

APPENDIX B

CHRONIC AND ACUTE TOXICITY CRITERIA COMPILED FOR COMPOUNDS NOT INCLUDED IN USEPA'S HHRAP

APPENDIX B

CHRONIC AND ACUTE HUMAN HEALTH TOXICITY CRITERIA COMPILED FOR COMPOUNDS NOT INCLUDED IN USEPA'S HHRAP

Human health toxicity criteria were used in the risk assessment to evaluate the potential for both long-term, chronic and short-term, acute health risks. The chronic toxicity criteria used in the risk assessment included oral cancer slope factors and inhalation unit risk factors for predicting excess lifetime cancer risks, and oral reference doses (RfDs) and inhalation reference concentrations (RfCs) for predicting the potential for long-term non-cancer effects. The acute toxicity criteria consisted of acute reference air concentrations.

The toxicity criteria were compiled, where available, for each evaluated compound directly from the 2005 U.S. Environmental Protection Agency (USEPA) Human Health Risk Assessment Protocol (HHRAP) chemical-specific database. The information in this USEPA database is programmed into the IRAP software.¹ If toxicity criteria were not available from HHRAP, they were compiled using a hierarchy of toxicity data sources recommended by HHRAP.

This appendix presents the toxicity criteria that were compiled for compounds not already in USEPA's HHRAP database. Table 1 lists the chronic human health toxicity criteria compiled for this project, as well as the basis for each value. Table 2 lists the acute reference air concentrations compiled for this project, also including the basis for each value.

In addition, the oral cancer slope factors for two hexachlorodibenzodioxin congeners (1,2,3,6,7,8-HxCDD and 1,2,3,7,8,9-HxCDD) were corrected from the values listed in HHRAP (and which were entered in the IRAP software exactly as indicated in HHRAP). HHRAP and IRAP include an oral cancer slope factor of $0.0062 \text{ (mg/kg-day)}^{-1}$ for these two PCDD/PCDF congeners, however, USEPA's Integrated Risk Information System (IRIS) lists the slope factor as $6,200 \text{ (mg/kg-day)}^{-1}$. The IRIS value was thus entered into IRAP.

Finally, three additional toxicity values were entered into the IRAP software for compounds discussed in HHRAP, but for which the HHRAP chemical-specific database lists "no data". A "no data" entry in HHRAP results in a "0" entry in the IRAP software. First, the USEPA-specified 2,3,7,8-TCDD oral cancer slope factor of $1.5\text{E}+5 \text{ (mg/kg-day)}^{-1}$ was multiplied by the toxic equivalency factor (TEF) for each PCDD/PCDF congener (except the two HxCDDs noted above) and then this product was entered as the oral cancer slope factor into IRAP for each PCDD/PCDF congener. This enabled the IRAP program to calculate oral cancer risks for the mixture of PCDDs/PCDFs using the 2,3,7,8-TCDD slope factor in conjunction with 2,3,7,8-TCDD toxic equivalency factors. Second, an inhalation unit risk factor for 2,3,7,8-TCDD of $33 \text{ (}\mu\text{g/m}^3\text{)}^{-1}$ from USEPA's 1997 Health Effects Assessment Summary Tables was multiplied by the toxic equivalency factor (TEF) and then this product was entered for each PCDD/PCDF congener (except the two

¹ The IRAP software, which was programmed by Lakes Environmental to implement the 2005 HHRAP methodology, was used to perform the risk assessment calculations for stack and fugitive air emissions.

HxCDDs noted above which have their own IRIS-identified inhalation values of 1.3 ($\mu\text{g}/\text{m}^3$)⁻¹). Third, the oral cancer slope factor of 2 ($\text{mg}/\text{kg}\cdot\text{day}$)⁻¹ for Aroclor 1254 identified in the HHRAP report but not in its chemical-specific database was entered into IRAP. Polychlorinated biphenyls (PCBs) were evaluated in the risk assessment as Aroclor 1254 based on an evaluation of the PCB homologue distribution measured during the Performance Demonstration Test in accordance with HHRAP guidance. Additionally, Aroclor 1254 was selected over Aroclor 1016 because it has more conservative toxicity criteria.

Table 1
Compilation of Chronic Human Health Toxicity Criteria for Compounds Not Included in USEPA's 2005 HHRAP (a)

Toxicity Criteria							Sources for Toxicity Criteria				
CAS #	Compound name	Oral RfD (mg/kg/day)	Oral cancer slope factor (mg/kg/day) ⁻¹	Inhalation RfC (mg/m ³)	Inhalation unit risk factor (ug/m ³) ⁻¹	Health endpoint(s)	Oral RfD (mg/kg/day)	Oral cancer slope factor (mg/kg/day) ⁻¹	Inhalation RfC (mg/m ³)	Inhalation Unit risk factor (ug/m ³) ¹	Health endpoint(s)
563-58-6	1,1-Dichloropropene	NA	NA	NA	NA	NA					
95-63-6	1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA					
142-28-9	1,3-Dichloropropane	0.02	NA	0.07	NA	Liver/ Kidney	PPRTV		RTR (b)		PPRTV
108-60-1	2,2'-oxybis (1-Chloropropane)	0.04	NA	0.14	NA	Blood	IRIS		RTR (b)		IRIS
594-20-7	2,2-Dichloropropane	NA	NA	NA	NA	NA					
625-86-5	2,5-Dimethylfuran	NA	NA	NA	NA	NA					
2216-30-0	2,5-Dimethylheptane	NA	NA	NA	NA	NA					
17559-81-8	2,5-Dione, 3-hexene	NA	NA	NA	NA	NA					
78-93-3	2-Butanone	0.6	NA	5	NA	Developmental/ Reproductive System	IRIS		IRIS		IRIS
95-49-8	2-Chlorotoluene	0.02	NA	0.07	NA	Body Weight	IRIS		RTR (b)		IRIS
591-78-6	2-Hexanone	NA	NA	NA	NA	NA					
3221-61-2	2-Methyl octane	NA	NA	NA	NA	NA					
91-57-6	2-Methylnaphthalene	0.004	NA	0.014	NA	Respiratory tract	IRIS		RTR (b)		IRIS
34246-54-3	3-Ethyl benzaldehyde	NA	NA	NA	NA	NA					
763-93-9	3-Hexen-2-one	NA	NA	NA	NA	NA					
625-33-2	3-Penten-2-one (ethylidene acetone)	NA	NA	NA	NA	NA					
141-79-7	3-Penten-2-one, 4-methyl	NA	NA	NA	NA	NA					
534-52-1	4,6-Dinitro-2-methylphenol	0.004	NA	0.014	NA	Nervous System	ATSDR		RTR (b)		ASTDR
106-43-4	4-Chlorotoluene	0.07	NA	0.245	NA	Liver/ Kidney	PPRTV		RTR (b)		PPRTV
4748-78-1	4-Ethyl benzaldehyde	NA	NA	NA	NA	NA					
301-02-0	9-Octadecenamide (oleamide)	NA	NA	NA	NA	NA					
208-96-8	Acenaphthylene	NA	NA	NA	NA	NA					
7429-90-5	Aluminum	1	NA	0.005	NA	Developmental/ Nervous system	PPRTV		PPRTV		PPRTV
92-87-5	Benzidine	0.003	230	NA	0.067	Urinary/ Nervous System/ Liver	IRIS	IRIS		IRIS	IRIS
192-97-2	Benzo(e)pyrene	NA	NA	NA	NA	NA					
191-24-2	Benzo(g,h,i)perylene	NA	NA	NA	NA	NA					
93-58-3	Benzoic acid, methyl ester (methyl benzoate)	NA	NA	NA	NA	NA					
111-91-1	Bis(2-chloroethoxy) methane	0.003	NA	0.0105	NA	Liver	PPRTV		RTR (b)		PPRTV
108-86-1	Bromobenzene	NA	NA	NA	NA	NA					
74-97-5	Bromochloromethane	NA	NA	NA	NA	NA					
104-51-8	Butylbenzene, n-	NA	NA	NA	NA	NA					
135-98-8	Butylbenzene, sec	NA	NA	NA	NA	NA					
98-06-6	Butylbenzene, tert	NA	NA	NA	NA	NA					
86-74-8	Carbazole	NA	NA	NA	NA	NA					
7440-48-4	Cobalt	0.01	NA	0.0001	NA	Respiratory tract/ Blood	ATSDR		ASTDR		ATSDR
7440-50-8	Copper	0.01	NA	0.035	NA	Gastrointestinal	ATSDR		RTR (b)		ATSDR
2303-16-4	Diallate	NA	NA	NA	NA	NA					
132-64-9	Dibenzofuran	0.001	NA	0.0035	NA	Organ (weight)	PPRTV		RTR (b)		PPRTV
122-39-4	Diphenylamine	0.025	NA	0.0875	NA	Body Weight/ Kidney/ Liver	IRIS		RTR (b)		IRIS

Table 1
Compilation of Chronic Human Health Toxicity Criteria for Compounds Not Included in USEPA's 2005 HHRAP (a)

Toxicity Criteria							Sources for Toxicity Criteria				
CAS #	Compound name	Oral RfD (mg/kg/day)	Oral cancer slope factor (mg/kg/day) ⁻¹	Inhalation RfC (mg/m ³)	Inhalation unit risk factor (ug/m ³) ⁻¹	Health endpoint(s)	Oral RfD (mg/kg/day)	Oral cancer slope factor (mg/kg/day) ⁻¹	Inhalation RfC (mg/m ³)	Inhalation Unit risk factor (ug/m ³) ¹	Health endpoint(s)
1031-07-8	Endosulfan sulfate	NA	NA	NA	NA	NA					
7421-93-4	Endrin aldehyde	NA	NA	NA	NA	NA					
53494-70-5	Endrin ketone	NA	NA	NA	NA	NA					
76-13-1	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	3	NA	10.5	NA	Nervous System			RTR (b)		IRIS
74-88-4	Iodomethane	NA	NA	NA	NA	NA					
99-87-6	Isopropyl toluene, p-	NA	NA	NA	NA	NA					
7439-96-5	Manganese	0.14	NA	0.00005	NA	Nervous System			IRIS		IRIS
62-75-9	N-nitrosodimethylamine	NA	51	NA	0.014	Liver		IRIS		IRIS	IRIS
198-55-0	Perylene	NA	NA	NA	NA	NA					
2240-47-3	Phosphine imide, P,P,P-triphenyl	NA	NA	NA	NA	NA					
103-65-1	Propylbenzene, n-	NA	NA	NA	NA	NA					
7440-62-2	Vanadium	0.003	NA	0.0002	NA	Respiratory tract/ Kidney			ATSDR		ATSDR
58-89-9	γ-BHC (Lindane)	0.0047	NA	NA	NA	Liver/blood	OPPTS HED (c)	OPPTS HED (c)		OPPTS HED (c)	OPPTS HED (c)
319-86-8	δ-BHC	0.083	NA	NA	NA	Liver	CPF (d)				CPF (d)
110-54-3	1-Hexane (n-hexane)	0.06	NA	0.7	NA	Nervous System	HEAST		IRIS		IRIS/HEAST
79-10-7	Acrylic Acid	0.5	NA	0.001	NA	Developmental/ Respiratory Tract	IRIS		IRIS		IRIS
107-21-1	Ethylene Glycol	2	NA	1.3	NA	Kidney	IRIS		ATSDR		IRIS
80-62-6	Methyl methacrylate	1.4	NA	0.7	NA	Organ(weight)/ Respiratory Tract	IRIS		IRIS		IRIS
1634-04-4	methyl tert-butyl ether	0.3	NA	3	NA	Liver/Kidney	ATSDR		IRIS		IRIS
75-56-9	Propylene oxide	NA	0.24	0.03	0.0000037	Gastrointestinal/ Respiratory Tract		IRIS	IRIS	IRIS	IRIS
33213-65-9	Endosulfan II	NA	NA	NA	NA	NA					
7446-09-5	Sulfur dioxide	NA	NA	0.078	NA	Respiratory Tract			NAAQS (e)		
10102-44-0	Nitrogen oxides	NA	NA	0.1	NA	Respiratory Tract			NAAQS (e)		
Additional Compounds Addressed in Fugitive Air Emissions Inhalation Risk Assessment											
106-99-0	1,3-Butadiene	--	--	2.00E-03	3.00E-05				IRIS	IRIS	
110-82-7	Cyclohexane	--	--	6	NA				IRIS		

NA = not available

-- = not applicable. Only the inhalation pathway of exposure was evaluated.

(a) Hierarchy for chronic toxicity data, based on 2005 HHRAP: 1) EPA's Integrated Risk Information System (IRIS); 2) EPA's provisional peer-reviewed toxicity values (PPRTV); 3) Other - a) CALEPA (California Environmental Protection Agency) chronic reference exposure level (REL) and unit risk factor (URF); b) Agency for Toxic Substances and Disease Registry (ATSDR) chronic minimum risk level (MRL); c) USEPA's 1997 Health Effects Assessment Summary Tables (HEAST).

(b) RTR = route to route extrapolation, based on Appendix A-2 of USEPA's 2005 HHRAP. RTR was conducted if an oral toxicity value was available but no inhalation toxicity value was available. Inhal RfC (mg/m³) = Oral RfD (mg/kg-day) * 70 kg BW / 20 m³/day. This assumes that the toxicity of the compound is equivalent when inhaled or ingested; this is used as an initial screening tool.

(c) OPPTS HED = USEPA's Office of Prevention, Pesticides and Toxic Substances, Health Effects Division. 2002. Revised HED Risk Assessment for Lindane. DP Barcode D280622. Reregistration case #0315. January 30, 2002.

(d) CPF = CPF Associates, Inc. 2006. Comments on Assessment of Lindane and Other Hexachlorocyclohexane Isomers. EPA-HQ-OPP-2006-0034. www.cpfassociates.com/pdf/HCH_Assessment_Comments_2006.pdf.

(e) NAAQS = National Ambient Air Quality Standard set under the U.S. Clean Air Act

Table 2

Compilation of Acute Inhalation Toxicity Criteria for Compounds Not Included in USEPA'S 2005 HHRAP

CAS Number	Compound	Toxicity Criteria Data Sources (a)				Acute Inhalation Reference Air Concentration Used in Risk Assessment (mg/m ³)
		AEGL-1 (mg/m ³) (b)	ERPG-1 (mg/m ³)	TEEL-1 (mg/m ³)	CALEPA Acute REL (mg/m ³)	
563-58-6	1,1-Dichloropropene			12.5		12.5
95-63-6	1,2,4-Trimethylbenzene	687		150		687
142-28-9	1,3-Dichloropropane			75		75
108-60-1	2,2'-oxybis (1-Chloropropane)			75		75
594-20-7	2,2-Dichloropropane			60		60
625-86-5	2,5-Dimethylfuran					NA
2216-30-0	2,5-Dimethylheptane			350 (d)		350
17559-81-8	2,5-Dione, 3-hexene					NA
78-93-3	2-Butanone (MEK)	589			13	13
95-49-8	2-Chlorotoluene			400		400
591-78-6	2-Hexanone			40		40
3221-61-2	2-Methyl octane					NA
91-57-6	2-Methylnaphthalene			20		20
34246-54-3	3-Ethyl benzaldehyde			150 (c)		150
763-93-9	3-Hexen-2-one					NA
625-33-2	3-Penten-2-one (ethylidene acetone)					NA
141-79-7	3-Penten-2-one, 4-methyl (mesityl oxide)			100		100
534-52-1	4,6-Dinitro-2-methylphenol (4,6-dinitro-o-cresol)			0.2		0.2
106-43-4	4-Chlorotoluene			350		350
4748-78-1	4-Ethyl benzaldehyde			150 (c)		150
301-02-0	9-Octadecenamide (oleamide)					NA
208-96-8	Acenaphthylene			0.2		0.2
7429-90-5	Aluminum			30		30
92-87-5	Benzidine			0.5		0.5
192-97-2	Benzo(e)pyrene					NA
191-24-2	Benzo(g,h,i)perylene			30		30
93-58-3	Benzoic acid, methyl ester (methyl benzoate)					NA
111-91-1	Bis(2-chloroethoxy) methane			15		15
108-86-1	Bromobenzene			15		15
74-97-5	Bromochloromethane			3000		3000
104-51-8	Butylbenzene, n-			125		125
135-98-8	Butylbenzene, sec			25		25
98-06-6	Butylbenzene, tert			125		125
86-74-8	Carbazole			2.5		2.5
7440-48-4	Cobalt			3		3
7440-50-8	Copper				0.1	0.1
2303-16-4	Diallate					NA
132-64-9	Dibenzofuran			30		30
122-39-4	Diphenylamine			30		30
1031-07-8	Endosulfan sulfate					NA
7421-93-4	Endrin aldehyde					NA
53494-70-5	Endrin ketone					NA
76-13-1	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)			10000		10000
74-88-4	Iodomethane (methyl iodide)		145			145
99-87-6	Isopropyl toluene, p-					NA
7439-96-5	Manganese			3		3
62-75-9	N-nitrosodimethylamine			10		10
198-55-0	Perylene					NA

Table 2

Compilation of Acute Inhalation Toxicity Criteria for Compounds Not Included in USEPA'S 2005 HHRAP

CAS Number	Compound	Toxicity Criteria Data Sources (a)				Acute Inhalation Reference Air Concentration Used in Risk Assessment (mg/m ³)
		AEGL-1 (mg/m ³) (b)	ERPG-1 (mg/m ³)	TEEL-1 (mg/m ³)	CALEPA Acute REL (mg/m ³)	
2240-47-3	Phosphine imide, P,P,P-triphenyl					NA
103-65-1	Propylbenzene, n- (isocumene)			400		400
7440-62-2	Vanadium			0.15		0.15
58-89-9	γ-BHC (Lindane)			1.5		1.5
319-86-8	δ-BHC					NA
110-54-3	1-Hexane (n-hexane)			1,500		1,500
79-10-7	Acrylic Acid	4.4	5.9		6	6.0
107-21-1	Ethylene Glycol			100		100
80-62-6	Methyl methacrylate	70				70
1634-04-4	methyl tert-butyl ether	180				180
75-56-9	Propylene oxide	173			3.1	3.1
7446-09-5	Sulfur dioxide				0.66	0.66
10102-44-0	Nitrogen dioxide				0.47	0.47
33213-65-9	Endosulfan II					NA
<i>Additional Compounds Addressed in Fugitive Air Emissions Inhalation Risk Assessment</i>						
106-99-0	1,3-Butadiene	1,480				1,480
110-82-7	Cyclohexane			1,000		1,000

Abbreviations:

HHRAP = USEPA's 2005 Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

NA = Acute inhalation values were not available from the referenced data sources.

(a) Hierarchy for acute inhalation toxicity criteria, based on 2005 HHRAP: 1) CALEPA RELs, 2) USEPA AEGL-1, 3) ERPG-1, and 4) TEEL-1. Definitions are provided below:

CALEPA REL = California Environmental Protection Agency Acute Reference Exposure Level. The acute REL is the concentration level at or below which no adverse health effects are anticipated for a 1-hour exposure duration.

USEPA AEGL-1 = Acute exposure guideline level developed by USEPA. The AEGL-1 is the 1-hour average concentration in air below which mild transient effects (e.g., irritation) are not expected to occur in the general population, including susceptible individuals, but above which such transient effects might occur. AEGLs are developed to evaluate intermittent, short-term exposures.

ERPG-1: The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor.

TEEL-1: The maximum airborne concentration below which it is believed that nearly all individuals could be exposed without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor.

(b) All listed AEGLs are interim values except for methyl tert butyl ether and 1,2,4-trimethylbenzene which are proposed AEGLs.

(c) TEEL-1 is for 2-ethyl benzaldehyde, no value was available for 3- or 4-ethyl benzaldehyde.

(d) TEEL-1 is for 2,2-dimethylheptane, no value was available for 2,5-dimethylheptane.