

Appendix E

Calculated Risk - Residential Exposures

Inhalation - Assuming Vapour Phase

CPWE Emissions Only

General Data/ Equations	Exposure Parameters (RME) Inhalation by Adult Resident			Exposure Parameters (RME) Inhalation by Young Child Resident (0-5 years)			Exposure Parameters (RME) Inhalation by Infant (0-1 yrs)		
Exposure Parameters									
Exposure Frequency (EF) [days/year]	337	Exposure every day minus holiday time		337	Exposure every day minus holiday time		337	Exposure every day minus holiday time	
Exposure Duration (ED) [years]	2	Remediation expected to take place over 2 yrs		2	Remediation expected to take place over 2 yrs		1	Period of exposure as an infant	
Body Weight (BW) [kg]	70	USEPA 1989 and CSMS 1996		13.2	NEPM 1999 and CSMS 1996		6	Average weight of 6 month old child	
Averaging Time - NonThreshold (ATc) [days]	25550	USEPA 1989 and CSMS 1996		25550	USEPA 1989 and CSMS 1996		25550	USEPA 1989 and CSMS 1996	
Averaging Time - Threshold (ATn) [days]	730	USEPA 1989 and CSMS 1996		730	USEPA 1989 and CSMS 1996		365	USEPA 1989 and CSMS 1996	
Inhalation Rate (InhR) [m ³ /hour]	1.34	Inhalation rate assuming 20 hours indoors at 1.17 m ³ /hr and 4 hours outdoors at 2.2 m ³ /hr		0.58	Inhalation rate assuming 20 hours indoors at 0.45 m ³ /hr and 4 hours outdoors at 1.25 m ³ /hr		0.19	Daily inhalation rate for children less than 1 year old as per USEPA 1997.	
Exposure Time (ET) [hours/day]	24	Assume 24 hours at home		24	Assume 24 hours at home		24	Assume 24 hours at home	
Fraction Inhaled from Contaminated Source (FI) [-]	1	Assume intake from source for whole time		1	Assume intake from source for whole time		1	Assume intake from source for whole time	
Intake Factor = $\frac{InhR \cdot ET \cdot FI \cdot EF \cdot ED}{BW \cdot AT}$	1.2E-02	NonThreshold		2.8E-02	NonThreshold		9.9E-03	NonThreshold	
[m³/kg/day]	4.2E-01	Threshold		9.8E-01	Threshold		6.9E-01	Threshold	

Daily Intake from Air = Concentration in Air x Intake Factor

NonThreshold Risk = Daily Intake from Air for NonThreshold Effects x Slope Factor

Hazard Quotients = (Daily Intake from Air for Threshold Effects/(ADI-background))

Chemical	Concentration			Concentration			Concentration		
	Daily Intake			Daily Intake			Daily Intake		
	in Air	Daily Intake from Air - NonThreshold	Daily Intake from Air - Threshold	in Air	Daily Intake from Air - NonThreshold	Daily Intake from Air - Threshold	in Air	Daily Intake from Air - NonThreshold	Daily Intake from Air - Threshold
	(mg/m ³)	(mg/kg/day)	(mg/kg/day)	(mg/m ³)	(mg/kg/day)	(mg/kg/day)	(mg/m ³)	(mg/kg/day)	(mg/kg/day)
tetrachloroethene (PCE)	4.58E-06		1.9E-06	4.58E-06		4.5E-06	4.58E-06		3.2E-06
trichloroethene (TCE)	1.26E-06	1.5E-08		1.26E-06	3.5E-08		1.26E-06	1.2E-08	
cis-1,2-dichloroethene	7.77E-07		3.3E-07	7.77E-07		7.6E-07	7.77E-07		5.4E-07
trans-1,2-dichloroethene	8.17E-08		3.5E-08	8.17E-08		8.0E-08	8.17E-08		5.7E-08
1,1-dichloroethene	2.22E-07		9.4E-08	2.22E-07		2.2E-07	2.22E-07		1.5E-07
vinyl chloride (lifetime exposures)	3.03E-07	3.7E-09		3.03E-07	8.5E-09		3.03E-07	3.0E-09	
vinyl chloride (adulthood)	3.03E-07	3.7E-09		3.03E-07	8.5E-09		3.03E-07	3.0E-09	
1,1,2-trichloroethane	2.76E-07		1.2E-07	2.76E-07		2.7E-07	2.76E-07		1.9E-07
1,2-dichloroethane (EDC)	2.04E-08	2.5E-10		2.04E-08	5.7E-10		2.04E-08	2.0E-10	
1,1-dichloroethane	6.44E-08		2.7E-08	6.44E-08		6.3E-08	6.44E-08		4.5E-08
chloroform	5.07E-08	6.2E-10	2.2E-08	5.07E-08	1.4E-09	5.0E-08	5.07E-08	5.0E-10	3.5E-08
dichloromethane	5.81E-08		2.5E-08	5.81E-08		5.7E-08	5.81E-08		4.0E-08
chloromethane	1.71E-07		7.3E-08	1.71E-07		1.7E-07	1.71E-07		1.2E-07
hexachloroethane (HCE)	4.01E-08		1.7E-08	4.01E-08		3.9E-08	4.01E-08		2.8E-08
pentachlorobenzene	4.66E-09		2.0E-09	4.66E-09		4.6E-09	4.66E-09		3.2E-09
hexachlorobutadiene (HCBD)	1.32E-05		5.6E-06	1.32E-05		1.3E-05	1.32E-05		9.1E-06
hexachlorobenzene (HCB)	1.24E-07		5.3E-08	1.24E-07		1.2E-07	1.24E-07		8.6E-08
octachlorostyrene (OCS)	1.64E-08		7.0E-09	1.64E-08		1.6E-08	1.64E-08		1.1E-08
dioxin	9.65E-13		4.1E-13	9.65E-13		9.4E-13	9.65E-13		6.7E-13
mercury (as total, inorganic)	9.65E-07		4.1E-07	9.65E-07		9.4E-07	9.65E-07		6.7E-07
PCB	6.01E-10		2.6E-10	6.01E-10		5.9E-10	6.01E-10		4.2E-10

Maximum modelled air concentration from off-site receptors
Annual average

Maximum modelled air concentration from off-site receptors
Annual average

Maximum modelled air concentration from off-site receptors
Annual average

Inhalation - Assuming Vapour Phase

Baseline Emissions	Exposure Parameters (RME)			Exposure Parameters (RME)			Exposure Parameters (RME)		
General Data/ Equations	Inhalation by Adult Resident			Inhalation by Young Child Resident (0-5 years)			Inhalation by Infant (0-1 yrs)		
Exposure Parameters									
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Averaging Time - Threshold (ATn) [days]	730	USEPA 1989 and CSMS 1996		730	USEPA 1989 and CSMS 1996		365	USEPA 1989 and CSMS 1996	
Inhalation Rate (InhR) [m³/hour]	1.34	Inhalation rate assuming 20 hours indoors at 1.17 m³/hr and 4 hours outdoors at 2.2 m³/hr		0.58	Inhalation rate assuming 20 hours indoors at 0.45 m³/hr and 4 hours outdoors at 1.25 m³/hr		0.19	Daily inhalation rate for children less than 1 year old as per USEPA 1997.	
Exposure Time (ET) [hours/day]	24	Assume 24 hours at home		24	Assume 24 hours at home		24	Assume 24 hours at home	
Fraction Inhaled from Contaminated Source (FI) [-]	1	Assume intake from source for whole time		1	Assume intake from source for whole time		1	Assume intake from source for whole time	
Intake Factor = $\frac{InhR \cdot ET \cdot FI \cdot EF \cdot ED}{BW \cdot AT}$	1.2E-02	NonThreshold		2.8E-02	NonThreshold		9.9E-03	NonThreshold	
[m³/kg/day]	4.2E-01	Threshold		9.8E-01	Threshold		6.9E-01	Threshold	

Daily Intake from Air = Concentration in Air x Intake Factor
NonThreshold Risk = Daily Intake from Air for NonThreshold Effects x Slope Factor
Hazard Quotients = (Daily Intake from Air for Threshold Effects/(ADI-background))

Chemical	Concentration	Daily Intake		Concentration	Daily Intake		Concentration	Daily Intake	
	in Air	Daily Intake from Air - NonThreshold	Daily Intake from Air - Threshold	in Air	Daily Intake from Air - NonThreshold	Daily Intake from Air - Threshold	in Air	Daily Intake from Air - NonThreshold	Daily Intake from Air - Threshold
	(mg/m³)	(mg/kg/day)	(mg/kg/day)	(mg/m³)	(mg/kg/day)	(mg/kg/day)	(mg/m³)	(mg/kg/day)	(mg/kg/day)
tetrachloroethene (PCE)	1.12E-03		4.8E-04	1.12E-03		1.1E-03	1.12E-03		7.8E-04
trichloroethene (TCE)	3.84E-05	4.7E-07		3.84E-05	1.1E-06		3.84E-05	3.8E-07	
cis-1,2-dichloroethene									
trans-1,2-dichloroethene									
1,1-dichloroethene	1.37E-06		5.8E-07	1.37E-06		1.3E-06	1.37E-06		9.5E-07
vinyl chloride (lifetime exposures)	1.03E-05	1.2E-07		1.03E-05	2.9E-07		1.03E-05	1.0E-07	
vinyl chloride (adulthood)	1.03E-05	1.2E-07		1.03E-05	2.9E-07		1.03E-05	1.0E-07	
1,1,2-trichloroethane									
1,2-dichloroethane (EDC)	6.87E-06	8.3E-08		6.87E-06	1.9E-07		6.87E-06	6.8E-08	
1,1-dichloroethane									
chloroform	8.23E-06	1.0E-07	3.5E-06	8.23E-06	2.3E-07	8.1E-06	8.23E-06	8.1E-08	5.7E-06
dichloromethane	5.63E-08		2.4E-08	5.63E-08		5.5E-08	5.63E-08		3.9E-08
chloromethane									
hexachloroethane (HCE)	9.62E-05		4.1E-05	9.62E-05		9.4E-05	9.62E-05		6.7E-05
pentachlorobenzene									
hexachlorobutadiene (HCBD)	7.41E-07		3.1E-07	7.41E-07		7.3E-07	7.41E-07		5.1E-07
hexachlorobenzene (HCB)	5.98E-09		2.5E-09	5.98E-09		5.9E-09	5.98E-09		4.1E-09
octachlorostyrene (OCS)									
dioxin	4.52E-13		1.9E-13	4.52E-13		4.4E-13	4.52E-13		3.1E-13
mercury (as total, inorganic)	8.87E-08		3.8E-08	8.87E-08		8.7E-08	8.87E-08		6.1E-08
PCB									

↑
Maximum modelled air concentration from off-site receptors
Annual average

↑
Maximum modelled air concentration from off-site receptors
Annual average

↑
Maximum modelled air concentration from off-site receptors
Annual average

Summary of Risk - All chemicals Inhalation Exposures

Intake and Risk Associated with CPWE Emissions Only

Chemical	Non-Threshold Slope Factor (mg/kg-day) ⁻¹	Intake from CPWE Only (mg/kg/day) - Non-Threshold			Intake from CPWE Only (mg/kg/day) - Non-Threshold		
		Adult Residents	Child Residents	Infants	Adult Residents	Child Residents	Infants
trichloroethene (TCE)	1.5E-03	1.5E-08	3.5E-08	1.2E-08	2.3E-11	5.3E-11	1.9E-11
vinyl chloride (lifetime exposures)	3.1E-02	3.7E-09	8.5E-09	3.0E-09	1.1E-10	2.6E-10	9.2E-11
vinyl chloride (adulthood)	1.5E-02						
1,2-dichloroethane (EDC)	9.8E-03	2.5E-10	5.7E-10	2.0E-10	2.4E-12	5.6E-12	2.0E-12
chloroform	1.5E-03	6.2E-10	1.4E-09	5.0E-10	9.0E-13	2.1E-12	7.4E-13
TOTAL NON-THRESHOLD RISK					1E-10	3E-10	1E-10

Intake Associated with Baseline Emissions and Cumulative Risks

Chemical	Non-Threshold Slope Factor (mg/kg-day) ⁻¹	Intake from Other Sources (mg/kg/day) - Non-Threshold			Calculated Non-Threshold Risk All Sources		
		Adult Residents	Child Residents	Infants	Adult Residents	Child Residents	Infants
trichloroethene (TCE)	1.5E-03	4.7E-07	1.1E-06	3.8E-07	7.2E-10	1.7E-09	5.9E-10
vinyl chloride (lifetime exposures)	3.1E-02	1.2E-07	2.9E-07	1.0E-07	4.0E-09	9.1E-09	3.2E-09
vinyl chloride (adulthood)	1.5E-02						
1,2-dichloroethane (EDC)	9.8E-03	8.3E-08	1.9E-07	6.8E-08	8.2E-10	1.9E-09	6.7E-10
chloroform	1.5E-03	1.0E-07	2.3E-07	8.1E-08	1.5E-10	3.4E-10	1.2E-10
TOTAL NON-THRESHOLD RISK					6E-09	1E-08	5E-09

Summary of Risk - All chemicals
Inhalation Exposures
Intake and Risk Associated with CPWE Emissions Only

Chemical	Threshold ADI, TDI or RfD (mg/kg/day)	Intake (mg/kg/day) - Threshold			Intake (mg/kg/day) - Threshold		
		Adult Residents	Child Residents	Infants	Adult Residents	Child Residents	Infants
tetrachloroethene (PCE)	5.7E-02	1.9E-06	4.5E-06	3.2E-06	5.2E-05	1.2E-04	8.4E-05
cis-1,2-dichloroethene	1.0E-02	3.3E-07	7.6E-07	5.4E-07	3.3E-05	7.6E-05	5.4E-05
trans-1,2-dichloroethene	1.7E-02	3.5E-08	8.0E-08	5.7E-08	2.0E-06	4.7E-06	3.3E-06
1,1-dichloroethene	5.7E-02	9.4E-08	2.2E-07	1.5E-07	1.6E-06	3.8E-06	2.7E-06
1,1,2-trichloroethane	4.0E-03	1.2E-07	2.7E-07	1.9E-07	2.9E-05	6.8E-05	4.8E-05
1,1-dichloroethane	1.4E-01	2.7E-08	6.3E-08	4.5E-08	1.9E-07	4.4E-07	3.1E-07
chloroform	4.0E-02	2.2E-08	5.0E-08	3.5E-08	1.1E-06	2.5E-06	1.8E-06
dichloromethane	2.9E-01	2.5E-08	5.7E-08	4.0E-08	1.1E-07	2.5E-07	1.8E-07
chloromethane	5.1E-03	7.3E-08	1.7E-07	1.2E-07	1.4E-05	3.3E-05	2.3E-05
hexachloroethane (HCE)	1.0E-03	1.7E-08	3.9E-08	2.8E-08	1.7E-05	3.9E-05	2.8E-05
pentachlorobenzene	1.0E-02	2.0E-09	4.6E-09	3.2E-09	2.0E-07	4.6E-07	3.2E-07
hexachlorobutadiene (HCBD)	2.0E-04	5.6E-06	1.3E-05	9.1E-06	2.8E-02	6.5E-02	4.6E-02
hexachlorobenzene (HCB)	1.6E-04	5.3E-08	1.2E-07	8.6E-08	3.3E-04	7.6E-04	5.4E-04
octachlorostyrene (OCS)	3.1E-04	7.0E-09	1.6E-08	1.1E-08	2.3E-05	5.2E-05	3.7E-05
dioxin	2.3E-09	4.1E-13	9.4E-13	6.7E-13	3.9E-04	8.9E-04	6.3E-04
mercury (as methyl mercury)	2.9E-04						
mercury (as total, inorganic)	2.9E-04	4.1E-07	9.4E-07	6.7E-07	2.9E-03	6.6E-03	4.7E-03
PCB	1.0E-05	2.6E-10	5.9E-10	4.2E-10	5.1E-05	1.2E-04	8.3E-05
TOTAL THRESHOLD RISK					1E-04	3E-04	2E-04
TOTAL THRESHOLD RISK (including multi-pathway exposures)					4E-02	9E-02	1E-01

Intake Associated with Baseline Emissions and Cumulative Risks

Chemical	Intake Background (%)	Intake from Other Sources (mg/kg/day) - Threshold			Calculated Threshold HI for all Sources		
		Adult Residents	Child Residents	Infants	Adult Residents	Child Residents	Infants
tetrachloroethene (PCE)	34.0%	4.8E-04	1.1E-03	7.8E-04	1.3E-02	2.9E-02	2.1E-02
cis-1,2-dichloroethene	0.0%	0.0E+00	0.0E+00	0.0E+00	3.3E-05	7.6E-05	5.4E-05
trans-1,2-dichloroethene	0.0%	0.0E+00	0.0E+00	0.0E+00	2.0E-06	4.7E-06	3.3E-06
1,1-dichloroethene	0.0%	5.8E-07	1.3E-06	9.5E-07	1.2E-05	2.7E-05	1.9E-05
1,1,2-trichloroethane	0.0%	0.0E+00	0.0E+00	0.0E+00	2.9E-05	6.8E-05	4.8E-05
1,1-dichloroethane	0.0%	0.0E+00	0.0E+00	0.0E+00	1.9E-07	4.4E-07	3.1E-07
chloroform	50.0%	3.5E-06	8.1E-06	5.7E-06	1.8E-04	4.1E-04	2.9E-04
dichloromethane	20.0%	2.4E-08	5.5E-08	3.9E-08	2.1E-07	4.9E-07	3.5E-07
chloromethane	0.0%	0.0E+00	0.0E+00	0.0E+00	1.4E-05	3.3E-05	2.3E-05
hexachloroethane (HCE)	0.0%	4.1E-05	9.4E-05	6.7E-05	4.1E-02	9.4E-02	6.7E-02
pentachlorobenzene	0.0%	0.0E+00	0.0E+00	0.0E+00	2.0E-07	4.6E-07	3.2E-07
hexachlorobutadiene (HCBD)	0.0%	3.1E-07	7.3E-07	5.1E-07	3.0E-02	6.8E-02	4.8E-02
hexachlorobenzene (HCB)	0.0%	2.5E-09	5.9E-09	4.1E-09	3.5E-04	8.0E-04	5.6E-04
octachlorostyrene (OCS)	0.0%	0.0E+00	0.0E+00	0.0E+00	2.3E-05	5.2E-05	3.7E-05
dioxin	54.0%	1.9E-13	4.4E-13	3.1E-13	5.7E-04	1.3E-03	9.3E-04
mercury (as methyl mercury)	15.0%						
mercury (as total, inorganic)	50.0%	3.8E-08	8.7E-08	6.1E-08	3.1E-03	7.2E-03	5.1E-03
PCB	50.0%	0.0E+00	0.0E+00	0.0E+00	5.1E-05	1.2E-04	8.3E-05
TOTAL THRESHOLD RISK					1E-02	3E-02	2E-02
TOTAL THRESHOLD RISK (including multi-pathway exposures)					1E-01	2E-01	2E-01

1.3E-03 Calculated risk for persistent and bioaccumulative chemicals included in multipathway calculations - not included in sum presented