6.03E-14	8.75E-09	9.05E-09	1.78E-08
PCB-81	1.75E-11	1.85E-14	1.28E-14	NA	NA	1.59E-15	1.64E-15	2.38E-10	2.46E-10	4.84E-10
PCB-105	9.36E-09	9.90E-12	6.82E-12	NA	NA	8.49E-13	8.77E-13	1.27E-07	1.32E-07	2.59E-07
PCB-114	1.76E-09	1.86E-12	1.28E-12	NA	NA	1.59E-13	1.65E-13	2.39E-08	2.47E-08	4.86E-08
PCB-118	1.82E-08	1.92E-11	1.32E-11	NA	NA	1.65E-12	1.70E-12	2.47E-07	2.55E-07	5.02E-07
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	6.78E-07	7.17E-10	4.94E-10	NA	NA	6.14E-11	6.35E-11	9.21E-06	9.53E-06	1.87E-05
PCB-156	4.59E-08	4.86E-11	3.35E-11	NA	NA	4.16E-12	4.31E-12	6.25E-07	6.46E-07	1.27E-06
PCB-157	1.77E-08	1.87E-11	1.29E-11	NA	NA	1.60E-12	1.66E-12	2.41E-07	2.49E-07	4.89E-07
PCB-167	6.24E-10	6.59E-13	4.54E-13	NA	NA	5.65E-14	5.84E-14	8.48E-09	8.76E-09	1.72E-08
PCB-169	9.54E-09	1.01E-11	6.95E-12	NA	NA	8.65E-13	8.94E-13	1.30E-07	1.34E-07	2.64E-07
PCB-189	3.01E-09	3.18E-12	2.19E-12	NA	NA	2.73E-13	2.82E-13	4.09E-08	4.23E-08	8.32E-08
2,3,7,8-TCDD	1.61E-08	1.71E-11	1.18E-11	NA	NA	1.46E-12	1.51E-12	2.19E-07	2.27E-07	4.46E-07
1,2,3,7,8-PeCDD	2.94E-08	3.10E-11	2.14E-11	NA	NA	2.66E-12	2.75E-12	3.99E-07	4.13E-07	8.12E-07
1,2,3,4,7,8-HxCDD	2.22E-09	2.35E-12	1.62E-12	NA	NA	2.01E-13	2.08E-13	3.02E-08	3.12E-08	6.14E-08
1,2,3,6,7,8-HxCDD	1.02E-08	1.07E-11	7.40E-12	NA	NA	9.20E-13	9.52E-13	1.38E-07	1.43E-07	2.81E-07
1,2,3,7,8,9-HxCDD	2.57E-09	2.72E-12	1.87E-12	NA	NA	2.33E-13	2.41E-13	3.49E-08	3.61E-08	7.11E-08
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	3.48E-10	3.68E-13	2.54E-13	NA	NA	3.15E-14	3.26E-14	4.73E-09	4.89E-09	9.63E-09
2,3,7,8-TCDF	3.38E-08	3.58E-11	2.47E-11	NA	NA	3.07E-12	3.17E-12	4.60E-07	4.76E-07	9.36E-07
1,2,3,7,8-PeCDF	8.90E-09	9.41E-12	6.49E-12	NA	NA	8.07E-13	8.34E-13	1.21E-07	1.25E-07	2.46E-07
2,3,4,7,8-PeCDF	1.24E-07	1.31E-10	9.05E-11	NA	NA	1.13E-11	1.16E-11	1.69E-06	1.75E-06	3.43E-06
1,2,3,4,7,8-HxCDF	1.32E-08	1.40E-11	9.65E-12	NA	NA	1.20E-12	1.24E-12	1.80E-07	1.86E-07	3.66E-07
1,2,3,6,7,8-HXCDF	8.06E-09	8.52E-12	5.87E-12	NA	NA	7.30E-13	7.55E-13	1.10E-07	1.13E-07	2.23E-07
2,3,4,6,7,8-HxCDF	5.91E-09	6.25E-12	4.31E-12	NA	NA	5.36E-13	5.54E-13	8.04E-08	8.31E-08	1.64E-07
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	1.71E-09	1.81E-12	1.25E-12	NA	NA	1.55E-13	1.60E-13	2.32E-08	2.40E-08	4.72E-08
1,2,3,4,7,8,9-HpCDF	1.48E-10	1.57E-13	1.08E-13	NA	NA	1.34E-14	1.39E-14	2.01E-09	2.08E-09	4.09E-09
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**3E-06**	**3E-06**	**7E-06**
Dioxin-like PCB congeners	1.1E-05	1.1E-05	2.2E-05
Dioxins	8.3E-07	8.5E-07	1.7E-06
Furans	2.7E-06	2.8E-06	5.4E-06
Total TEQ CTE Cancer Risk	**1E-05**	**1E-05**	**3E-05**
Total CTE Hazard Index	**2E+00**	**1E+00**	

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Poultry Risk (2 ppm) (R) P7

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR POULTRY (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Poultry Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME $ADD_{poultry}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{poultry}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.80E-02	8.81E-05	5.29E-05	4.41E+00	2.65E+00	7.55E-06	2.95E-05	1.51E-05	5.90E-05	7.41E-05
PCB-77	1.18E-09	1.53E-12	9.19E-13	NA	NA	1.31E-13	5.12E-13	1.97E-08	7.68E-08	9.65E-08
PCB-81	3.21E-11	4.16E-14	2.50E-14	NA	NA	3.57E-15	1.39E-14	5.35E-10	2.09E-09	2.62E-09
PCB-105	1.72E-08	2.23E-11	1.34E-11	NA	NA	1.91E-12	7.45E-12	2.86E-07	1.12E-06	1.40E-06
PCB-114	3.23E-09	4.18E-12	2.51E-12	NA	NA	3.59E-13	1.40E-12	5.38E-08	2.10E-07	2.64E-07
PCB-118	3.33E-08	4.32E-11	2.59E-11	NA	NA	3.70E-12	1.45E-11	5.55E-07	2.17E-06	2.72E-06
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	1.24E-06	1.61E-09	9.68E-10	NA	NA	1.38E-10	5.39E-10	2.07E-05	8.09E-05	1.02E-04
PCB-156	8.43E-08	1.09E-10	6.56E-11	NA	NA	9.37E-12	3.66E-11	1.40E-06	5.49E-06	6.89E-06
PCB-157	3.25E-08	4.21E-11	2.53E-11	NA	NA	3.61E-12	1.41E-11	5.41E-07	2.11E-06	2.65E-06
PCB-167	1.14E-09	1.48E-12	8.91E-13	NA	NA	1.27E-13	4.96E-13	1.91E-08	7.44E-08	9.35E-08
PCB-169	1.75E-08	2.27E-11	1.36E-11	NA	NA	1.94E-12	7.59E-12	2.92E-07	1.14E-06	1.43E-06
PCB-189	5.52E-09	7.16E-12	4.30E-12	NA	NA	6.13E-13	2.39E-12	9.20E-08	3.59E-07	4.51E-07
2,3,7,8-TCDD	2.96E-08	3.84E-11	2.30E-11	NA	NA	3.29E-12	1.28E-11	4.93E-07	1.93E-06	2.42E-06
1,2,3,7,8-PeCDD	5.39E-08	6.98E-11	4.19E-11	NA	NA	5.98E-12	2.34E-11	8.97E-07	3.50E-06	4.40E-06
1,2,3,4,7,8-HxCDD	4.08E-09	5.28E-12	3.17E-12	NA	NA	4.53E-13	1.77E-12	6.79E-08	2.65E-07	3.33E-07
1,2,3,6,7,8-HxCDD	1.86E-08	2.42E-11	1.45E-11	NA	NA	2.07E-12	8.08E-12	3.11E-07	1.21E-06	1.52E-06
1,2,3,7,8,9-HxCDD	4.72E-09	6.11E-12	3.67E-12	NA	NA	5.24E-13	2.05E-12	7.86E-08	3.07E-07	3.85E-07
1,2,3,4,6,7,8-HpCDD	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	6.39E-10	8.28E-13	4.97E-13	NA	NA	7.10E-14	2.77E-13	1.06E-08	4.16E-08	5.22E-08
2,3,7,8-TCDF	6.21E-08	8.05E-11	4.83E-11	NA	NA	6.90E-12	2.69E-11	1.03E-06	4.04E-06	5.07E-06
1,2,3,7,8-PeCDF	1.63E-08	2.12E-11	1.27E-11	NA	NA	1.81E-12	7.09E-12	2.72E-07	1.06E-06	1.33E-06
2,3,4,7,8-PeCDF	2.28E-07	2.95E-10	1.77E-10	NA	NA	2.53E-11	9.88E-11	3.80E-06	1.48E-05	1.86E-05
1,2,3,4,7,8-HxCDF	2.43E-08	3.15E-11	1.89E-11	NA	NA	2.70E-12	1.05E-11	4.05E-07	1.58E-06	1.99E-06
1,2,3,6,7,8-HXCDF	1.48E-08	1.92E-11	1.15E-11	NA	NA	1.64E-12	6.41E-12	2.46E-07	9.62E-07	1.21E-06
2,3,4,6,7,8-HxCDF	1.09E-08	1.41E-11	8.45E-12	NA	NA	1.21E-12	4.71E-12	1.81E-07	7.06E-07	8.87E-07
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	3.14E-09	4.06E-12	2.44E-12	NA	NA	3.48E-13	1.36E-12	5.22E-08	2.04E-07	2.56E-07
1,2,3,4,7,8,9-HpCDF	2.72E-10	3.52E-13	2.12E-13	NA	NA	3.02E-14	1.18E-13	4.53E-09	1.77E-08	2.22E-08
OCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REASONABLE MAXIMUM EXPOSURE:

	Child	Adult	Total
Total PCB RME Cancer Risk	**2E-05**	**6E-05**	**7E-05**
Dioxin-like PCB congeners	2.4E-05	9.4E-05	1.2E-04
Dioxins	1.9E-06	7.3E-06	9.1E-06
Furans	6.0E-06	2.3E-05	2.9E-05
Total TEQ RME Cancer Risk	**3E-05**	**1E-04**	**2E-04**
Total RME Hazard Index	**4E+00**	**3E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EGG (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE egg concentration (mg total PCB/kg egg; mg congener TEQ/kg egg)	CTE ADD_{egg} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{egg}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	1.80E-01	2.74E-04	1.16E-04	1.37E+01	5.80E+00	2.35E-05	4.81E-05	2.35E-05	4.81E-05	7.16E-05
PCB-77	5.43E-09	8.28E-12	3.50E-12	NA	NA	7.09E-13	1.45E-12	1.06E-07	2.17E-07	3.24E-07
PCB-81	1.18E-10	1.80E-13	7.61E-14	NA	NA	1.54E-14	3.15E-14	2.31E-09	4.73E-09	7.04E-09
PCB-105	7.58E-08	1.16E-10	4.89E-11	NA	NA	9.91E-12	2.02E-11	1.49E-06	3.04E-06	4.52E-06
PCB-114	1.66E-08	2.53E-11	1.07E-11	NA	NA	2.17E-12	4.44E-12	3.26E-07	6.65E-07	9.91E-07
PCB-118	1.63E-07	2.49E-10	1.05E-10	NA	NA	2.14E-11	4.36E-11	3.20E-06	6.54E-06	9.75E-06
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	4.44E-06	6.77E-09	2.86E-09	NA	NA	5.81E-10	1.19E-09	8.71E-05	1.78E-04	2.65E-04
PCB-156	3.77E-07	5.75E-10	2.43E-10	NA	NA	4.93E-11	1.01E-10	7.40E-06	1.51E-05	2.25E-05
PCB-157	1.33E-07	2.02E-10	8.55E-11	NA	NA	1.73E-11	3.54E-11	2.60E-06	5.31E-06	7.91E-06
PCB-167	5.05E-09	7.70E-12	3.25E-12	NA	NA	6.60E-13	1.35E-12	9.90E-08	2.02E-07	3.01E-07
PCB-169	7.15E-08	1.09E-10	4.61E-11	NA	NA	9.35E-12	1.91E-11	1.40E-06	2.86E-06	4.27E-06
PCB-189	2.99E-08	4.56E-11	1.93E-11	NA	NA	3.91E-12	7.99E-12	5.87E-07	1.20E-06	1.78E-06
2,3,7,8-TCDD	1.40E-07	2.13E-10	9.02E-11	NA	NA	1.83E-11	3.74E-11	2.74E-06	5.60E-06	8.35E-06
1,2,3,7,8-PeCDD	2.24E-07	3.41E-10	1.44E-10	NA	NA	2.93E-11	5.98E-11	4.39E-06	8.97E-06	1.34E-05
1,2,3,4,7,8-HxCDD	2.16E-08	3.30E-11	1.39E-11	NA	NA	2.83E-12	5.78E-12	4.24E-07	8.67E-07	1.29E-06
1,2,3,6,7,8-HxCDD	7.07E-08	1.08E-10	4.56E-11	NA	NA	9.25E-12	1.89E-11	1.39E-06	2.83E-06	4.22E-06
1,2,3,7,8,9-HxCDD	3.18E-08	4.85E-11	2.05E-11	NA	NA	4.15E-12	8.49E-12	6.23E-07	1.27E-06	1.90E-06
1,2,3,4,6,7,8-HpCDD	7.44E-08	1.13E-10	4.79E-11	NA	NA	9.72E-12	1.99E-11	1.46E-06	2.98E-06	4.44E-06
OCDD	3.76E-09	5.73E-12	2.42E-12	NA	NA	4.91E-13	1.00E-12	7.37E-08	1.50E-07	2.24E-07
2,3,7,8-TCDF	9.51E-08	1.45E-10	6.13E-11	NA	NA	1.24E-11	2.54E-11	1.87E-06	3.81E-06	5.68E-06
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.52E-06	2.31E-09	9.77E-10	NA	NA	1.98E-10	4.05E-10	2.97E-05	6.07E-05	9.04E-05
1,2,3,4,7,8-HxCDF	2.43E-07	3.70E-10	1.56E-10	NA	NA	3.17E-11	6.48E-11	4.75E-06	9.71E-06	1.45E-05
1,2,3,6,7,8-HXCDF	1.32E-07	2.01E-10	8.51E-11	NA	NA	1.73E-11	3.53E-11	2.59E-06	5.29E-06	7.88E-06
2,3,4,6,7,8-HxCDF	7.98E-08	1.22E-10	5.14E-11	NA	NA	1.04E-11	2.13E-11	1.56E-06	3.20E-06	4.76E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	6.92E-08	1.05E-10	4.46E-11	NA	NA	9.04E-12	1.85E-11	1.36E-06	2.77E-06	4.13E-06
1,2,3,4,7,8,9-HpCDF	5.50E-09	8.38E-12	3.54E-12	NA	NA	7.18E-13	1.47E-12	1.08E-07	2.20E-07	3.28E-07
OCDF	2.94E-10	4.49E-13	1.90E-13	NA	NA	3.85E-14	7.86E-14	5.77E-09	1.18E-08	1.76E-08

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**2E-05**	**5E-05**	**7E-05**
Dioxin-like PCB congeners	1.0E-04	2.1E-04	3.2E-04
Dioxins	1.1E-05	2.3E-05	3.4E-05
Furans	4.2E-05	8.6E-05	1.3E-04
Total TEQ CTE Cancer Risk	**2E-04**	**3E-04**	**5E-04**
Total CTE Hazard Index	**1E+01**	**6E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EGG (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Egg Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME ADD_{egg} (mg/kg-day)		RME Hazard Index		RME $LADD_{egg}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	1.80E-01	3.30E-04	1.46E-04	1.65E+01	7.30E+00	2.83E-05	1.34E-04	5.65E-05	2.67E-04	3.24E-04
PCB-77	5.43E-09	9.94E-12	4.40E-12	NA	NA	8.52E-13	4.03E-12	1.28E-07	6.04E-07	7.32E-07
PCB-81	1.18E-10	2.16E-13	9.58E-14	NA	NA	1.85E-14	8.76E-14	2.78E-09	1.31E-08	1.59E-08
PCB-105	7.58E-08	1.39E-10	6.15E-11	NA	NA	1.19E-11	5.62E-11	1.79E-06	8.44E-06	1.02E-05
PCB-114	1.66E-08	3.04E-11	1.35E-11	NA	NA	2.61E-12	1.23E-11	3.91E-07	1.85E-06	2.24E-06
PCB-118	1.63E-07	2.99E-10	1.33E-10	NA	NA	2.57E-11	1.21E-10	3.85E-06	1.82E-05	2.20E-05
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	4.44E-06	8.14E-09	3.60E-09	NA	NA	6.97E-10	3.29E-09	1.05E-04	4.94E-04	5.99E-04
PCB-156	3.77E-07	6.91E-10	3.06E-10	NA	NA	5.92E-11	2.80E-10	8.89E-06	4.20E-05	5.09E-05
PCB-157	1.33E-07	2.43E-10	1.08E-10	NA	NA	2.08E-11	9.84E-11	3.12E-06	1.48E-05	1.79E-05
PCB-167	5.05E-09	9.25E-12	4.10E-12	NA	NA	7.93E-13	3.74E-12	1.19E-07	5.62E-07	6.81E-07
PCB-169	7.15E-08	1.31E-10	5.80E-11	NA	NA	1.12E-11	5.31E-11	1.68E-06	7.96E-06	9.64E-06
PCB-189	2.99E-08	5.48E-11	2.43E-11	NA	NA	4.70E-12	2.22E-11	7.05E-07	3.33E-06	4.03E-06
2,3,7,8-TCDD	1.40E-07	2.56E-10	1.14E-10	NA	NA	2.20E-11	1.04E-10	3.30E-06	1.56E-05	1.89E-05
1,2,3,7,8-PeCDD	2.24E-07	4.10E-10	1.82E-10	NA	NA	3.51E-11	1.66E-10	5.27E-06	2.49E-05	3.02E-05
1,2,3,4,7,8-HxCDD	2.16E-08	3.96E-11	1.76E-11	NA	NA	3.40E-12	1.61E-11	5.10E-07	2.41E-06	2.92E-06
1,2,3,6,7,8-HxCDD	7.07E-08	1.30E-10	5.74E-11	NA	NA	1.11E-11	5.25E-11	1.67E-06	7.87E-06	9.54E-06
1,2,3,7,8,9-HxCDD	3.18E-08	5.82E-11	2.58E-11	NA	NA	4.99E-12	2.36E-11	7.49E-07	3.54E-06	4.29E-06
1,2,3,4,6,7,8-HpCDD	7.44E-08	1.36E-10	6.04E-11	NA	NA	1.17E-11	5.52E-11	1.75E-06	8.28E-06	1.00E-05
OCDD	3.76E-09	6.88E-12	3.05E-12	NA	NA	5.90E-13	2.79E-12	8.85E-08	4.18E-07	5.07E-07
2,3,7,8-TCDF	9.51E-08	1.74E-10	7.72E-11	NA	NA	1.49E-11	7.06E-11	2.24E-06	1.06E-05	1.28E-05
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.52E-06	2.78E-09	1.23E-09	NA	NA	2.38E-10	1.12E-09	3.57E-05	1.69E-04	2.04E-04
1,2,3,4,7,8-HxCDF	2.43E-07	4.44E-10	1.97E-10	NA	NA	3.81E-11	1.80E-10	5.71E-06	2.70E-05	3.27E-05
1,2,3,6,7,8-HXCDF	1.32E-07	2.42E-10	1.07E-10	NA	NA	2.07E-11	9.79E-11	3.11E-06	1.47E-05	1.78E-05
2,3,4,6,7,8-HxCDF	7.98E-08	1.46E-10	6.47E-11	NA	NA	1.25E-11	5.92E-11	1.88E-06	8.88E-06	1.08E-05
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	6.92E-08	1.27E-10	5.61E-11	NA	NA	1.09E-11	5.13E-11	1.63E-06	7.70E-06	9.33E-06
1,2,3,4,7,8,9-HpCDF	5.50E-09	1.01E-11	4.46E-12	NA	NA	8.63E-13	4.08E-12	1.29E-07	6.11E-07	7.41E-07
OCDF	2.94E-10	5.39E-13	2.39E-13	NA	NA	4.62E-14	2.18E-13	6.93E-09	3.27E-08	3.97E-08

REASONABLE MAXIMUM EXPOSURE:

	Child	Adult	Total
Total PCB RME Cancer Risk	**6E-05**	**3E-04**	**3E-04**
Dioxin-like PCB congeners	1.3E-04	5.9E-04	7.2E-04
Dioxins	1.3E-05	6.3E-05	7.6E-05
Furans	5.0E-05	2.4E-04	2.9E-04
Total TEQ RME Cancer Risk	**2E-04**	**9E-04**	**1E-03**
Total RME Hazard Index	**2E+01**	**7E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EGG (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE egg concentration (mg total PCB/kg egg; mg congener TEQ/kg egg)	CTE ADD_{egg} (mg/kg-day)		CTE Hazard Index		CTE $LADD_{egg}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	1.80E-01	2.74E-04	1.36E-04	1.37E+01	6.81E+00	2.35E-05	1.75E-05	2.35E-05	1.75E-05	4.10E-05
PCB-77	5.43E-09	8.28E-12	4.11E-12	NA	NA	7.09E-13	5.28E-13	1.06E-07	7.92E-08	1.86E-07
PCB-81	1.18E-10	1.80E-13	8.93E-14	NA	NA	1.54E-14	1.15E-14	2.31E-09	1.72E-09	4.04E-09
PCB-105	7.58E-08	1.16E-10	5.74E-11	NA	NA	9.91E-12	7.38E-12	1.49E-06	1.11E-06	2.59E-06
PCB-114	1.66E-08	2.53E-11	1.26E-11	NA	NA	2.17E-12	1.62E-12	3.26E-07	2.42E-07	5.68E-07
PCB-118	1.63E-07	2.49E-10	1.24E-10	NA	NA	2.14E-11	1.59E-11	3.20E-06	2.38E-06	5.59E-06
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	4.44E-06	6.77E-09	3.36E-09	NA	NA	5.81E-10	4.32E-10	8.71E-05	6.48E-05	1.52E-04
PCB-156	3.77E-07	5.75E-10	2.86E-10	NA	NA	4.93E-11	3.67E-11	7.40E-06	5.51E-06	1.29E-05
PCB-157	1.33E-07	2.02E-10	1.00E-10	NA	NA	1.73E-11	1.29E-11	2.60E-06	1.94E-06	4.54E-06
PCB-167	5.05E-09	7.70E-12	3.82E-12	NA	NA	6.60E-13	4.91E-13	9.90E-08	7.37E-08	1.73E-07
PCB-169	7.15E-08	1.09E-10	5.41E-11	NA	NA	9.35E-12	6.96E-12	1.40E-06	1.04E-06	2.45E-06
PCB-189	2.99E-08	4.56E-11	2.26E-11	NA	NA	3.91E-12	2.91E-12	5.87E-07	4.37E-07	1.02E-06
2,3,7,8-TCDD	1.40E-07	2.13E-10	1.06E-10	NA	NA	1.83E-11	1.36E-11	2.74E-06	2.04E-06	4.79E-06
1,2,3,7,8-PeCDD	2.24E-07	3.41E-10	1.69E-10	NA	NA	2.93E-11	2.18E-11	4.39E-06	3.27E-06	7.66E-06
1,2,3,4,7,8-HxCDD	2.16E-08	3.30E-11	1.64E-11	NA	NA	2.83E-12	2.11E-12	4.24E-07	3.16E-07	7.40E-07
1,2,3,6,7,8-HxCDD	7.07E-08	1.08E-10	5.35E-11	NA	NA	9.25E-12	6.88E-12	1.39E-06	1.03E-06	2.42E-06
1,2,3,7,8,9-HxCDD	3.18E-08	4.85E-11	2.41E-11	NA	NA	4.15E-12	3.09E-12	6.23E-07	4.64E-07	1.09E-06
1,2,3,4,6,7,8-HpCDD	7.44E-08	1.13E-10	5.63E-11	NA	NA	9.72E-12	7.24E-12	1.46E-06	1.09E-06	2.54E-06
OCDD	3.76E-09	5.73E-12	2.84E-12	NA	NA	4.91E-13	3.66E-13	7.37E-08	5.48E-08	1.29E-07
2,3,7,8-TCDF	9.51E-08	1.45E-10	7.20E-11	NA	NA	1.24E-11	9.26E-12	1.87E-06	1.39E-06	3.25E-06
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.52E-06	2.31E-09	1.15E-09	NA	NA	1.98E-10	1.47E-10	2.97E-05	2.21E-05	5.18E-05
1,2,3,4,7,8-HxCDF	2.43E-07	3.70E-10	1.84E-10	NA	NA	3.17E-11	2.36E-11	4.75E-06	3.54E-06	8.29E-06
1,2,3,6,7,8-HXCDF	1.32E-07	2.01E-10	9.99E-11	NA	NA	1.73E-11	1.28E-11	2.59E-06	1.93E-06	4.52E-06
2,3,4,6,7,8-HxCDF	7.98E-08	1.22E-10	6.04E-11	NA	NA	1.04E-11	7.76E-12	1.56E-06	1.16E-06	2.73E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	6.92E-08	1.05E-10	5.23E-11	NA	NA	9.04E-12	6.73E-12	1.36E-06	1.01E-06	2.37E-06
1,2,3,4,7,8,9-HpCDF	5.50E-09	8.38E-12	4.16E-12	NA	NA	7.18E-13	5.35E-13	1.08E-07	8.02E-08	1.88E-07
OCDF	2.94E-10	4.49E-13	2.23E-13	NA	NA	3.85E-14	2.86E-14	5.77E-09	4.30E-09	1.01E-08

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**2E-05**	**2E-05**	**4E-05**
Dioxin-like PCB congeners	1.0E-04	7.8E-05	1.8E-04
Dioxins	1.1E-05	8.3E-06	1.9E-05
Furans	4.2E-05	3.1E-05	7.3E-05
Total TEQ CTE Cancer Risk	**2E-04**	**1E-04**	**3E-04**
Total CTE Hazard Index	**1E+01**	**7E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EGG (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Egg Concentration (mg total PCB /kg; mg congener TEQ/kg)	RME ADD_{egg} (mg/kg-day)		RME Hazard Index		RME $LADD_{egg}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	1.80E-01	3.30E-04	1.47E-04	1.65E+01	7.36E+00	2.83E-05	8.20E-05	5.65E-05	1.64E-04	2.21E-04
PCB-77	5.43E-09	9.94E-12	4.44E-12	NA	NA	8.52E-13	2.47E-12	1.28E-07	3.71E-07	4.99E-07
PCB-81	1.18E-10	2.16E-13	9.66E-14	NA	NA	1.85E-14	5.38E-14	2.78E-09	8.07E-09	1.08E-08
PCB-105	7.58E-08	1.39E-10	6.20E-11	NA	NA	1.19E-11	3.46E-11	1.79E-06	5.18E-06	6.97E-06
PCB-114	1.66E-08	3.04E-11	1.36E-11	NA	NA	2.61E-12	7.57E-12	3.91E-07	1.14E-06	1.53E-06
PCB-118	1.63E-07	2.99E-10	1.34E-10	NA	NA	2.57E-11	7.45E-11	3.85E-06	1.12E-05	1.50E-05
PCB-123	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-126	4.44E-06	8.14E-09	3.63E-09	NA	NA	6.97E-10	2.02E-09	1.05E-04	3.04E-04	4.08E-04
PCB-156	3.77E-07	6.91E-10	3.09E-10	NA	NA	5.92E-11	1.72E-10	8.89E-06	2.58E-05	3.47E-05
PCB-157	1.33E-07	2.43E-10	1.08E-10	NA	NA	2.08E-11	6.04E-11	3.12E-06	9.07E-06	1.22E-05
PCB-167	5.05E-09	9.25E-12	4.13E-12	NA	NA	7.93E-13	2.30E-12	1.19E-07	3.45E-07	4.64E-07
PCB-169	7.15E-08	1.31E-10	5.85E-11	NA	NA	1.12E-11	3.26E-11	1.68E-06	4.89E-06	6.57E-06
PCB-189	2.99E-08	5.48E-11	2.45E-11	NA	NA	4.70E-12	1.36E-11	7.05E-07	2.05E-06	2.75E-06
2,3,7,8-TCDD	1.40E-07	2.56E-10	1.14E-10	NA	NA	2.20E-11	6.38E-11	3.30E-06	9.57E-06	1.29E-05
1,2,3,7,8-PeCDD	2.24E-07	4.10E-10	1.83E-10	NA	NA	3.51E-11	1.02E-10	5.27E-06	1.53E-05	2.06E-05
1,2,3,4,7,8-HxCDD	2.16E-08	3.96E-11	1.77E-11	NA	NA	3.40E-12	9.86E-12	5.10E-07	1.48E-06	1.99E-06
1,2,3,6,7,8-HxCDD	7.07E-08	1.30E-10	5.79E-11	NA	NA	1.11E-11	3.22E-11	1.67E-06	4.84E-06	6.50E-06
1,2,3,7,8,9-HxCDD	3.18E-08	5.82E-11	2.60E-11	NA	NA	4.99E-12	1.45E-11	7.49E-07	2.17E-06	2.92E-06
1,2,3,4,6,7,8-HpCDD	7.44E-08	1.36E-10	6.09E-11	NA	NA	1.17E-11	3.39E-11	1.75E-06	5.09E-06	6.84E-06
OCDD	3.76E-09	6.88E-12	3.07E-12	NA	NA	5.90E-13	1.71E-12	8.85E-08	2.57E-07	3.45E-07
2,3,7,8-TCDF	9.51E-08	1.74E-10	7.78E-11	NA	NA	1.49E-11	4.34E-11	2.24E-06	6.50E-06	8.74E-06
1,2,3,7,8-PeCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,4,7,8-PeCDF	1.52E-06	2.78E-09	1.24E-09	NA	NA	2.38E-10	6.91E-10	3.57E-05	1.04E-04	1.39E-04
1,2,3,4,7,8-HxCDF	2.43E-07	4.44E-10	1.98E-10	NA	NA	3.81E-11	1.11E-10	5.71E-06	1.66E-05	2.23E-05
1,2,3,6,7,8-HXCDF	1.32E-07	2.42E-10	1.08E-10	NA	NA	2.07E-11	6.02E-11	3.11E-06	9.03E-06	1.21E-05
2,3,4,6,7,8-HxCDF	7.98E-08	1.46E-10	6.53E-11	NA	NA	1.25E-11	3.64E-11	1.88E-06	5.45E-06	7.33E-06
1,2,3,7,8,9-HxCDF	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	6.92E-08	1.27E-10	5.66E-11	NA	NA	1.09E-11	3.15E-11	1.63E-06	4.73E-06	6.36E-06
1,2,3,4,7,8,9-HpCDF	5.50E-09	1.01E-11	4.49E-12	NA	NA	8.63E-13	2.50E-12	1.29E-07	3.76E-07	5.05E-07
OCDF	2.94E-10	5.39E-13	2.41E-13	NA	NA	4.62E-14	1.34E-13	6.93E-09	2.01E-08	2.71E-08

REASONABLE MAXIMUM EXPOSURE:			
	Child	**Adult**	**Total**
Total PCB RME Cancer Risk	**6E-05**	**2E-04**	**2E-04**
Dioxin-like PCB congeners	1.3E-04	3.6E-04	4.9E-04
Dioxins	1.3E-05	3.9E-05	5.2E-05
Furans	5.0E-05	1.5E-04	2.0E-04
Total TEQ RME Cancer Risk	**2E-04**	**5E-04**	**7E-04**
Total RME Hazard Index	**2E+01**	**7E+00**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED FRUIT (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE exposed fruit concentration (mg total PCB/kg exposed fruit; mg congener TEQ/kg exposed fruit)	CTE ADD$_{exposed\ fruit}$ (mg/kg-day)		CTE Hazard Index		CTE LADD$_{exposed\ fruit}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	4.69E-07	2.54E-07	2.35E-02	1.27E-02	4.02E-08	1.05E-07	4.02E-08	1.05E-07	1.45E-07
PCB-77	3.43E-10	4.47E-14	2.42E-14	NA	NA	3.83E-15	1.00E-14	5.75E-10	1.50E-09	2.08E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	1.56E-13	8.41E-14	NA	NA	1.33E-14	3.48E-14	2.00E-09	5.22E-09	7.22E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	4.45E-13	2.40E-13	NA	NA	3.81E-14	9.96E-14	5.72E-09	1.49E-08	2.07E-08
PCB-123	8.27E-11	1.08E-14	5.83E-15	NA	NA	9.25E-16	2.42E-15	1.39E-10	3.62E-10	5.01E-10
PCB-126	3.22E-07	4.20E-11	2.27E-11	NA	NA	3.60E-12	9.39E-12	5.39E-07	1.41E-06	1.95E-06
PCB-156	4.47E-09	5.83E-13	3.15E-13	NA	NA	5.00E-14	1.31E-13	7.50E-09	1.96E-08	2.71E-08
PCB-157	1.26E-09	1.64E-13	8.87E-14	NA	NA	1.41E-14	3.68E-14	2.11E-09	5.51E-09	7.63E-09
PCB-167	6.86E-11	8.94E-15	4.83E-15	NA	NA	7.67E-16	2.00E-15	1.15E-10	3.00E-10	4.15E-10
PCB-169	3.01E-08	3.93E-12	2.12E-12	NA	NA	3.37E-13	8.80E-13	5.05E-08	1.32E-07	1.83E-07
PCB-189	4.20E-10	5.48E-14	2.96E-14	NA	NA	4.70E-15	1.23E-14	7.05E-10	1.84E-09	2.55E-09
2,3,7,8-TCDD	3.73E-09	4.87E-13	2.63E-13	NA	NA	4.17E-14	1.09E-13	6.26E-09	1.63E-08	2.26E-08
1,2,3,7,8-PeCDD	8.27E-09	1.08E-12	5.83E-13	NA	NA	9.24E-14	2.41E-13	1.39E-08	3.62E-08	5.01E-08
1,2,3,4,7,8-HxCDD	1.67E-10	2.17E-14	1.17E-14	NA	NA	1.86E-15	4.86E-15	2.79E-10	7.29E-10	1.01E-09
1,2,3,6,7,8-HxCDD	9.29E-10	1.21E-13	6.54E-14	NA	NA	1.04E-14	2.71E-14	1.56E-09	4.07E-09	5.62E-09
1,2,3,7,8,9-HxCDD	6.07E-10	7.91E-14	4.28E-14	NA	NA	6.78E-15	1.77E-14	1.02E-09	2.66E-09	3.68E-09
1,2,3,4,6,7,8-HpCDD	3.43E-10	4.48E-14	2.42E-14	NA	NA	3.84E-15	1.00E-14	5.76E-10	1.50E-09	2.08E-09
OCDD	6.58E-11	8.58E-15	4.64E-15	NA	NA	7.35E-16	1.92E-15	1.10E-10	2.88E-10	3.98E-10
2,3,7,8-TCDF	1.05E-08	1.36E-12	7.38E-13	NA	NA	1.17E-13	3.06E-13	1.75E-08	4.58E-08	6.34E-08
1,2,3,7,8-PeCDF	2.13E-09	2.78E-13	1.50E-13	NA	NA	2.38E-14	6.22E-14	3.57E-09	9.33E-09	1.29E-08
2,3,4,7,8-PeCDF	2.63E-08	3.43E-12	1.86E-12	NA	NA	2.94E-13	7.69E-13	4.42E-08	1.15E-07	1.59E-07
1,2,3,4,7,8-HxCDF	2.68E-09	3.50E-13	1.89E-13	NA	NA	3.00E-14	7.83E-14	4.49E-09	1.17E-08	1.62E-08
1,2,3,6,7,8-HXCDF	1.63E-09	2.13E-13	1.15E-13	NA	NA	1.82E-14	4.76E-14	2.73E-09	7.14E-09	9.88E-09
2,3,4,6,7,8-HxCDF	1.86E-09	2.43E-13	1.31E-13	NA	NA	2.08E-14	5.44E-14	3.12E-09	8.16E-09	1.13E-08
1,2,3,7,8,9-HxCDF	5.38E-10	7.01E-14	3.79E-14	NA	NA	6.01E-15	1.57E-14	9.01E-10	2.35E-09	3.26E-09
1,2,3,4,6,7,8-HpCDF	6.69E-10	8.72E-14	4.71E-14	NA	NA	7.47E-15	1.95E-14	1.12E-09	2.93E-09	4.05E-09
1,2,3,4,7,8,9-HpCDF	4.35E-11	5.67E-15	3.06E-15	NA	NA	4.86E-16	1.27E-15	7.29E-11	1.90E-10	2.63E-10
OCDF	2.06E-12	2.69E-16	1.45E-16	NA	NA	2.30E-17	6.02E-17	3.45E-12	9.02E-12	1.25E-11

CENTRAL TENDENCY EXPOSURE:

	Child	Adult	Total
Total PCB CTE Cancer Risk	**4E-08**	**1E-07**	**1E-07**
Dioxin-like PCB congeners	6.1E-07	1.6E-06	2.2E-06
Dioxins	2.4E-08	6.2E-08	8.5E-08
Furans	7.8E-08	2.0E-07	2.8E-07
Total TEQ CTE Cancer Risk	**7E-07**	**2E-06**	**3E-06**
Total CTE Hazard Index	**2E-02**	**1E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED FRUIT (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Exposed Fruit Concentration (mg total PCB /kg exposed fruit; mg congener TEQ/kg exposed fruit)	RME ADD$_{exposed\ fruit}$ (mg/kg-day)		RME Hazard Index		RME LADD$_{exposed\ fruit}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	6.50E-07	3.70E-07	3.25E-02	1.85E-02	5.57E-08	3.38E-07	1.11E-07	6.76E-07	7.87E-07
PCB-77	3.43E-10	6.19E-14	3.52E-14	NA	NA	5.30E-15	3.22E-14	7.96E-10	4.83E-09	5.62E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	2.15E-13	1.23E-13	NA	NA	1.85E-14	1.12E-13	2.77E-09	1.68E-08	1.96E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	6.16E-13	3.50E-13	NA	NA	5.28E-14	3.20E-13	7.92E-09	4.80E-08	5.60E-08
PCB-123	8.27E-11	1.49E-14	8.50E-15	NA	NA	1.28E-15	7.77E-15	1.92E-10	1.17E-09	1.36E-09
PCB-126	3.22E-07	5.81E-11	3.30E-11	NA	NA	4.98E-12	3.02E-11	7.47E-07	4.53E-06	5.28E-06
PCB-156	4.47E-09	8.08E-13	4.60E-13	NA	NA	6.93E-14	4.20E-13	1.04E-08	6.30E-08	7.34E-08
PCB-157	1.26E-09	2.27E-13	1.29E-13	NA	NA	1.95E-14	1.18E-13	2.92E-09	1.77E-08	2.07E-08
PCB-167	6.86E-11	1.24E-14	7.04E-15	NA	NA	1.06E-15	6.44E-15	1.59E-10	9.66E-10	1.13E-09
PCB-169	3.01E-08	5.44E-12	3.10E-12	NA	NA	4.66E-13	2.83E-12	7.00E-08	4.24E-07	4.94E-07
PCB-189	4.20E-10	7.59E-14	4.32E-14	NA	NA	6.51E-15	3.95E-14	9.76E-10	5.92E-09	6.90E-09
2,3,7,8-TCDD	3.73E-09	6.74E-13	3.83E-13	NA	NA	5.78E-14	3.50E-13	8.66E-09	5.26E-08	6.12E-08
1,2,3,7,8-PeCDD	8.27E-09	1.49E-12	8.49E-13	NA	NA	1.28E-13	7.76E-13	1.92E-08	1.16E-07	1.36E-07
1,2,3,4,7,8-HxCDD	1.67E-10	3.01E-14	1.71E-14	NA	NA	2.58E-15	1.56E-14	3.87E-10	2.35E-09	2.73E-09
1,2,3,6,7,8-HxCDD	9.29E-10	1.68E-13	9.54E-14	NA	NA	1.44E-14	8.72E-14	2.16E-09	1.31E-08	1.52E-08
1,2,3,7,8,9-HxCDD	6.07E-10	1.10E-13	6.23E-14	NA	NA	9.39E-15	5.70E-14	1.41E-09	8.55E-09	9.96E-09
1,2,3,4,6,7,8-HpCDD	3.43E-10	6.20E-14	3.53E-14	NA	NA	5.31E-15	3.22E-14	7.97E-10	4.84E-09	5.63E-09
OCDD	6.58E-11	1.19E-14	6.75E-15	NA	NA	1.02E-15	6.18E-15	1.53E-10	9.26E-10	1.08E-09
2,3,7,8-TCDF	1.05E-08	1.89E-12	1.07E-12	NA	NA	1.62E-13	9.83E-13	2.43E-08	1.47E-07	1.72E-07
1,2,3,7,8-PeCDF	2.13E-09	3.85E-13	2.19E-13	NA	NA	3.30E-14	2.00E-13	4.94E-09	3.00E-08	3.49E-08
2,3,4,7,8-PeCDF	2.63E-08	4.76E-12	2.70E-12	NA	NA	4.08E-13	2.47E-12	6.11E-08	3.71E-07	4.32E-07
1,2,3,4,7,8-HxCDF	2.68E-09	4.84E-13	2.75E-13	NA	NA	4.15E-14	2.52E-13	6.22E-09	3.78E-08	4.40E-08
1,2,3,6,7,8-HXCDF	1.63E-09	2.95E-13	1.68E-13	NA	NA	2.52E-14	1.53E-13	3.79E-09	2.30E-08	2.68E-08
2,3,4,6,7,8-HxCDF	1.86E-09	3.36E-13	1.91E-13	NA	NA	2.88E-14	1.75E-13	4.32E-09	2.62E-08	3.05E-08
1,2,3,7,8,9-HxCDF	5.38E-10	9.71E-14	5.52E-14	NA	NA	8.32E-15	5.05E-14	1.25E-09	7.57E-09	8.82E-09
1,2,3,4,6,7,8-HpCDF	6.69E-10	1.21E-13	6.87E-14	NA	NA	1.03E-14	6.28E-14	1.55E-09	9.42E-09	1.10E-08
1,2,3,4,7,8,9-HpCDF	4.35E-11	7.85E-15	4.46E-15	NA	NA	6.73E-16	4.08E-15	1.01E-10	6.12E-10	7.13E-10
OCDF	2.06E-12	3.72E-16	2.12E-16	NA	NA	3.19E-17	1.93E-16	4.78E-12	2.90E-11	3.38E-11

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**1E-07**	**7E-07**	**8E-07**
Dioxin-like PCB congeners	8.4E-07	5.1E-06	6.0E-06
Dioxins	3.3E-08	2.0E-07	2.3E-07
Furans	1.1E-07	6.5E-07	7.6E-07
Total TEQ RME Cancer Risk	**1E-06**	**6E-06**	**7E-06**
Total RME Hazard Index	**3E-02**	**2E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED FRUIT (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE exposed fruit concentration (mg total PCB/kg exposed fruit; mg congener TEQ/kg exposed fruit)	CTE $ADD_{exposed\ fruit}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{exposed\ fruit}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	4.69E-07	3.61E-07	2.35E-02	1.80E-02	4.02E-08	4.64E-08	4.02E-08	4.64E-08	8.66E-08
PCB-77	3.43E-10	4.47E-14	3.43E-14	NA	NA	3.83E-15	4.41E-15	5.75E-10	6.62E-10	1.24E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	1.56E-13	1.20E-13	NA	NA	1.33E-14	1.54E-14	2.00E-09	2.30E-09	4.30E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	4.45E-13	3.42E-13	NA	NA	3.81E-14	4.39E-14	5.72E-09	6.59E-09	1.23E-08
PCB-123	8.27E-11	1.08E-14	8.29E-15	NA	NA	9.25E-16	1.07E-15	1.39E-10	1.60E-10	2.99E-10
PCB-126	3.22E-07	4.20E-11	3.22E-11	NA	NA	3.60E-12	4.14E-12	5.39E-07	6.22E-07	1.16E-06
PCB-156	4.47E-09	5.83E-13	4.48E-13	NA	NA	5.00E-14	5.76E-14	7.50E-09	8.65E-09	1.61E-08
PCB-157	1.26E-09	1.64E-13	1.26E-13	NA	NA	1.41E-14	1.62E-14	2.11E-09	2.43E-09	4.54E-09
PCB-167	6.86E-11	8.94E-15	6.87E-15	NA	NA	7.67E-16	8.84E-16	1.15E-10	1.33E-10	2.48E-10
PCB-169	3.01E-08	3.93E-12	3.02E-12	NA	NA	3.37E-13	3.88E-13	5.05E-08	5.82E-08	1.09E-07
PCB-189	4.20E-10	5.48E-14	4.21E-14	NA	NA	4.70E-15	5.42E-15	7.05E-10	8.12E-10	1.52E-09
2,3,7,8-TCDD	3.73E-09	4.87E-13	3.74E-13	NA	NA	4.17E-14	4.81E-14	6.26E-09	7.21E-09	1.35E-08
1,2,3,7,8-PeCDD	8.27E-09	1.08E-12	8.28E-13	NA	NA	9.24E-14	1.06E-13	1.39E-08	1.60E-08	2.98E-08
1,2,3,4,7,8-HxCDD	1.67E-10	2.17E-14	1.67E-14	NA	NA	1.86E-15	2.14E-15	2.79E-10	3.22E-10	6.01E-10
1,2,3,6,7,8-HxCDD	9.29E-10	1.21E-13	9.30E-14	NA	NA	1.04E-14	1.20E-14	1.56E-09	1.79E-09	3.35E-09
1,2,3,7,8,9-HxCDD	6.07E-10	7.91E-14	6.08E-14	NA	NA	6.78E-15	7.82E-15	1.02E-09	1.17E-09	2.19E-09
1,2,3,4,6,7,8-HpCDD	3.43E-10	4.48E-14	3.44E-14	NA	NA	3.84E-15	4.42E-15	5.76E-10	6.64E-10	1.24E-09
OCDD	6.58E-11	8.58E-15	6.59E-15	NA	NA	7.35E-16	8.47E-16	1.10E-10	1.27E-10	2.37E-10
2,3,7,8-TCDF	1.05E-08	1.36E-12	1.05E-12	NA	NA	1.17E-13	1.35E-13	1.75E-08	2.02E-08	3.78E-08
1,2,3,7,8-PeCDF	2.13E-09	2.78E-13	2.13E-13	NA	NA	2.38E-14	2.74E-14	3.57E-09	4.11E-09	7.68E-09
2,3,4,7,8-PeCDF	2.63E-08	3.43E-12	2.64E-12	NA	NA	2.94E-13	3.39E-13	4.42E-08	5.09E-08	9.50E-08
1,2,3,4,7,8-HxCDF	2.68E-09	3.50E-13	2.69E-13	NA	NA	3.00E-14	3.45E-14	4.49E-09	5.18E-09	9.67E-09
1,2,3,6,7,8-HXCDF	1.63E-09	2.13E-13	1.63E-13	NA	NA	1.82E-14	2.10E-14	2.73E-09	3.15E-09	5.89E-09
2,3,4,6,7,8-HxCDF	1.86E-09	2.43E-13	1.87E-13	NA	NA	2.08E-14	2.40E-14	3.12E-09	3.60E-09	6.72E-09
1,2,3,7,8,9-HxCDF	5.38E-10	7.01E-14	5.39E-14	NA	NA	6.01E-15	6.93E-15	9.01E-10	1.04E-09	1.94E-09
1,2,3,4,6,7,8-HpCDF	6.69E-10	8.72E-14	6.70E-14	NA	NA	7.47E-15	8.61E-15	1.12E-09	1.29E-09	2.41E-09
1,2,3,4,7,8,9-HpCDF	4.35E-11	5.67E-15	4.35E-15	NA	NA	4.86E-16	5.60E-16	7.29E-11	8.40E-11	1.57E-10
OCDF	2.06E-12	2.69E-16	2.06E-16	NA	NA	2.30E-17	2.65E-17	3.45E-12	3.98E-12	7.44E-12

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**4E-08**	**5E-08**	**9E-08**
Dioxin-like PCB congeners	6.1E-07	7.0E-07	1.3E-06
Dioxins	2.4E-08	2.7E-08	5.1E-08
Furans	7.8E-08	9.0E-08	1.7E-07
Total TEQ CTE Cancer Risk	**7E-07**	**8E-07**	**2E-06**
Total CTE Hazard Index	**2E-02**	**2E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED FRUIT (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME Exposed Fruit Concentration (mg total PCB /kg exposed fruit; mg congener TEQ/kg exposed fruit)	RME $ADD_{exposed\ fruit}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{exposed\ fruit}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	6.50E-07	3.87E-07	3.25E-02	1.93E-02	5.57E-08	2.15E-07	1.11E-07	4.31E-07	5.42E-07
PCB-77	3.43E-10	6.19E-14	3.68E-14	NA	NA	5.30E-15	2.05E-14	7.96E-10	3.08E-09	3.87E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	2.15E-13	1.28E-13	NA	NA	1.85E-14	7.14E-14	2.77E-09	1.07E-08	1.35E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	6.16E-13	3.66E-13	NA	NA	5.28E-14	2.04E-13	7.92E-09	3.06E-08	3.85E-08
PCB-123	8.27E-11	1.49E-14	8.89E-15	NA	NA	1.28E-15	4.95E-15	1.92E-10	7.43E-10	9.35E-10
PCB-126	3.22E-07	5.81E-11	3.46E-11	NA	NA	4.98E-12	1.93E-11	7.47E-07	2.89E-06	3.63E-06
PCB-156	4.47E-09	8.08E-13	4.81E-13	NA	NA	6.93E-14	2.68E-13	1.04E-08	4.02E-08	5.05E-08
PCB-157	1.26E-09	2.27E-13	1.35E-13	NA	NA	1.95E-14	7.53E-14	2.92E-09	1.13E-08	1.42E-08
PCB-167	6.86E-11	1.24E-14	7.37E-15	NA	NA	1.06E-15	4.10E-15	1.59E-10	6.16E-10	7.75E-10
PCB-169	3.01E-08	5.44E-12	3.24E-12	NA	NA	4.66E-13	1.80E-12	7.00E-08	2.71E-07	3.40E-07
PCB-189	4.20E-10	7.59E-14	4.52E-14	NA	NA	6.51E-15	2.52E-14	9.76E-10	3.77E-09	4.75E-09
2,3,7,8-TCDD	3.73E-09	6.74E-13	4.01E-13	NA	NA	5.78E-14	2.23E-13	8.66E-09	3.35E-08	4.22E-08
1,2,3,7,8-PeCDD	8.27E-09	1.49E-12	8.88E-13	NA	NA	1.28E-13	4.95E-13	1.92E-08	7.42E-08	9.34E-08
1,2,3,4,7,8-HxCDD	1.67E-10	3.01E-14	1.79E-14	NA	NA	2.58E-15	9.96E-15	3.87E-10	1.49E-09	1.88E-09
1,2,3,6,7,8-HxCDD	9.29E-10	1.68E-13	9.97E-14	NA	NA	1.44E-14	5.56E-14	2.16E-09	8.33E-09	1.05E-08
1,2,3,7,8,9-HxCDD	6.07E-10	1.10E-13	6.52E-14	NA	NA	9.39E-15	3.63E-14	1.41E-09	5.45E-09	6.86E-09
1,2,3,4,6,7,8-HpCDD	3.43E-10	6.20E-14	3.69E-14	NA	NA	5.31E-15	2.05E-14	7.97E-10	3.08E-09	3.88E-09
OCDD	6.58E-11	1.19E-14	7.06E-15	NA	NA	1.02E-15	3.94E-15	1.53E-10	5.90E-10	7.43E-10
2,3,7,8-TCDF	1.05E-08	1.89E-12	1.12E-12	NA	NA	1.62E-13	6.26E-13	2.43E-08	9.39E-08	1.18E-07
1,2,3,7,8-PeCDF	2.13E-09	3.85E-13	2.29E-13	NA	NA	3.30E-14	1.27E-13	4.94E-09	1.91E-08	2.41E-08
2,3,4,7,8-PeCDF	2.63E-08	4.76E-12	2.83E-12	NA	NA	4.08E-13	1.58E-12	6.11E-08	2.36E-07	2.98E-07
1,2,3,4,7,8-HxCDF	2.68E-09	4.84E-13	2.88E-13	NA	NA	4.15E-14	1.60E-13	6.22E-09	2.41E-08	3.03E-08
1,2,3,6,7,8-HXCDF	1.63E-09	2.95E-13	1.75E-13	NA	NA	2.52E-14	9.76E-14	3.79E-09	1.46E-08	1.84E-08
2,3,4,6,7,8-HxCDF	1.86E-09	3.36E-13	2.00E-13	NA	NA	2.88E-14	1.11E-13	4.32E-09	1.67E-08	2.10E-08
1,2,3,7,8,9-HxCDF	5.38E-10	9.71E-14	5.77E-14	NA	NA	8.32E-15	3.22E-14	1.25E-09	4.83E-09	6.07E-09
1,2,3,4,6,7,8-HpCDF	6.69E-10	1.21E-13	7.18E-14	NA	NA	1.03E-14	4.00E-14	1.55E-09	6.00E-09	7.55E-09
1,2,3,4,7,8,9-HpCDF	4.35E-11	7.85E-15	4.67E-15	NA	NA	6.73E-16	2.60E-15	1.01E-10	3.90E-10	4.91E-10
OCDF	2.06E-12	3.72E-16	2.21E-16	NA	NA	3.19E-17	1.23E-16	4.78E-12	1.85E-11	2.33E-11

REASONABLE MAXIMUM EXPOSURE:

	Child	Adult	Total
Total PCB RME Cancer Risk	**1E-07**	**4E-07**	**5E-07**
Dioxin-like PCB congeners	8.4E-07	3.3E-06	4.1E-06
Dioxins	3.3E-08	1.3E-07	1.6E-07
Furans	1.1E-07	4.2E-07	5.2E-07
Total TEQ RME Cancer Risk	**1E-06**	**4E-06**	**5E-06**
Total RME Hazard Index	**3E-02**	**2E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED VEGETABLE (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE exposed vegetable concentration (mg total PCB/kg exposed vegetable; mg congener TEQ/kg exposed vegetable)	CTE $ADD_{exposed\ vegetable}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{exposed\ vegetable}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	1.97E-06	9.66E-07	9.83E-02	4.83E-02	1.69E-07	4.00E-07	1.69E-07	4.00E-07	5.69E-07
PCB-77	3.43E-10	1.87E-13	9.19E-14	NA	NA	1.60E-14	3.81E-14	2.41E-09	5.71E-09	8.12E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	6.51E-13	3.20E-13	NA	NA	5.58E-14	1.33E-13	8.38E-09	1.99E-08	2.83E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	1.86E-12	9.15E-13	NA	NA	1.60E-13	3.79E-13	2.39E-08	5.68E-08	8.08E-08
PCB-123	8.27E-11	4.52E-14	2.22E-14	NA	NA	3.87E-15	9.19E-15	5.81E-10	1.38E-09	1.96E-09
PCB-126	3.22E-07	1.76E-10	8.63E-11	NA	NA	1.51E-11	3.58E-11	2.26E-06	5.36E-06	7.62E-06
PCB-156	4.47E-09	2.44E-12	1.20E-12	NA	NA	2.09E-13	4.97E-13	3.14E-08	7.46E-08	1.06E-07
PCB-157	1.26E-09	6.88E-13	3.38E-13	NA	NA	5.89E-14	1.40E-13	8.84E-09	2.10E-08	2.98E-08
PCB-167	6.86E-11	3.75E-14	1.84E-14	NA	NA	3.21E-15	7.62E-15	4.82E-10	1.14E-09	1.62E-09
PCB-169	3.01E-08	1.65E-11	8.08E-12	NA	NA	1.41E-12	3.35E-12	2.12E-07	5.02E-07	7.14E-07
PCB-189	4.20E-10	2.30E-13	1.13E-13	NA	NA	1.97E-14	4.67E-14	2.95E-09	7.01E-09	9.96E-09
2,3,7,8-TCDD	3.73E-09	2.04E-12	1.00E-12	NA	NA	1.75E-13	4.15E-13	2.62E-08	6.22E-08	8.84E-08
1,2,3,7,8-PeCDD	8.27E-09	4.51E-12	2.22E-12	NA	NA	3.87E-13	9.19E-13	5.80E-08	1.38E-07	1.96E-07
1,2,3,4,7,8-HxCDD	1.67E-10	9.09E-14	4.47E-14	NA	NA	7.79E-15	1.85E-14	1.17E-09	2.78E-09	3.94E-09
1,2,3,6,7,8-HxCDD	9.29E-10	5.07E-13	2.49E-13	NA	NA	4.35E-14	1.03E-13	6.52E-09	1.55E-08	2.20E-08
1,2,3,7,8,9-HxCDD	6.07E-10	3.31E-13	1.63E-13	NA	NA	2.84E-14	6.74E-14	4.26E-09	1.01E-08	1.44E-08
1,2,3,4,6,7,8-HpCDD	3.43E-10	1.88E-13	9.21E-14	NA	NA	1.61E-14	3.82E-14	2.41E-09	5.72E-09	8.14E-09
OCDD	6.58E-11	3.59E-14	1.76E-14	NA	NA	3.08E-15	7.31E-15	4.62E-10	1.10E-09	1.56E-09
2,3,7,8-TCDF	1.05E-08	5.72E-12	2.81E-12	NA	NA	4.90E-13	1.16E-12	7.35E-08	1.74E-07	2.48E-07
1,2,3,7,8-PeCDF	2.13E-09	1.16E-12	5.71E-13	NA	NA	9.97E-14	2.37E-13	1.50E-08	3.55E-08	5.05E-08
2,3,4,7,8-PeCDF	2.63E-08	1.44E-11	7.06E-12	NA	NA	1.23E-12	2.93E-12	1.85E-07	4.39E-07	6.24E-07
1,2,3,4,7,8-HxCDF	2.68E-09	1.46E-12	7.19E-13	NA	NA	1.25E-13	2.98E-13	1.88E-08	4.47E-08	6.35E-08
1,2,3,6,7,8-HXCDF	1.63E-09	8.91E-13	4.38E-13	NA	NA	7.64E-14	1.81E-13	1.15E-08	2.72E-08	3.86E-08
2,3,4,6,7,8-HxCDF	1.86E-09	1.02E-12	4.99E-13	NA	NA	8.72E-14	2.07E-13	1.31E-08	3.10E-08	4.41E-08
1,2,3,7,8,9-HxCDF	5.38E-10	2.94E-13	1.44E-13	NA	NA	2.52E-14	5.97E-14	3.78E-09	8.96E-09	1.27E-08
1,2,3,4,6,7,8-HpCDF	6.69E-10	3.65E-13	1.79E-13	NA	NA	3.13E-14	7.43E-14	4.70E-09	1.11E-08	1.58E-08
1,2,3,4,7,8,9-HpCDF	4.35E-11	2.37E-14	1.17E-14	NA	NA	2.03E-15	4.83E-15	3.05E-10	7.24E-10	1.03E-09
OCDF	2.06E-12	1.13E-15	5.53E-16	NA	NA	9.65E-17	2.29E-16	1.45E-11	3.43E-11	4.88E-11

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**2E-07**	**4E-07**	**6E-07**
Dioxin-like PCB congeners	2.5E-06	6.1E-06	8.6E-06
Dioxins	9.9E-08	2.4E-07	3.3E-07
Furans	3.3E-07	7.7E-07	1.1E-06
Total TEQ CTE Cancer Risk	**3E-06**	**7E-06**	**1E-05**
Total CTE Hazard Index	**1E-01**	**5E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED VEGETABLE (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME exposed vegetable Concentration (mg total PCB /kg exposed vegetable; mg congener TEQ/kg exposed vegetable)	RME $ADD_{exposed\ vegetable}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{exposed\ vegetable}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	3.04E-06	1.70E-06	1.52E-01	8.49E-02	2.61E-07	1.55E-06	5.22E-07	3.11E-06	3.63E-06
PCB-77	3.43E-10	2.90E-13	1.62E-13	NA	NA	2.48E-14	1.48E-13	3.73E-09	2.22E-08	2.59E-08
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	1.01E-12	5.63E-13	NA	NA	8.65E-14	5.15E-13	1.30E-08	7.72E-08	9.01E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	2.88E-12	1.61E-12	NA	NA	2.47E-13	1.47E-12	3.71E-08	2.21E-07	2.58E-07
PCB-123	8.27E-11	7.00E-14	3.90E-14	NA	NA	6.00E-15	3.57E-14	9.00E-10	5.35E-09	6.25E-09
PCB-126	3.22E-07	2.72E-10	1.52E-10	NA	NA	2.33E-11	1.39E-10	3.50E-06	2.08E-05	2.43E-05
PCB-156	4.47E-09	3.78E-12	2.11E-12	NA	NA	3.24E-13	1.93E-12	4.87E-08	2.90E-07	3.38E-07
PCB-157	1.26E-09	1.06E-12	5.94E-13	NA	NA	9.13E-14	5.43E-13	1.37E-08	8.15E-08	9.52E-08
PCB-167	6.86E-11	5.80E-14	3.24E-14	NA	NA	4.97E-15	2.96E-14	7.46E-10	4.44E-09	5.18E-09
PCB-169	3.01E-08	2.55E-11	1.42E-11	NA	NA	2.18E-12	1.30E-11	3.28E-07	1.95E-06	2.28E-06
PCB-189	4.20E-10	3.56E-13	1.98E-13	NA	NA	3.05E-14	1.81E-13	4.57E-09	2.72E-08	3.18E-08
2,3,7,8-TCDD	3.73E-09	3.16E-12	1.76E-12	NA	NA	2.71E-13	1.61E-12	4.06E-08	2.41E-07	2.82E-07
1,2,3,7,8-PeCDD	8.27E-09	6.99E-12	3.90E-12	NA	NA	5.99E-13	3.57E-12	8.99E-08	5.35E-07	6.25E-07
1,2,3,4,7,8-HxCDD	1.67E-10	1.41E-13	7.86E-14	NA	NA	1.21E-14	7.18E-14	1.81E-09	1.08E-08	1.26E-08
1,2,3,6,7,8-HxCDD	9.29E-10	7.85E-13	4.38E-13	NA	NA	6.73E-14	4.01E-13	1.01E-08	6.01E-08	7.02E-08
1,2,3,7,8,9-HxCDD	6.07E-10	5.13E-13	2.86E-13	NA	NA	4.40E-14	2.62E-13	6.60E-09	3.93E-08	4.59E-08
1,2,3,4,6,7,8-HpCDD	3.43E-10	2.90E-13	1.62E-13	NA	NA	2.49E-14	1.48E-13	3.73E-09	2.22E-08	2.60E-08
OCDD	6.58E-11	5.56E-14	3.10E-14	NA	NA	4.77E-15	2.84E-14	7.15E-10	4.26E-09	4.97E-09
2,3,7,8-TCDF	1.05E-08	8.85E-12	4.94E-12	NA	NA	7.59E-13	4.51E-12	1.14E-07	6.77E-07	7.91E-07
1,2,3,7,8-PeCDF	2.13E-09	1.80E-12	1.00E-12	NA	NA	1.54E-13	9.19E-13	2.32E-08	1.38E-07	1.61E-07
2,3,4,7,8-PeCDF	2.63E-08	2.23E-11	1.24E-11	NA	NA	1.91E-12	1.14E-11	2.86E-07	1.70E-06	1.99E-06
1,2,3,4,7,8-HxCDF	2.68E-09	2.27E-12	1.26E-12	NA	NA	1.94E-13	1.16E-12	2.92E-08	1.73E-07	2.03E-07
1,2,3,6,7,8-HXCDF	1.63E-09	1.38E-12	7.70E-13	NA	NA	1.18E-13	7.04E-13	1.77E-08	1.06E-07	1.23E-07
2,3,4,6,7,8-HxCDF	1.86E-09	1.57E-12	8.78E-13	NA	NA	1.35E-13	8.03E-13	2.02E-08	1.20E-07	1.41E-07
1,2,3,7,8,9-HxCDF	5.38E-10	4.55E-13	2.54E-13	NA	NA	3.90E-14	2.32E-13	5.85E-09	3.48E-08	4.06E-08
1,2,3,4,6,7,8-HpCDF	6.69E-10	5.66E-13	3.15E-13	NA	NA	4.85E-14	2.88E-13	7.27E-09	4.33E-08	5.05E-08
1,2,3,4,7,8,9-HpCDF	4.35E-11	3.68E-14	2.05E-14	NA	NA	3.15E-15	1.87E-14	4.73E-10	2.81E-09	3.28E-09
OCDF	2.06E-12	1.74E-15	9.72E-16	NA	NA	1.49E-16	8.89E-16	2.24E-11	1.33E-10	1.56E-10

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**5E-07**	**3E-06**	**4E-06**
Dioxin-like PCB congeners	3.9E-06	2.3E-05	2.7E-05
Dioxins	1.5E-07	9.1E-07	1.1E-06
Furans	5.0E-07	3.0E-06	3.5E-06
Total TEQ RME Cancer Risk	**5E-06**	**3E-05**	**3E-05**
Total RME Hazard Index	**2E-01**	**8E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED VEGETABLE (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE exposed vegetable concentration (mg total PCB/kg exposed vegetable; mg congener TEQ/kg exposed vegetable)	CTE $ADD_{exposed\ vegetable}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{exposed\ vegetable}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	1.97E-06	1.09E-06	9.83E-02	5.44E-02	1.69E-07	1.40E-07	1.69E-07	1.40E-07	3.08E-07
PCB-77	3.43E-10	1.87E-13	1.04E-13	NA	NA	1.60E-14	1.33E-14	2.41E-09	2.00E-09	4.40E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	6.51E-13	3.60E-13	NA	NA	5.58E-14	4.63E-14	8.38E-09	6.95E-09	1.53E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	1.86E-12	1.03E-12	NA	NA	1.60E-13	1.32E-13	2.39E-08	1.99E-08	4.38E-08
PCB-123	8.27E-11	4.52E-14	2.50E-14	NA	NA	3.87E-15	3.21E-15	5.81E-10	4.82E-10	1.06E-09
PCB-126	3.22E-07	1.76E-10	9.72E-11	NA	NA	1.51E-11	1.25E-11	2.26E-06	1.87E-06	4.13E-06
PCB-156	4.47E-09	2.44E-12	1.35E-12	NA	NA	2.09E-13	1.74E-13	3.14E-08	2.61E-08	5.75E-08
PCB-157	1.26E-09	6.88E-13	3.80E-13	NA	NA	5.89E-14	4.89E-14	8.84E-09	7.33E-09	1.62E-08
PCB-167	6.86E-11	3.75E-14	2.07E-14	NA	NA	3.21E-15	2.66E-15	4.82E-10	4.00E-10	8.81E-10
PCB-169	3.01E-08	1.65E-11	9.10E-12	NA	NA	1.41E-12	1.17E-12	2.12E-07	1.76E-07	3.87E-07
PCB-189	4.20E-10	2.30E-13	1.27E-13	NA	NA	1.97E-14	1.63E-14	2.95E-09	2.45E-09	5.40E-09
2,3,7,8-TCDD	3.73E-09	2.04E-12	1.13E-12	NA	NA	1.75E-13	1.45E-13	2.62E-08	2.17E-08	4.79E-08
1,2,3,7,8-PeCDD	8.27E-09	4.51E-12	2.50E-12	NA	NA	3.87E-13	3.21E-13	5.80E-08	4.82E-08	1.06E-07
1,2,3,4,7,8-HxCDD	1.67E-10	9.09E-14	5.03E-14	NA	NA	7.79E-15	6.47E-15	1.17E-09	9.70E-10	2.14E-09
1,2,3,6,7,8-HxCDD	9.29E-10	5.07E-13	2.80E-13	NA	NA	4.35E-14	3.61E-14	6.52E-09	5.41E-09	1.19E-08
1,2,3,7,8,9-HxCDD	6.07E-10	3.31E-13	1.83E-13	NA	NA	2.84E-14	2.36E-14	4.26E-09	3.54E-09	7.80E-09
1,2,3,4,6,7,8-HpCDD	3.43E-10	1.88E-13	1.04E-13	NA	NA	1.61E-14	1.33E-14	2.41E-09	2.00E-09	4.41E-09
OCDD	6.58E-11	3.59E-14	1.99E-14	NA	NA	3.08E-15	2.55E-15	4.62E-10	3.83E-10	8.45E-10
2,3,7,8-TCDF	1.05E-08	5.72E-12	3.16E-12	NA	NA	4.90E-13	4.06E-13	7.35E-08	6.10E-08	1.34E-07
1,2,3,7,8-PeCDF	2.13E-09	1.16E-12	6.43E-13	NA	NA	9.97E-14	8.27E-14	1.50E-08	1.24E-08	2.74E-08
2,3,4,7,8-PeCDF	2.63E-08	1.44E-11	7.95E-12	NA	NA	1.23E-12	1.02E-12	1.85E-07	1.53E-07	3.38E-07
1,2,3,4,7,8-HxCDF	2.68E-09	1.46E-12	8.10E-13	NA	NA	1.25E-13	1.04E-13	1.88E-08	1.56E-08	3.44E-08
1,2,3,6,7,8-HXCDF	1.63E-09	8.91E-13	4.93E-13	NA	NA	7.64E-14	6.34E-14	1.15E-08	9.50E-09	2.10E-08
2,3,4,6,7,8-HxCDF	1.86E-09	1.02E-12	5.62E-13	NA	NA	8.72E-14	7.23E-14	1.31E-08	1.08E-08	2.39E-08
1,2,3,7,8,9-HxCDF	5.38E-10	2.94E-13	1.62E-13	NA	NA	2.52E-14	2.09E-14	3.78E-09	3.13E-09	6.91E-09
1,2,3,4,6,7,8-HpCDF	6.69E-10	3.65E-13	2.02E-13	NA	NA	3.13E-14	2.60E-14	4.70E-09	3.90E-09	8.59E-09
1,2,3,4,7,8,9-HpCDF	4.35E-11	2.37E-14	1.31E-14	NA	NA	2.03E-15	1.69E-15	3.05E-10	2.53E-10	5.58E-10
OCDF	2.06E-12	1.13E-15	6.22E-16	NA	NA	9.65E-17	8.00E-17	1.45E-11	1.20E-11	2.65E-11

CENTRAL TENDENCY EXPOSURE:			
	Child	**Adult**	**Total**
Total PCB CTE Cancer Risk	**2E-07**	**1E-07**	**3E-07**
Dioxin-like PCB congeners	2.5E-06	2.1E-06	4.7E-06
Dioxins	9.9E-08	8.2E-08	1.8E-07
Furans	3.3E-07	2.7E-07	6.0E-07
Total TEQ CTE Cancer Risk	**3E-06**	**2E-06**	**5E-06**
Total CTE Hazard Index	**1E-01**	**5E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR EXPOSED VEGETABLE (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME exposed vegetable Concentration (mg total PCB /kg exposed vegetable; mg congener TEQ/kg exposed vegetable)	RME $ADD_{exposed\ vegetable}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{exposed\ vegetable}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	3.60E-03	3.04E-06	1.50E-06	1.52E-01	7.51E-02	2.61E-07	8.37E-07	5.22E-07	1.67E-06	2.20E-06
PCB-77	3.43E-10	2.90E-13	1.43E-13	NA	NA	2.48E-14	7.97E-14	3.73E-09	1.19E-08	1.57E-08
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.19E-09	1.01E-12	4.98E-13	NA	NA	8.65E-14	2.77E-13	1.30E-08	4.16E-08	5.46E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	3.41E-09	2.88E-12	1.42E-12	NA	NA	2.47E-13	7.93E-13	3.71E-08	1.19E-07	1.56E-07
PCB-123	8.27E-11	7.00E-14	3.45E-14	NA	NA	6.00E-15	1.92E-14	9.00E-10	2.88E-09	3.78E-09
PCB-126	3.22E-07	2.72E-10	1.34E-10	NA	NA	2.33E-11	7.48E-11	3.50E-06	1.12E-05	1.47E-05
PCB-156	4.47E-09	3.78E-12	1.87E-12	NA	NA	3.24E-13	1.04E-12	4.87E-08	1.56E-07	2.05E-07
PCB-157	1.26E-09	1.06E-12	5.25E-13	NA	NA	9.13E-14	2.93E-13	1.37E-08	4.39E-08	5.76E-08
PCB-167	6.86E-11	5.80E-14	2.86E-14	NA	NA	4.97E-15	1.59E-14	7.46E-10	2.39E-09	3.14E-09
PCB-169	3.01E-08	2.55E-11	1.26E-11	NA	NA	2.18E-12	7.00E-12	3.28E-07	1.05E-06	1.38E-06
PCB-189	4.20E-10	3.56E-13	1.75E-13	NA	NA	3.05E-14	9.77E-14	4.57E-09	1.47E-08	1.92E-08
2,3,7,8-TCDD	3.73E-09	3.16E-12	1.56E-12	NA	NA	2.71E-13	8.67E-13	4.06E-08	1.30E-07	1.71E-07
1,2,3,7,8-PeCDD	8.27E-09	6.99E-12	3.45E-12	NA	NA	5.99E-13	1.92E-12	8.99E-08	2.88E-07	3.78E-07
1,2,3,4,7,8-HxCDD	1.67E-10	1.41E-13	6.95E-14	NA	NA	1.21E-14	3.87E-14	1.81E-09	5.80E-09	7.61E-09
1,2,3,6,7,8-HxCDD	9.29E-10	7.85E-13	3.87E-13	NA	NA	6.73E-14	2.16E-13	1.01E-08	3.24E-08	4.25E-08
1,2,3,7,8,9-HxCDD	6.07E-10	5.13E-13	2.53E-13	NA	NA	4.40E-14	1.41E-13	6.60E-09	2.12E-08	2.78E-08
1,2,3,4,6,7,8-HpCDD	3.43E-10	2.90E-13	1.43E-13	NA	NA	2.49E-14	7.98E-14	3.73E-09	1.20E-08	1.57E-08
OCDD	6.58E-11	5.56E-14	2.74E-14	NA	NA	4.77E-15	1.53E-14	7.15E-10	2.29E-09	3.01E-09
2,3,7,8-TCDF	1.05E-08	8.85E-12	4.37E-12	NA	NA	7.59E-13	2.43E-12	1.14E-07	3.65E-07	4.79E-07
1,2,3,7,8-PeCDF	2.13E-09	1.80E-12	8.88E-13	NA	NA	1.54E-13	4.95E-13	2.32E-08	7.42E-08	9.74E-08
2,3,4,7,8-PeCDF	2.63E-08	2.23E-11	1.10E-11	NA	NA	1.91E-12	6.12E-12	2.86E-07	9.18E-07	1.20E-06
1,2,3,4,7,8-HxCDF	2.68E-09	2.27E-12	1.12E-12	NA	NA	1.94E-13	6.23E-13	2.92E-08	9.35E-08	1.23E-07
1,2,3,6,7,8-HXCDF	1.63E-09	1.38E-12	6.80E-13	NA	NA	1.18E-13	3.79E-13	1.77E-08	5.69E-08	7.46E-08
2,3,4,6,7,8-HxCDF	1.86E-09	1.57E-12	7.77E-13	NA	NA	1.35E-13	4.33E-13	2.02E-08	6.49E-08	8.52E-08
1,2,3,7,8,9-HxCDF	5.38E-10	4.55E-13	2.24E-13	NA	NA	3.90E-14	1.25E-13	5.85E-09	1.87E-08	2.46E-08
1,2,3,4,6,7,8-HpCDF	6.69E-10	5.66E-13	2.79E-13	NA	NA	4.85E-14	1.55E-13	7.27E-09	2.33E-08	3.06E-08
1,2,3,4,7,8,9-HpCDF	4.35E-11	3.68E-14	1.81E-14	NA	NA	3.15E-15	1.01E-14	4.73E-10	1.52E-09	1.99E-09
OCDF	2.06E-12	1.74E-15	8.60E-16	NA	NA	1.49E-16	4.79E-16	2.24E-11	7.18E-11	9.42E-11

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**5E-07**	**2E-06**	**2E-06**
Dioxin-like PCB congeners	3.9E-06	1.3E-05	1.7E-05
Dioxins	1.5E-07	4.9E-07	6.5E-07
Furans	5.0E-07	1.6E-06	2.1E-06
Total TEQ RME Cancer Risk	**5E-06**	**1E-05**	**2E-05**
Total RME Hazard Index	**2E-01**	**8E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR ROOT VEGETABLES (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE root vegetable concentration (mg total PCB/kg root vegetable; mg congener TEQ/kg root vegetable)	CTE $ADD_{root\ vegetable}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{root\ vegetable}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.00E-04	2.44E-07	1.39E-07	1.22E-02	6.93E-03	2.09E-08	5.75E-08	2.09E-08	5.75E-08	7.83E-08
PCB-77	5.71E-11	2.32E-14	1.32E-14	NA	NA	1.99E-15	5.47E-15	2.98E-10	8.20E-10	1.12E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.99E-10	8.07E-14	4.59E-14	NA	NA	6.92E-15	1.90E-14	1.04E-09	2.86E-09	3.89E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	5.68E-10	2.31E-13	1.31E-13	NA	NA	1.98E-14	5.44E-14	2.97E-09	8.16E-09	1.11E-08
PCB-123	1.38E-11	5.60E-15	3.19E-15	NA	NA	4.80E-16	1.32E-15	7.20E-11	1.98E-10	2.70E-10
PCB-126	5.36E-08	2.18E-11	1.24E-11	NA	NA	1.87E-12	5.13E-12	2.80E-07	7.70E-07	1.05E-06
PCB-156	7.46E-10	3.03E-13	1.72E-13	NA	NA	2.59E-14	7.14E-14	3.89E-09	1.07E-08	1.46E-08
PCB-157	2.10E-10	8.52E-14	4.85E-14	NA	NA	7.30E-15	2.01E-14	1.10E-09	3.01E-09	4.11E-09
PCB-167	1.14E-11	4.64E-15	2.64E-15	NA	NA	3.98E-16	1.09E-15	5.97E-11	1.64E-10	2.24E-10
PCB-169	5.02E-09	2.04E-12	1.16E-12	NA	NA	1.75E-13	4.81E-13	2.62E-08	7.21E-08	9.84E-08
PCB-189	7.01E-11	2.84E-14	1.62E-14	NA	NA	2.44E-15	6.71E-15	3.66E-10	1.01E-09	1.37E-09
2,3,7,8-TCDD	7.39E-09	3.00E-12	1.71E-12	NA	NA	2.57E-13	7.07E-13	3.85E-08	1.06E-07	1.45E-07
1,2,3,7,8-PeCDD	1.64E-08	6.64E-12	3.78E-12	NA	NA	5.69E-13	1.57E-12	8.54E-08	2.35E-07	3.20E-07
1,2,3,4,7,8-HxCDD	8.66E-10	3.51E-13	2.00E-13	NA	NA	3.01E-14	8.29E-14	4.52E-09	1.24E-08	1.70E-08
1,2,3,6,7,8-HxCDD	3.05E-09	1.24E-12	7.05E-13	NA	NA	1.06E-13	2.92E-13	1.59E-08	4.38E-08	5.97E-08
1,2,3,7,8,9-HxCDD	1.99E-09	8.09E-13	4.61E-13	NA	NA	6.94E-14	1.91E-13	1.04E-08	2.86E-08	3.90E-08
1,2,3,4,6,7,8-HpCDD	2.40E-09	9.76E-13	5.56E-13	NA	NA	8.36E-14	2.30E-13	1.25E-08	3.45E-08	4.71E-08
OCDD	2.72E-10	1.11E-13	6.30E-14	NA	NA	9.48E-15	2.61E-14	1.42E-09	3.91E-09	5.34E-09
2,3,7,8-TCDF	1.90E-08	7.72E-12	4.40E-12	NA	NA	6.62E-13	1.82E-12	9.93E-08	2.73E-07	3.73E-07
1,2,3,7,8-PeCDF	4.81E-09	1.95E-12	1.11E-12	NA	NA	1.67E-13	4.60E-13	2.51E-08	6.90E-08	9.41E-08
2,3,4,7,8-PeCDF	6.54E-08	2.66E-11	1.51E-11	NA	NA	2.28E-12	6.27E-12	3.42E-07	9.40E-07	1.28E-06
1,2,3,4,7,8-HxCDF	8.81E-09	3.58E-12	2.04E-12	NA	NA	3.06E-13	8.43E-13	4.60E-08	1.27E-07	1.72E-07
1,2,3,6,7,8-HXCDF	5.36E-09	2.18E-12	1.24E-12	NA	NA	1.86E-13	5.13E-13	2.80E-08	7.70E-08	1.05E-07
2,3,4,6,7,8-HxCDF	6.12E-09	2.48E-12	1.41E-12	NA	NA	2.13E-13	5.86E-13	3.19E-08	8.79E-08	1.20E-07
1,2,3,7,8,9-HxCDF	1.77E-09	7.17E-13	4.08E-13	NA	NA	6.15E-14	1.69E-13	9.22E-09	2.54E-08	3.46E-08
1,2,3,4,6,7,8-HpCDF	3.69E-09	1.50E-12	8.53E-13	NA	NA	1.28E-13	3.53E-13	1.93E-08	5.30E-08	7.22E-08
1,2,3,4,7,8,9-HpCDF	2.40E-10	9.73E-14	5.54E-14	NA	NA	8.34E-15	2.30E-14	1.25E-09	3.44E-09	4.70E-09
OCDF	2.28E-11	9.26E-15	5.27E-15	NA	NA	7.94E-16	2.18E-15	1.19E-10	3.28E-10	4.47E-10

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**2E-08**	**6E-08**	**8E-08**
Dioxin-like PCB congeners	3.2E-07	8.7E-07	1.2E-06
Dioxins	1.7E-07	4.6E-07	6.3E-07
Furans	6.0E-07	1.7E-06	2.3E-06
Total TEQ CTE Cancer Risk	**1E-06**	**3E-06**	**4E-06**
Total CTE Hazard Index	**1E-02**	**7E-03**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR ROOT VEGETABLES (FARMER) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME root vegetable Concentration (mg total PCB /kg root vegetable; mg congener TEQ/kg root vegetable)	RME $ADD_{root\ vegetable}$ (mg/kg-day)		RME Hazard Index		RME $LADD_{root\ vegetable}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.00E-04	4.04E-07	2.26E-07	2.02E-02	1.13E-02	3.46E-08	2.07E-07	6.92E-08	4.13E-07	4.83E-07
PCB-77	5.71E-11	3.85E-14	2.15E-14	NA	NA	3.30E-15	1.97E-14	4.94E-10	2.95E-09	3.45E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.99E-10	1.34E-13	7.49E-14	NA	NA	1.15E-14	6.85E-14	1.72E-09	1.03E-08	1.20E-08
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	5.68E-10	3.83E-13	2.14E-13	NA	NA	3.28E-14	1.96E-13	4.92E-09	2.94E-08	3.43E-08
PCB-123	1.38E-11	9.28E-15	5.20E-15	NA	NA	7.96E-16	4.75E-15	1.19E-10	7.13E-10	8.32E-10
PCB-126	5.36E-08	3.61E-11	2.02E-11	NA	NA	3.09E-12	1.85E-11	4.64E-07	2.77E-06	3.24E-06
PCB-156	7.46E-10	5.02E-13	2.81E-13	NA	NA	4.30E-14	2.57E-13	6.45E-09	3.85E-08	4.50E-08
PCB-157	2.10E-10	1.41E-13	7.91E-14	NA	NA	1.21E-14	7.23E-14	1.82E-09	1.08E-08	1.27E-08
PCB-167	1.14E-11	7.70E-15	4.31E-15	NA	NA	6.60E-16	3.94E-15	9.89E-11	5.91E-10	6.90E-10
PCB-169	5.02E-09	3.38E-12	1.89E-12	NA	NA	2.90E-13	1.73E-12	4.35E-08	2.60E-07	3.03E-07
PCB-189	7.01E-11	4.72E-14	2.64E-14	NA	NA	4.04E-15	2.41E-14	6.07E-10	3.62E-09	4.23E-09
2,3,7,8-TCDD	7.39E-09	4.97E-12	2.78E-12	NA	NA	4.26E-13	2.54E-12	6.39E-08	3.82E-07	4.46E-07
1,2,3,7,8-PeCDD	1.64E-08	1.10E-11	6.17E-12	NA	NA	9.44E-13	5.64E-12	1.42E-07	8.46E-07	9.87E-07
1,2,3,4,7,8-HxCDD	8.66E-10	5.83E-13	3.26E-13	NA	NA	5.00E-14	2.98E-13	7.49E-09	4.47E-08	5.22E-08
1,2,3,6,7,8-HxCDD	3.05E-09	2.05E-12	1.15E-12	NA	NA	1.76E-13	1.05E-12	2.64E-08	1.58E-07	1.84E-07
1,2,3,7,8,9-HxCDD	1.99E-09	1.34E-12	7.51E-13	NA	NA	1.15E-13	6.87E-13	1.73E-08	1.03E-07	1.20E-07
1,2,3,4,6,7,8-HpCDD	2.40E-09	1.62E-12	9.06E-13	NA	NA	1.39E-13	8.28E-13	2.08E-08	1.24E-07	1.45E-07
OCDD	2.72E-10	1.83E-13	1.03E-13	NA	NA	1.57E-14	9.39E-14	2.36E-09	1.41E-08	1.64E-08
2,3,7,8-TCDF	1.90E-08	1.28E-11	7.17E-12	NA	NA	1.10E-12	6.56E-12	1.65E-07	9.83E-07	1.15E-06
1,2,3,7,8-PeCDF	4.81E-09	3.23E-12	1.81E-12	NA	NA	2.77E-13	1.66E-12	4.16E-08	2.48E-07	2.90E-07
2,3,4,7,8-PeCDF	6.54E-08	4.41E-11	2.47E-11	NA	NA	3.78E-12	2.25E-11	5.66E-07	3.38E-06	3.95E-06
1,2,3,4,7,8-HxCDF	8.81E-09	5.93E-12	3.32E-12	NA	NA	5.08E-13	3.04E-12	7.62E-08	4.55E-07	5.31E-07
1,2,3,6,7,8-HXCDF	5.36E-09	3.61E-12	2.02E-12	NA	NA	3.09E-13	1.85E-12	4.64E-08	2.77E-07	3.23E-07
2,3,4,6,7,8-HxCDF	6.12E-09	4.12E-12	2.31E-12	NA	NA	3.53E-13	2.11E-12	5.30E-08	3.16E-07	3.69E-07
1,2,3,7,8,9-HxCDF	1.77E-09	1.19E-12	6.66E-13	NA	NA	1.02E-13	6.09E-13	1.53E-08	9.13E-08	1.07E-07
1,2,3,4,6,7,8-HpCDF	3.69E-09	2.48E-12	1.39E-12	NA	NA	2.13E-13	1.27E-12	3.19E-08	1.91E-07	2.23E-07
1,2,3,4,7,8,9-HpCDF	2.40E-10	1.61E-13	9.04E-14	NA	NA	1.38E-14	8.26E-14	2.08E-09	1.24E-08	1.45E-08
OCDF	2.28E-11	1.54E-14	8.60E-15	NA	NA	1.32E-15	7.86E-15	1.97E-10	1.18E-09	1.38E-09

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**7E-08**	**4E-07**	**5E-07**
Dioxin-like PCB congeners	5.2E-07	3.1E-06	3.7E-06
Dioxins	2.8E-07	1.7E-06	2.0E-06
Furans	1.0E-06	6.0E-06	7.0E-06
Total TEQ RME Cancer Risk	**2E-06**	**1E-05**	**1E-05**
Total RME Hazard Index	**2E-02**	**1E-02**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR ROOT VEGETABLES (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	CTE root vegetable concentration (mg total PCB/kg root vegetable; mg congener TEQ/kg root vegetable)	CTE $ADD_{root\ vegetable}$ (mg/kg-day)		CTE Hazard Index		CTE $LADD_{root\ vegetable}$ (mg/kg-day)		CTE Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.00E-04	2.44E-07	1.65E-07	1.22E-02	8.24E-03	2.09E-08	2.12E-08	2.09E-08	2.12E-08	4.21E-08
PCB-77	5.71E-11	2.32E-14	1.57E-14	NA	NA	1.99E-15	2.02E-15	2.98E-10	3.03E-10	6.01E-10
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.99E-10	8.07E-14	5.46E-14	NA	NA	6.92E-15	7.02E-15	1.04E-09	1.05E-09	2.09E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	5.68E-10	2.31E-13	1.56E-13	NA	NA	1.98E-14	2.01E-14	2.97E-09	3.01E-09	5.98E-09
PCB-123	1.38E-11	5.60E-15	3.79E-15	NA	NA	4.80E-16	4.87E-16	7.20E-11	7.30E-11	1.45E-10
PCB-126	5.36E-08	2.18E-11	1.47E-11	NA	NA	1.87E-12	1.89E-12	2.80E-07	2.84E-07	5.64E-07
PCB-156	7.46E-10	3.03E-13	2.05E-13	NA	NA	2.59E-14	2.63E-14	3.89E-09	3.95E-09	7.84E-09
PCB-157	2.10E-10	8.52E-14	5.76E-14	NA	NA	7.30E-15	7.41E-15	1.10E-09	1.11E-09	2.21E-09
PCB-167	1.14E-11	4.64E-15	3.14E-15	NA	NA	3.98E-16	4.04E-16	5.97E-11	6.05E-11	1.20E-10
PCB-169	5.02E-09	2.04E-12	1.38E-12	NA	NA	1.75E-13	1.77E-13	2.62E-08	2.66E-08	5.28E-08
PCB-189	7.01E-11	2.84E-14	1.92E-14	NA	NA	2.44E-15	2.47E-15	3.66E-10	3.71E-10	7.37E-10
2,3,7,8-TCDD	7.39E-09	3.00E-12	2.03E-12	NA	NA	2.57E-13	2.61E-13	3.85E-08	3.91E-08	7.77E-08
1,2,3,7,8-PeCDD	1.64E-08	6.64E-12	4.49E-12	NA	NA	5.69E-13	5.78E-13	8.54E-08	8.66E-08	1.72E-07
1,2,3,4,7,8-HxCDD	8.66E-10	3.51E-13	2.38E-13	NA	NA	3.01E-14	3.06E-14	4.52E-09	4.59E-09	9.10E-09
1,2,3,6,7,8-HxCDD	3.05E-09	1.24E-12	8.38E-13	NA	NA	1.06E-13	1.08E-13	1.59E-08	1.62E-08	3.21E-08
1,2,3,7,8,9-HxCDD	1.99E-09	8.09E-13	5.48E-13	NA	NA	6.94E-14	7.04E-14	1.04E-08	1.06E-08	2.10E-08
1,2,3,4,6,7,8-HpCDD	2.40E-09	9.76E-13	6.60E-13	NA	NA	8.36E-14	8.49E-14	1.25E-08	1.27E-08	2.53E-08
OCDD	2.72E-10	1.11E-13	7.48E-14	NA	NA	9.48E-15	9.62E-15	1.42E-09	1.44E-09	2.86E-09
2,3,7,8-TCDF	1.90E-08	7.72E-12	5.22E-12	NA	NA	6.62E-13	6.72E-13	9.93E-08	1.01E-07	2.00E-07
1,2,3,7,8-PeCDF	4.81E-09	1.95E-12	1.32E-12	NA	NA	1.67E-13	1.70E-13	2.51E-08	2.54E-08	5.05E-08
2,3,4,7,8-PeCDF	6.54E-08	2.66E-11	1.80E-11	NA	NA	2.28E-12	2.31E-12	3.42E-07	3.47E-07	6.88E-07
1,2,3,4,7,8-HxCDF	8.81E-09	3.58E-12	2.42E-12	NA	NA	3.06E-13	3.11E-13	4.60E-08	4.66E-08	9.26E-08
1,2,3,6,7,8-HXCDF	5.36E-09	2.18E-12	1.47E-12	NA	NA	1.86E-13	1.89E-13	2.80E-08	2.84E-08	5.64E-08
2,3,4,6,7,8-HxCDF	6.12E-09	2.48E-12	1.68E-12	NA	NA	2.13E-13	2.16E-13	3.19E-08	3.24E-08	6.43E-08
1,2,3,7,8,9-HxCDF	1.77E-09	7.17E-13	4.85E-13	NA	NA	6.15E-14	6.24E-14	9.22E-09	9.35E-09	1.86E-08
1,2,3,4,6,7,8-HpCDF	3.69E-09	1.50E-12	1.01E-12	NA	NA	1.28E-13	1.30E-13	1.93E-08	1.95E-08	3.88E-08
1,2,3,4,7,8,9-HpCDF	2.40E-10	9.73E-14	6.58E-14	NA	NA	8.34E-15	8.47E-15	1.25E-09	1.27E-09	2.52E-09
OCDF	2.28E-11	9.26E-15	6.26E-15	NA	NA	7.94E-16	8.05E-16	1.19E-10	1.21E-10	2.40E-10

CENTRAL TENDENCY EXPOSURE:	Child	Adult	Total
Total PCB CTE Cancer Risk	**2E-08**	**2E-08**	**4E-08**
Dioxin-like PCB congeners	3.2E-07	3.2E-07	6.4E-07
Adjusted Dioxin-like PCB Congeners	2.9E-07	3.0E-07	5.9E-07
Dioxins	1.7E-07	1.7E-07	3.4E-07
Furans	6.0E-07	6.1E-07	1.2E-06
Total TEQ CTE Cancer Risk	**1E-06**	**1E-06**	**2E-06**
Total CTE Hazard Index	**1E-02**	**8E-03**	

ATTACHMENT D.3
CANCER RISK AND NONCANCER HAZARD CALCULATIONS
FOR ROOT VEGETABLES (RESIDENT) AT 2 MG/KG TOTAL PCBS IN SOIL

	RME root vegetable Concentration (mg total PCB /kg root vegetable; mg congener TEQ/kg root vegetable)	RME ADD$_{root\ vegetable}$ (mg/kg-day)		RME Hazard Index		RME LADD$_{root\ vegetable}$ (mg/kg-day)		RME Cancer Risk		
		Child	Adult	Child	Adult	Child	Adult	Child	Adult	Total
Total PCBs	6.00E-04	4.04E-07	2.28E-07	2.02E-02	1.14E-02	3.46E-08	1.27E-07	6.92E-08	2.54E-07	3.23E-07
PCB-77	5.71E-11	3.85E-14	2.17E-14	NA	NA	3.30E-15	1.21E-14	4.94E-10	1.81E-09	2.31E-09
PCB-81	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-105	1.99E-10	1.34E-13	7.55E-14	NA	NA	1.15E-14	4.21E-14	1.72E-09	6.31E-09	8.03E-09
PCB-114	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PCB-118	5.68E-10	3.83E-13	2.16E-13	NA	NA	3.28E-14	1.20E-13	4.92E-09	1.80E-08	2.30E-08
PCB-123	1.38E-11	9.28E-15	5.24E-15	NA	NA	7.96E-16	2.92E-15	1.19E-10	4.38E-10	5.57E-10
PCB-126	5.36E-08	3.61E-11	2.04E-11	NA	NA	3.09E-12	1.13E-11	4.64E-07	1.70E-06	2.17E-06
PCB-156	7.46E-10	5.02E-13	2.83E-13	NA	NA	4.30E-14	1.58E-13	6.45E-09	2.37E-08	3.01E-08
PCB-157	2.10E-10	1.41E-13	7.97E-14	NA	NA	1.21E-14	4.44E-14	1.82E-09	6.66E-09	8.48E-09
PCB-167	1.14E-11	7.70E-15	4.34E-15	NA	NA	6.60E-16	2.42E-15	9.89E-11	3.63E-10	4.62E-10
PCB-169	5.02E-09	3.38E-12	1.91E-12	NA	NA	2.90E-13	1.06E-12	4.35E-08	1.59E-07	2.03E-07
PCB-189	7.01E-11	4.72E-14	2.66E-14	NA	NA	4.04E-15	1.48E-14	6.07E-10	2.22E-09	2.83E-09
2,3,7,8-TCDD	7.39E-09	4.97E-12	2.80E-12	NA	NA	4.26E-13	1.56E-12	6.39E-08	2.34E-07	2.98E-07
1,2,3,7,8-PeCDD	1.64E-08	1.10E-11	6.21E-12	NA	NA	9.44E-13	3.46E-12	1.42E-07	5.19E-07	6.61E-07
1,2,3,4,7,8-HxCDD	8.66E-10	5.83E-13	3.29E-13	NA	NA	5.00E-14	1.83E-13	7.49E-09	2.75E-08	3.50E-08
1,2,3,6,7,8-HxCDD	3.05E-09	2.05E-12	1.16E-12	NA	NA	1.76E-13	6.45E-13	2.64E-08	9.68E-08	1.23E-07
1,2,3,7,8,9-HxCDD	1.99E-09	1.34E-12	7.57E-13	NA	NA	1.15E-13	4.22E-13	1.73E-08	6.33E-08	8.05E-08
1,2,3,4,6,7,8-HpCDD	2.40E-09	1.62E-12	9.13E-13	NA	NA	1.39E-13	5.09E-13	2.08E-08	7.63E-08	9.71E-08
OCDD	2.72E-10	1.83E-13	1.03E-13	NA	NA	1.57E-14	5.76E-14	2.36E-09	8.65E-09	1.10E-08
2,3,7,8-TCDF	1.90E-08	1.28E-11	7.23E-12	NA	NA	1.10E-12	4.03E-12	1.65E-07	6.04E-07	7.69E-07
1,2,3,7,8-PeCDF	4.81E-09	3.23E-12	1.82E-12	NA	NA	2.77E-13	1.02E-12	4.16E-08	1.52E-07	1.94E-07
2,3,4,7,8-PeCDF	6.54E-08	4.41E-11	2.48E-11	NA	NA	3.78E-12	1.38E-11	5.66E-07	2.08E-06	2.64E-06
1,2,3,4,7,8-HxCDF	8.81E-09	5.93E-12	3.34E-12	NA	NA	5.08E-13	1.86E-12	7.62E-08	2.80E-07	3.56E-07
1,2,3,6,7,8-HXCDF	5.36E-09	3.61E-12	2.04E-12	NA	NA	3.09E-13	1.13E-12	4.64E-08	1.70E-07	2.16E-07
2,3,4,6,7,8-HxCDF	6.12E-09	4.12E-12	2.32E-12	NA	NA	3.53E-13	1.29E-12	5.30E-08	1.94E-07	2.47E-07
1,2,3,7,8,9-HxCDF	1.77E-09	1.19E-12	6.71E-13	NA	NA	1.02E-13	3.74E-13	1.53E-08	5.61E-08	7.13E-08
1,2,3,4,6,7,8-HpCDF	3.69E-09	2.48E-12	1.40E-12	NA	NA	2.13E-13	7.81E-13	3.19E-08	1.17E-07	1.49E-07
1,2,3,4,7,8,9-HpCDF	2.40E-10	1.61E-13	9.11E-14	NA	NA	1.38E-14	5.07E-14	2.08E-09	7.61E-09	9.69E-09
OCDF	2.28E-11	1.54E-14	8.66E-15	NA	NA	1.32E-15	4.83E-15	1.97E-10	7.24E-10	9.21E-10

REASONABLE MAXIMUM EXPOSURE:	Child	Adult	Total
Total PCB RME Cancer Risk	**7E-08**	**3E-07**	**3E-07**
Dioxin-like PCB congeners	5.2E-07	1.9E-06	2.4E-06
Adjusted Dioxin-like PCB congeners	4.9E-07	1.8E-06	2.3E-06
Dioxins	2.8E-07	1.0E-06	1.3E-06
Furans	1.0E-06	3.7E-06	4.7E-06
Total TEQ RME Cancer Risk	**2E-06**	**7E-06**	**8E-06**
Total RME Hazard Index	**2E-02**	**1E-02**	