Table 10:   PCB Congener Oral RfDs

Congener	TRV	TRV Type	Agency	Effects
Aroclor 1254	2×10^{-5} mg/kg-day	RfD	IRIS, US EPA	Ocular exudate, inflamed and prominent Meibomian glands, distorted growth of finger and toe nails; decreased IgG and IgM response to sheep erythrocytes.
Aroclor 1016	7×10^{-5} mg/kg-day	RfD	IRIS, US EPA	Reduced birth weights

The ATSDR (2000) provides oral minimal risk levels (MRLs) for intermediate and chronic exposure to PCBs. These MRLs, presented in Table 25 were derived to reflect exposure to PCB mixtures and are based on studies that involved Aroclor 1254.

Table 11:   ATSDR (2000) MRLs for Oral Exposure to PCBs

Exposure	TRV	Basis	Effects
Intermediate (15-364 days)	0.03 µg/kg-day	LOAEL (0.0075 mg/kg-day)	Neurobehavioral alterations in infant monkeys that were exposed to a PCB congener mixture representing 80% of the congeners typically found in human breast milk
Chronic (365 days or more)	0.02 µg/kg-day	LOAEL (0.005 mg/kg-day)	Immunological effects in adult monkeys that were evaluated after 23 and 55 months of exposure to Aroclor 1254

The chronic MRL corresponds with the US EPA RfD for Aroclor 1254. However, Health Canada (2003) provides a TDI of 0.001 mg/kg-d, which was used in this assessment.

6.3.2   Cancer Oral Toxicity Reference Values

The US EPA (1997) established oral slope factors for PCB mixtures using a tiered approach that depends on the information available. Slope factors for high risk and persistence are considered appropriate for food chain exposure, sediment and soil ingestion, inhalation of dust or aerosol, dermal exposure (if an absorption factor has been applied) and all early life exposure. Slope factors for low risk and persistence are considered appropriate for inhalation of evaporated congeners. Central and upper bound-bound estimates are provided; central estimates describe a typical individual's risk, while upper bounds provide assurance that this risk is not likely to be underestimated. Based on the above, the upper-bound slope factor of 2.0 (mg/kg/day)$^{-1}$ for high risk and persistence was used to assess the potential for carcinogenic effects via oral exposure pathways.

6.3.3 Non-Cancer Inhalation Toxicity Reference Values

Chronic inhalation exposure of workers to PCBs has been reported to result in respiratory tract symptoms (ATSDR, 2000). Despite these observed effects, non-cancer inhalation TRVs were not found.

6.3.4 Cancer Inhalation Toxicity Reference Values

The US EPA (1997) established inhalation slope factors for PCB mixtures using a tiered approach that depends on the information available. Slope factors for high risk and persistence are considered appropriate for food chain exposure, sediment and soil ingestion, inhalation of dust or aerosol, dermal exposure (if an absorption factor has been applied) and all early life exposure. Slope factors for low risk and persistence are considered appropriate for inhalation of evaporated congeners. Central and upper bound-bound estimates are provided; central estimates describe a typical individual's risk, while upper bounds provide assurance that this risk is not likely to be underestimated. Based on the above, the upper-bound slope factor of $0.4\ (\text{mg/kg/day})^{-1}$ was used to assess the potential for carcinogenic effects via inhalation exposure.

6.4 Bioavailability

PCBs are well absorbed after oral, inhalation, or dermal exposure and transported similarly through circulation (US EPA, 1997; ATSDR, 2000). Initially absorbed PCBs are transported to the liver and muscle, subsequently PCBs are stored in fat and skin (US EPA, 1996c).

6.4.1 Oral Bioavailability

Animal studies have shown that PCBs are readily absorbed by the gastrointestinal tract with the degree of absorption ranging from 66 to 96% (ATSDR, 2000; WHO, 2000).

Specific information concerning absorption of Aroclor 1254 is limited. Pregnant ferrets administered a single oral dose of 0.06 mg/kg Aroclor 1254 absorbed 85% of the administered dose (Bleavins *et al.*, 1984). Rats, mice, and monkeys absorb between 75 to >90% of orally administered doses of PCBs (US EPA, 1996a). Oral exposure through consumption of contaminated food (including breast milk) is the major route of exposure to PCBs for the general population.

The oral relative bioavailability for PCBs used in this assessment was 1.0.

6.4.2   Inhalation Bioavailability

Inhalation is considered to be a major occupational route of exposure (ATSDR, 2000). However, quantitative data concerning inhalation exposure to PCBs is scarce (ATSDR, 2000). Following the inhalation of PCBs, absorption and distribution similar to orally administered PCBs is witnessed in rats (WHO, 2000), this evidence is supported by the US EPA (1997). Furthermore, a study reported by the International Programme on Chemical Safety (IPCS) (1993) administered a PCB mixture in an aerosol to rats that was readily absorbed, resulting in 50% of the maximum applied concentration in the liver, 2 hours following administration.

The ATSDR summarized a study by Wolff (1985) where a maximum of 80% of the PCB levels in adipose tissue of exposed capacitor workers may have been absorbed by the inhalation route. A maximum of 20% would have been derived from dermal or oral exposure (ATSDR, 2000). The relative inhalation bioavailability factor used in this assessment was 1.0.

6.4.3   Dermal Bioavailability

Dermal absorption has been observed in animal species ranging from 20 to 60% (WHO, 2000). Given the previously mentioned study by Wolff (1985), where a maximum of 20% of PCB levels in adipose tissue may have been attributed to oral and dermal exposure. The US EPA Region III (1995) recommends a dermal bioavailability factor of 0.06 based on the dermal absorption of 3,3',4,4'-tetrachlorobiphenyl.

The US EPA (2001) recommends an absorption factor of 0.14 based on *in vitro* human and monkey testing. Based on findings in animal studies reported by the World Health Organization (WHO), a conservative 0.60 relative dermal bioavailability factor has been adopted.

6.5   Conclusion

The following tables summarize the selected TRVs and relative bioavailabilities of PCBs.

Table 12:   Selected Toxicity Reference Values for PCBs

Route of Exposure	TRV	TRV Type	Source Agency
Non-Cancer Effects			
Ingestion	0.01 mg/kg-day	TDI	Health Canada, 2003
Inhalation	NA	NA	NA
Cancer Effects			
Ingestion	2.0 $(mg/kg/day)^{-1}$	Slope Factor	US EPA, 1997
Inhalation	0.4 $(mg/kg/day)^{-1}$	Slope Factor	US EPA, 1997

Notes:
NA: Not Applicable

Table 13:   Selected Bioavailabilities for PCBs

Route of Exposure	Relative Bioavailability	Reference
Ingestion	1.0	Assumed
Inhalation	1.0	Assumed
Dermal	0.60	WHO (2000)

6.6   References

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APPENDIX B

HHRA MODELEQUATIONS, INPUTS AND OUTPUTS

TABLE OF CONTENTS

1.0   HUMAN HEALTH INTAKE EQUATIONS

1.1   Oral/Dermal Exposure

1.1.1   Soil Ingestion

$$\text{Intake}_{SING} = \frac{C_{soil} \times IR_{soil} \times RAF_{ing} \times ET_{ing} \times EF_{ing} \times ED \times CF_I}{BW \times AT}$$

Where: **Units**

Intake_{SING}	$=$	daily intake from ingestion of soil/dust	mg/kg-day
C_{soil}	$=$	concentration of chemical in soil	mg/kg
IR_{soil}	$=$	ingestion rate of soil	mg/hour
RAF_{ing}	$=$	relative absorption factor - ingestion	unitless
ET_{ing}	$=$	exposure time - ingestion	hours/day
EF_{ing}	$=$	exposure frequency - ingestion	days/year
ED	$=$	exposure duration	years
CF_I	$=$	conversion factor	1E-06 kg/mg
BW	$=$	body weight of receptor	kg
AT_c	$=$	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc}	$=$	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.1.2   Soil Dermal

$$\text{Intake}_{SDERM} = \frac{C_{soil} \times \left(\left(SA_{body} \times SAF_{body}\right) + \left(SA_{hand} \times SAF_{hand}\right)\right) \times RAF_{derm} \times ET_{derm} \times EF_{derm} \times ED \times CF_1 \times CF_2}{BW \times AT}$$

Where: **Units**

Intake_{SDERM}	=	daily intake from dermal contact with soil	mg/kg-day
C_{soil}	=	concentration of chemical in soil	mg/kg
SA_{body}	=	exposed surface area - body	cm^2
SAF_{body}	=	soil adherence factor - body	mg/cm^2-day
SA_{hand}	=	exposed surface area - hand	cm^2
SAF_{hand}	=	soil adherence factor - hand	mg/cm^2-day
RAF_{derm}	=	relative absorption factor - dermal	unitless
ET_{derm}	=	exposure time	hours/day
EF_{derm}	=	exposure frequency	days/year
ED	=	exposure duration	years
CF_1	=	conversion factor	1E-06 kg/mg
CF_2	=	conversion factor	0.042 days/hour
BW	=	body weight of receptor	kg
AT_c	=	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc}	=	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.1.3   Soil/Dust Inhalation

$$\text{Intake}_{SDINHAL} = \frac{C_{soil} \times P_{air} \times IR_{air} \times RAF_{inh} \times ET_{inh} \times EF_{inh} \times ED \times CF_2}{BW \times AT}$$

Where: **Units**

$\text{Intake}_{SDINHAL}$	=	daily intake from inhalation of soil/dust	mg/kg-day
C_{soil}	=	concentration of chemical in soil	mg/kg
P_{air}	=	particulate concentration in air	kg/m^3
RAF_{inh}	=	relative absorption factor - inhalation	unitless
IR_{air}	=	inhalation rate of air	m^3/hour
ET_{inh}	=	exposure time - inhalation	hours/day
EF_{inh}	=	exposure frequency - inhalation	days/year
ED	=	exposure duration	years
CF_2	=	conversion factor	0.042 days/hour
BW	=	body weight of receptor	kg
AT_c	=	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc}	=	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.2   Food Ingestion

1.2.1   Caribou Ingestion

$$\text{Intake}_{caribou} = \frac{C_{caribou} \cdot IR_{game} \times F_{caribou} \times F_{site} \times RAF_{ing} \times EF_{game} \times ED}{BW \times AT}$$

Where: **Units**

Intake $_{caribou}$ =	daily intake from the ingestion of caribou	mg/kg-day
$C_{caribou}$ =	concentration in caribou	mg/kg
IR_{game} =	ingestion rate of wild game	kg/day
F_{site} =	fraction of wild game consumed from site	unitless
$F_{caribou}$ =	fraction of wild game that is caribou	unitless
RAF_{ing} =	relative absorption factor - oral	unitless
EF_{game} =	exposure frequency – wild game ingestion	days/year
ED =	exposure duration	years
BW =	body weight of receptor	kg
AT_c =	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc} =	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.2.2   Arctic Hare Ingestion

$$\text{Intake}_{hare} = \frac{C_{hare} \cdot IR_{game} \times F_{hare} \times F_{site} \times RAF_{ing} \times EF_{game} \times ED}{BW \times AT}$$

Where: **Units**

Intake$_{hare}$ =	daily intake from the ingestion of arctic hare	mg/kg-day
C_{hare} =	concentration in arctic hare	mg/kg
IR_{game} =	ingestion rate of wild game	kg/day
F_{game} =	fraction of wild game consumed from site	unitless
F_{hare} =	fraction of wild game that is arctic hare	unitless
RAF_{ing} =	relative absorption factor - oral	unitless
EF_{game} =	exposure frequency – wild game ingestion	days/year
ED =	exposure duration	years
BW =	body weight of receptor	kg
AT_c =	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc} =	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.2.3   Fish Ingestion

$$\text{Intake}_{fish} = \frac{C_{fish} \cdot IR_{fish} \times F_{fish} \times F_{cf} \times RAF_{ing} \times EF_{fish} \times ED}{BW \times AT}$$

Where:			**Units**
Intake$_{fish}$ = daily intake from the ingestion of fish			mg/kg-day
C_{fish}	=	concentration in fish	mg/kg
IR_{fish}	=	ingestion rate of fish	kg/day
F_{fish}	=	fraction of fish caught from site	unitless
F_{cf}	=	fraction fish that are contaminated	unitless
RAF_{ing}	=	relative absorption factor - oral	unitless
EF_{fish}	=	exposure frequency – fish ingestion	days/year
ED	=	exposure duration	years
BW	=	body weight of receptor	kg
AT_c	=	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc}	=	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.2.4 Water Ingestion

$$\text{Intake}_{WATER} = \frac{C_{water} \times IR_{water} \times F_{water} \times RAF_{ing} \times EF_{water} \times ED}{BW \times AT}$$

Where:			**Units**
Intake$_{WATER}$ = daily intake from the ingestion of water			mg/kg-day
C_{water}	=	concentration in water	mg/L
IR_{water}	=	ingestion rate of water	L/day
F_{water}	=	fraction of water consumed from site	unitless
RAF_{ing}	=	relative absorption factor - oral	unitless
EF_{water}	=	exposure frequency – drinking water	days/year
ED	=	exposure duration	years
BW	=	body weight of receptor	kg
AT_c	=	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc}	=	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.3   Water Exposure

1.3.1   Dermal Exposure

$$\text{Intake}_{\text{dermwater}} = \frac{DA_{\text{event}} \times SA_{\text{water}} \times ET_{\text{dwater}} \times EF_{\text{dwater}} \times ED}{BW \times AT}$$

Where: **Units**

$\text{Intake}_{\text{dermwater}}$ =	daily intake from the dermal contact with surface water		mg/kg-day
DA_{event} =	absorbed dose per event		mg/cm2-event
SA_{water} =	exposed surface area – dermal water		cm^2
ET_{dwater} =	exposure time – dermal water		hours/day
EF_{dwater} =	exposure frequency – dermal water		days/year
ED =	exposure duration		years
BW =	body weight of receptor		kg
AT_c =	averaging time carcinogen = (365 days/year) x (75 years)		27375 days
AT_{nc} =	averaging time non-carcinogen = (365 days/year) x (exposure duration)		days

$$DA_{\text{event}} = K_p \times C_{\text{water}} \times t_{\text{event}}$$

Where: **Units**

DA_{event} =	absorbed dose per event		mg/cm^2-event
K_p =	dermal permeability coefficient of compound in water		cm/hr
C_{water} =	concentration of chemical in water		mg/cm^3
t_{event} =	event duration		hour/event

1.4   Risk Characterization

After the various intakes are derived, the final step is the calculation of the incremental excess lifetime cancer risks (IELCR) and non-carcinogenic hazard quotient (HQ) values for each of the pathways and receptors identified. IELCRs and HQs are then summed for individual receptors, across all applicable exposure pathways to obtain an estimate of the total individual IELCRs and HQs for specific receptors.

1.4.1   Carcinogenic Chemicals

For carcinogenic chemicals, risk estimates represent the incremental probability that an individual will develop cancer over a lifetime as a result of a specific exposure to that chemical (US EPA OW, 1998). Since carcinogenic risk estimates are over a lifetime of exposure, a composite receptor comprising five separate lifestages (infant, toddler, child, teen, adult) was used to evaluate carcinogenic intakes.

An intake value was derived for each exposure and each pathway. These values were then summed to get a pathway specific cancer intake.

$$IELCR_x = Intake_x \times CSF_x$$

Where:			Units
$IELCR_x$ =	incremental lifetime cancer risk for pathway x		unitless
$Intake_x$ =	chemical specific intake for pathway x		mg/kg-day
CSF_x =	chemical specific cancer slope factor for pathway x		$(mg/kg\text{-}day)^{-1}$

$$IELCR_{O/D} = Intake_{O/D} \times CSF_{O/D}$$

Where:			Units
$IELCR_{O/D}$ =	incremental lifetime cancer risk for oral/dermal exposure		unitless
$Intake_{O/D}$ =	chemical specific intake for oral/dermal pathway		mg/kg-day
$CSF_{O/D}$ =	chemical specific oral cancer slope factor		$(mg/kg\text{-}day)^{-1}$

$$IELCR_{FOOD} = Intake_{FOOD} \times CSF_{O/D}$$

Where:			Units
$IELCR_{FOOD}$ =	incremental lifetime cancer risk for food ingestion exposure		unitless
$Intake_{FOOD}$ =	chemical specific intake for food intake pathway		mg/kg-day
$CSF_{O/D}$ =	chemical specific oral cancer slope factor		$(mg/kg\text{-}day)^{-1}$

1.4.2   Non-carcinogenic Chemicals

The potential for non-carcinogenic health effects resulting from exposure to a chemical is generally assessed by comparing an exposure estimate to a reference dose (RfD). A RfD is a daily oral intake rate that is estimated to pose no appreciable risk of adverse health effects, even to sensitive populations (US EPA OW, 1998).

$$HQ_x = \frac{Intake_x}{RfD_x}$$

Where:			Units
HQ_x =	hazard quotient for pathway x		unitless
$Intake_x$ =	chemical specific intake for pathway x		mg/kg-day
RfD_x =	chemical specific reference dose for pathway x		mg/kg-day

The total non-carcinogenic hazard attributable to exposure to all chemicals through a single exposure pathway is known as a hazard index (HI) (US EPA OW, 1998). The HI is calculated as follows:

$$HI = \sum_i HQ_x$$

Where: **Units**

HI   hazard index for a specific exposure pathway   unitless

HQ_x hazard quotient for chemical x   unitless

A receptor's total hazard is considered to be the sum of all the HI values for each of the specific exposure pathways.

Table 1 Parameter Definitions and Receptor Exposure Assumptions

Parameter Definitions		Exposure Assumptions	
		Lower Site	Upper Site
$TDI =$	reference dose (mg/kg bw-day)	chemical specific	chemical specific
$EDI =$	estimated daily intake (multimedia exposure assessment) (mg/kg bw-day)	chemical specific	chemical specific
$SAF =$	soil allocation factor (unitless)	chemical specific	chemical specific
$BW =$	body weight (kg)	16.5	16.5
$BSC =$	background soil concentration (mg/kg)	chemical specific	chemical specific
$RAF_{ing} =$	relative absorption factor for gut (unitless)	chemical specific	chemical specific
$RAF_{derm} =$	relative absorption factor skin (unitless)	chemical specific	chemical specific
$C_{soil} =$	concentration of chemical in soil (mg/kg)	site specific	site specific
$C_{caribou} =$	concentration of chemical in caribou (mg/kg)	site specific	site specific
$C_{hare} =$	concentration of chemical in hare (mg/kg)	site specific	site specific
$C_{fish} =$	concentration of chemical in fish (mg/kg)	site specific	site specific
$C_{water} =$	concentration of chemical in water (mg/L)	site specific	site specific
$DA_{event} =$	absorbed dose per event (mg/cm^2-event)	chemical specific	chemical specific
$IR_{soil} =$	soil ingestion rate (mg/hr)	3.33	3.33
$IR_{air} =$	air inhalation rate (m^3/hr)	0.39	0.3875
$IR_{game} =$	wild game ingestion rate (mg/day)	85000.00	85000
$IR_{fish} =$	fish ingestion rate (mg/day)	95000.00	95000
$IR_{water} =$	water ingestion rate (L/day)	0.60	0.6
$P_{air} =$	particulate concentration in air (kg/m^3)	7.60E-10	7.6E-10
$SA_{body} =$	exposed receptor surface area - body (cm^2)	2580	2580
$SA_{hand} =$	exposed receptor surface area - hand (cm^2)	430	430
$SA_{water} =$	exposed receptor surface area - dermal water (cm^2)	430	430
$SAF_{body} =$	soil adherance factor - body (mg/cm^2-day)	0.01	0.01
$SAF_{hand} =$	soil adherance factor - hand (mg/cm^2-day)	0.10	0.1
$ETerm_{ing} =$	exposure term for soil ingestion pathway (unitless - event driven)	0.247	0.0384
$ETerm_{derm} =$	exposure term for soil dermal contact pathway (unitless - event driven)	0.247	0.0384
$ETerm_{inh} =$	exposure term for soil dust inhalation pathway (unitless - event driven)	0.247	0.0384
$ET_{ing} =$	exposure time for soil ingestion pathway (hour/day)	24	24
$ET_{derm} =$	exposure time for soil dermal contact pathway (hour/day)	24	24
$ET_{inh} =$	exposure time for soil dust inhalation pathway (hour/day)	24	24
$ET_{dwater} =$	exposure frequency for surface water dermal contact pathway (event/day)	3	3
$EF_{ing} =$	exposure frequency for soil ingestion pathway (days/year)	90	14
$EF_{derm} =$	exposure frequency for soil dermal contact pathway (days/year)	90	14
$EF_{inh} =$	exposure frequency for soil dust inhalation pathway (days/year)	90	14
$EF_{game} =$	exposure frequency for wild game ingestion pathway (days/year)	90	14
$EF_{fish} =$	exposure frequency for fish ingestion pathway (days/year)	90	14
$EF_{water} =$	exposure frequency for water ingestion pathway (days/year)	90	14
$EF_{dwater} =$	exposure frequency for water dermal contact pathway (days/year)	90	14
$ED =$	exposure duration (years)	4.5	4.5
$F_{site} =$	fraction of wild game caught from the site (unitless)	1.00	1
$F_{caribou} =$	fraction of wild game that is caribou (unitless)	0.90	0.9
$F_{hare} =$	fraction of wild game that is hare (unitless)	0.10	0.1
$F_{fish} =$	fraction of fish caught from site (unitless)	1.00	1
$F_{cf} =$	fraction of fish contaminated (unitless)	1.00	1
$F_{water} =$	fraction of drinking water from site (unitless)	1.00	1
$CF_1 =$	conversion factor (kg/mg)	1.00E-06	0.000001
$CF_2 =$	conversion factor (days/hour)	4.20E-02	0.042
$AT =$	averaging time (non-cancer/cancer days)	1642.5/27375	1642.5/27375

Table 2 Summary Toxicological Reference Values and Relative Absorption Factors

Compound	Non-carcinogenic		Carcinogenic		SAF	RAF_{ing}	RAF_{inh}	RAF_{derm}
	TDI (oral) mg/kg-d	TDI (inhal.) mg/kg-d	SFo (oral) $(mg/kg-d)^{-1}$	SFi (oral) $(mg/kg-d)^{-1}$				
Inorganics								
Beryllium	0.002	4.75E-6	--	10.1	0.2	1	1	0.03
Copper	1.0E-2	--	--	--	0.2	1	1	0.1
Lead	0.00357	--	--	--	0.2	1	1	0.006
TPH - CCME CWS								
Aliph>C06-C08 - F1	5	--	--	--	0.2	1	1	0.2
Aliph>C08-C10 -F1	0.1	--	--	--	0.2	1	1	0.2
Arom>C08-C10 -F1	0.04	--	--	--	0.2	1	1	0.2
F1 - Total								
Aliph>C10-C12 -F2	0.1	--	--	--	0.2	1	1	0.2
Aliph>C12-C16 -F2	0.1	--	--	--	0.2	1	1	0.2
Arom>C10-C12 -F2	0.04	--	--	--	0.2	1	1	0.2
Arom>C12-C16 -F2	0.04	--	--	--	0.2	1	1	0.2
F2 - Total								
Aliph>C16-C21-F3	2	--	--	--	0.2	1	1	0.2
Aliph>C21-C34 -F3	2	--	--	--	0.2	1	1	0.2
Arom>C16-C21 -F3	0.03	--	--	--	0.2	1	1	0.2
Arom>C21-C34 -F3	0.03	--	--	--	0.2	1	1	0.2
F3 - Total		--	--	--				
Aliph>C34-C50 -F4	20	--	--	--	0.2	1	1	0.2
Arom>C34-C50 -F4	0.03	--	--	--	0.2	1	1	0.2
F4 - Total								
Organics								
Total PCBs	0.001	0.001	--	--	na[a]	1	na[a]	na[a]

a- PCBs were only assessed for risk from ingestion of fish

-- not available: where separate inhalation TRVs are not available, the inhalation dose is summed with the dermal/ingestion dose and then compared to the oral TRV.

Table 3 Lower Site CoPC Concentrations Used in HHRA

Compound	C_{soil} (mg/kg)	$C_{caribou}$ (mg/kg)	C_{hare} (mg/kg)	C_{fish} (mg/kg)	C_{water} (mgL)
Inorganics					
Beryllium	5.80E-01	9.40E-05	9.40E-05	--	5.00E-05
Copper	--	6.60E-01	3.79E+00	4.60E-01	--
Lead	--	7.44E-03	1.02E+00	2.80E-02	--
TPH - CCME CWS					
Aliph>C16-C21-F3	1.01E+04	2.88E-01	2.88E-01	--	--
Aliph>C21-C34 -F3	4.32E+03	1.23E-01	1.23E-01	--	--
Arom>C16-C21 -F3	2.52E+03	7.20E-02	7.20E-02	--	--
Arom>C21-C34 -F3	1.08E+03	3.08E-02	3.08E-02	--	--
F3 - Total	1.80E+04	5.14E-01	5.14E-01	--	--
Organics					
Total PCBs	--	1.46E-1	1.46E-1	2.60E-03	

-- = Parameter not evaluated for this pathway

Table 4 Upper Site CoPC Concentrations Used in HHRA

Compound	C_{soil} (mg/kg)	$C_{caribou}$ (mg/kg)	C_{hare} (mg/kg)	C_{fish} (mg/kg)	C_{water} (mgL)
Inorganics					
Beryllium	7.80E-01	9.40E-05	9.40E-05		
Copper	3.81E+02	6.60E-01	3.79E+00	4.60E-01	2.00E-03
Lead	1.06E+03	7.44E-03	1.02E+00	2.80E-02	
TPH - CCME CWS					
Aliph>C10-C12 -F2	3.17E+03	4.24E-02	4.14E-02	--	--
Aliph>C12-C16 -F2	3.87E+03	5.18E-02	5.06E-02	--	--
Arom>C10-C12 -F2	7.92E+02	1.06E-02	1.04E-02	--	--
Arom>C12-C16 -F2	9.68E+02	1.29E-02	1.27E-02	--	--
F2 - Total	8.80E+03	1.18E-01	1.15E-01	--	--
Aliph>C16-C21-F3	1.79E+04	2.88E-01	2.88E-01	--	--
Aliph>C21-C34 -F3	7.66E+03	1.23E-01	1.23E-01	--	--
Arom>C16-C21 -F3	4.47E+03	7.20E-02	7.20E-02	--	--
Arom>C21-C34 -F3	1.91E+03	3.09E-02	3.09E-02	--	--
F3 - Total	3.19E+04	5.14E-01	5.14E-01	--	--
Aliph>C34-C50 -F4	4.58E+04	3.73E-02	3.73E-02	--	--
Arom>C34-C50 -F4	1.15E+04	9.33E-03	9.33E-03	--	--
F4 - Total	5.73E+04	4.66E-02	4.66E-02	--	--
Organics					
Total PCBs	2.20E+00	5.84E-3	5.84E-3	2.60E-03	--

-- = Parameter not evaluated for this pathway

Table 5 Exposure Pathway Specific Hazard Quotients for Lower Site Exposure

Compound	HQ Soil Ingestion	HQ Soil Dermal	HQ Soil Dust Inhalation	HQ Site Soil	HQ Caribou Ingestion	HQ Hare Ingestion	HQ Fish Ingestion	HQ Water Ingestion	HQ Food Intake	HQ Water Dermal
Inorganics										
Beryllium	3.5E-04	9.0E-06	1.3E-05	3.7E-04	5.4E-05	6.0E-06	--	2.2E-04	2.8E-04	2.4E-05
TPH - CCME CWS										
Organics										
Aliph>C16-C21-F3	6.0E-03	1.0E-03	5.3E-07	7.1E-03	1.6E-04	1.8E-05	--	--	1.8E-04	--
Aliph>C21-C34 -F3	2.6E-03	4.5E-04	2.3E-07	3.0E-03	7.1E-05	7.8E-06	--	--	7.8E-05	--
Arom>C16-C21 -F3	1.0E-01	1.7E-02	8.9E-06	1.2E-01	2.7E-03	3.0E-04	--	--	3.0E-03	--
Arom>C21-C34 -F3	4.3E-02	7.5E-03	3.8E-06	5.1E-02	1.2E-03	1.3E-04	--	--	1.3E-03	--
F3 - Total	1.5E-01	2.6E-02	1.3E-05	1.8E-01	4.2E-03	4.6E-04	--	--	4.6E-03	--
Total PCBs	--	--	--	--	1.7E-01	1.9E-02	3.7E-03	--	1.9E-01	--

-- = Parameter not evaluated for this pathway

Table 6 Exposure Pathway Incremental Lifetime Cancer Risks for Lower Site Exposure

Compound	ILCR Soil Ingestion	ILCR Soil Dermal	ILCR Soil Dust Inhalation	ILCR Site Soil	ILCR Caribou Ingestion	ILCR Hare Ingestion	ILCR Fish Ingestion	ILCR Water Ingestion	ILCR Food Dermal	ILCR Water Dermal
Inorganics										
Beryllium	--	--	2.68E-10	--	--	--	--	--	--	-

-- = Parameter not evaluated for this pathway

Table 7 Exposure Pathway Specific Hazard Quotients for Upper Site Exposure

Compound	HQ Soil Ingestion	HQ Soil Dermal	HQ Soil Dust Inhalation	HQ Site Soil	HQ Caribou Ingestion	HQ Hare Ingestion	HQ Fish Ingestion	HQ Water Ingestion	HQ Food Intake	HQ Water Dermal
Inorganics										
Beryllium	7.25E-05	1.89E-06	2.70E-06	7.71E-05	8.35E-06	9.28E-07	--	--	9.28E-06	--
Copper	7.09E-03	6.14E-04	6.26E-07	7.70E-03	1.17E-02	7.50E-03	1.02E-02	2.79E-04	2.87E-02	3.00E-05
Lead	5.52E-02	2.87E-04	4.88E-06	5.55E-02	3.71E-04	5.62E-03	1.73E-03	--	7.73E-03	--
TPH - CCME CWS										
Aliph>C10-C12 -F2	5.89E-03	1.02E-03	5.21E-07	6.91E-03	7.54E-05	8.39E-06	--	--	8.37E-05	--
Aliph>C12-C16 -F2	7.20E-03	1.25E-03	6.36E-07	8.45E-03	9.21E-05	1.02E-05	--	--	1.02E-04	--
Arom>C10-C12 -F2	3.68E-03	6.38E-04	3.25E-07	4.32E-03	4.71E-05	5.23E-06	--	--	5.23E-05	--
Arom>C12-C16 -F2	4.50E-03	7.80E-04	3.98E-07	5.28E-03	5.76E-05	6.40E-06	--	--	6.40E-05	--
F2 - Total	2.13E-02	3.69E-03	1.88E-06	2.50E-02	2.72E-04	3.02E-05	--	--	3.02E-04	--
Aliph>C16-C21-F3	1.66E-03	2.88E-04	1.47E-07	1.95E-03	2.56E-05	2.85E-06	--	--	2.85E-05	--
Aliph>C21-C34 -F3	7.12E-04	1.23E-04	6.29E-08	8.35E-04	1.10E-05	1.22E-06	--	--	1.22E-05	--
Arom>C16-C21 -F3	2.77E-02	4.80E-03	2.45E-06	3.25E-02	4.29E-04	4.74E-05	--	--	4.74E-04	--
Arom>C21-C34 -F3	1.19E-02	2.06E-03	1.05E-06	1.39E-02	1.83E-04	2.03E-05	--	--	2.03E-04	--
F3 - Total	4.19E-02	7.27E-03	3.70E-06	4.92E-02	6.46E-04	7.18E-05	--	--	7.18E-04	--
Aliph>C34-C50 -F4	4.26E-04	7.39E-05	3.77E-08	5.00E-04	3.32E-07	3.69E-08	--	--	3.69E-07	--
Arom>C34-C50 -F4	7.10E-02	1.23E-02	6.28E-06	8.34E-02	5.53E-05	6.14E-06	--	--	6.14E-05	--
F4 - Total	7.15E-02	1.24E-02	6.31E-06	8.39E-02	5.56E-05	6.18E-06	--	--	6.18E-05	--
Organics										
Total PCBs	4.09E-04	3.55E-05	3.61E-08	4.45E-04	1.04E-03	1.15E-04	5.74E-04	--	1.73E-03	--

-- = Parameter not evaluated for this pathway

Table 8 Exposure Pathway Incremental Lifetime Cancer Risks for Upper Site Exposure

Compound	ILCR Soil Ingestion	ILCR Soil Dermal	ILCR Soil Dust Inhalation	ILCR Site Soil Ingestion	ILCR Caribou Ingestion	ILCR Hare Ingestion	ILCR Fish Ingestion	ILCR Water Ingestion	ILCR Food Intake	ILCR Water Dermal
Inorganics										
Beryllium	--	--	5.60E-11	--	--	--	--	--	--	-

-- = Parameter not evaluated for this pathway