
APPENDIX K

LCIA SUPPORTING TABLES

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Table K-1. Fuel conversion factors

Fuel	Heat Value (H) (MJ/L)	Reference	Density (D) (kg/L)	Reference
Fuel oil # 2 (distillate)	36.739	(1)	0.843	(2)
Fuel oil # 6 (residual)	38.579	(1)	0.944	(2)
Fuel oil # 4 (average # 2 & # 6)	37.659	(1)	0.894	(2)
Liquified natural gas (LNG) ^a	21.185	(3)	0.412	(4)
Liquified petroleum gas (LPG)	23.276	(1)	0.542	(2)
Natural gas	0.034	(5)	7.58x 10 ⁻⁴	(6)

^a At -260 ° F; 1 ft³ of liquid methane = 630 ft³ of gaseous methane.

References:

1. Davis, S.C. 1999. *Transportation Energy Data Book, Edition 19*. 1999. Center for Transportation Analysis, Oak Ridge National Laboratory, ORNL 6958, Appendix B, Table B1. Oak Ridge, Tennessee. September.
2. Energy Information Administration (EIA) 1999. *International Energy Annual 1997*. U.S. Department of Energy. DOE/EIA-0219 (97), Washington, DC. April.
3. Natural Gas Vehicle Quick Reference Fuel Guide. http://naturalfuels.com/quick_ref_fuel_guide.htm. Downloaded 8/25/00.
4. Perry, R.H. and Green, D. (Eds.) 1984. *Perry's Chemical Engineer's Handbook*, 6th Edition, page 9-14. McGraw Hill, Inc., New York, NY.
5. Based on: Wang, M. 1999. *The Greenhouse Gases, Regulated Emissions, and energy Use in Transportation (GREET) Model*, Version 1.5. Argonne National Laboratory, University of Chicago.
6. Calculated from: Perry, R.H. and D. Green (Eds.) 1984. *Perry's Chemical Engineer's Handbook*, 6th Edition, page 9-15, Table 9-13, and p. 9-16, Table 9-14. McGraw-Hill, Inc., New York, NY.

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Table K-2. Global warming potentials (GWP)

Chemical	Synonym	CAS #	GWP ^a
carbon dioxide	CO ₂	124-38-9	1
trifluoromethane	HFC-23	75-46-7	11,700
difluoromethane	HFC-32	75-10-5	650
methyl fluoride	HFC-41	593-53-3	150
1,1,1,2,2,3,4,5,5,5-decafluoropentane	HFC-43-10mee20.8	138495-42-8	1300
pentafluoroethane	HFC-125	354-33-6	2800
1,1,2,2-tetrafluoro-1,2-diiodoethane	HFC-134	359-35-3	1000
1,1,1,2-tetrafluoroethane	HFC-134a	811-97-2	1300
1,1-difluoroethane	HFC-152a	75-37-6	140
1,1,2-trifluoroethane	HFC-143	430-66-0	300
1,1,1-trifluoroethane	HFC-143a	420-46-2	3800
1,1,1,2,3,3,3-heptafluoropropane	HFC-227ea	431-89-0	2900
1,1,1,3,3,3-hexafluoropropane	HFC-236fa	690-39-1	6300
1,1,2,2,3-pentafluoropropane	HFC-245ca	679-86-7	560
sulfur hexafluoride	sulfur hexafluoride	2551-62-4	23,900
carbon tetrafluoride	perfluoromethane	75-73-0	6500
hexafluoroethane/Freon 116	perfluoroethane	76-16-4	9200
octafluoropropane	perfluoropropane	76-19-7	7000
decafluorobutane	perfluorobutane	355-25-9	7000
cyclooctafluorobutane	perfluorocyclobutane	115-25-3	8700
dodecafluoro-pentane	perfluoropentane	678-26-2	7500
tetradecafluorohexane	perfluorohexane	355-42-0	7400
methane	methane	74-82-8	21
nitrous oxide	nitrous oxide	10024-97-2	310

^a IPCC's 1995 GWP estimates, 100-year time horizon. Because of the difficulties in calculating indirect effects of CFCs and halons, no indirect values were included.

Source: Houghton *et al.* 1996.

Table K-3. Ozone depletion potentials (ODP)

Chemical	Synonym(s)	CAS #	Ozone Depletion Potential ^c	
			ODP ^a	ODP ^b
1,1,1-trichloroethane ^c	methyl chloroform	71-55-56	0.12	0.1
1,2,2-trichloroethane ^c	methyl chloroform	79-00-5	--	--
CFC-11 ^c	trichlorofluoromethane	75-69-4	1	1.0
CFC-113 ^c	trichlorotrifluoroethane	76-13-1	1.07	0.8
CFC-114 ^c	dichlorotetrafluoroethane	76-14-2	0.8	1.0
CFC-115 ^c	(mono)chloropentafluoroethane	76-15-3	0.5	0.6
CFC-12 ^c	dichlorodifluoromethane	75-71-8	1	1.0
CFC-13 ^c	chlorotrifluoromethane	75-72-9	1	1.0
CFC-111 ^c	pentachlorofluoroethane	354-56-3	--	1.0
CFC-112 ^c	tetrachlorodifluoroethane	76-12-0	--	1.0
CFC-211 ^c	heptachlorofluoropropane	N/A	--	1.0
CFC-212 ^c	hexachlorodifluoropropane	76564-99-3	--	1.0
CFC-213 ^c	pentachlorotrifluoropropane	2354-06-5	--	1.0
CFC-214 ^c	tetrachlorotetrafluoropropane	2268-46-4	--	1.0
CFC-215 ^c	trichloropentafluoropropane	4259-43-2	--	1.0
CFC-216 ^c	dichlorohexafluoropropane	661-97-2	--	1.0
CFC-217 ^c	monochloroheptafluoropropane	422-86-6	--	1.0
CHF2Br	HBFC-22B1; bromodifluoromethane	1511-62-2	0.74	--
carbon tetrachloride ^c	tetrachloromethane	56-23-5	1.08	1.1
HALON-1201	--	--	1.4	--
HALON-1202	difluorodibromomethane	75-61-6	1.25	--
HALON-1211 ^c	bromochlorodifluoromethane	353-59-3	4	3.0
HALON-1301 ^c	bromotrifluoromethane	75-63-8	16	10.0
HALON-2311	--	--	0.14	--
HALON-2401	--	--	0.25	--
HALON-2402 ^c	dibromotetrafluoroethane	124-73-2	7	6.0
HCFC-123 ^d	2,2-dichloro-1,1,1-trifluoroethane	306-83-2	0.02	0.02
HCFC-124 ^d	2-chloro-1,1,1,2-tetrafluoroethane	2837-89-0	0.022	0.02
HCFC-141b ^d	1,1-dichloro-1-fluoroethane	1717-00-6	0.11	0.1
HCFC-142b ^d	1-chloro-1,1-difluoroethane	75-68-3	0.065	0.06
HCFC-22 ^d	chlorodifluoromethane	75-45-6	0.055	0.05
HCFC-225ca ^d	3,3-dichloro-1,1,1,2,2-pentafluoropropane	442-56-0	0.025	--
HCFC-225cb ^d	1,3-dichloro-1,1,2,2,3-pentafluoropropane	507-55-1	0.033	--
bromomethane ^c	methyl bromide	74-83-9	0.6	0.7

^a Source: Heijungs *et al.* 1992.

^b Listed in Title VI of the 1990 Clean Air Act Amendments (CAAA).

^c Class I substance as listed in Title VI of the 1990 CAAA..

^d Class II substance as listed in Title VI of the 1990 CAAA. (Additional Class III substances listed in the CAAA but not listed here currently have no ODP data.)

^e Weight ratios, compared to CFC-11 = 1.

-- represents no data.

Table K-4. Photochemical oxidant creation potentials (POCP)

Chemical/Material	Synonym(s)	CAS #	POCP ^a
1,1,1-trichloroethane	methyl chloroform	71-55-6	0.021
1,2-dichloroethane	ethylene dichloride	107-06-2	0.021
acetone	--	67-64-1	0.178
acetylene	--	74-86-2	0.168
alcohols ^b	--	N/A	0.196
aldehydes ^b	--	N/A	0.443
benzene	--	71-43-2	0.189
caprolactam	aminocaproic lactum	105-60-2	0.761
chlorophenols ^b	--	20-05-3	0.761
crude oil ^b	--	8002-05-9	0.398
C _x H _y ^b	hydrocarbons	N/A	0.398
C _x H _y aliphatic ^b	aliphatic hydrocarbons	N/A	0.398
C _x H _y aromatic ^b	aromatic hydrocarbons	N/A	0.761
C _x H _y chloro ^b	chlorinated hydrocarbons	N/A	0.021
dichloromethane	methylene chloride	75-09-2	0.021
diethyl ether	ethyl ether	66-29-7	0.398
diphenyl	biphenyl	92-52-4	0.761
ethanol	ethyl alcohol	64-17-5	0.268
ethene	ethylene	74-85-1	1
ethylene glycol	--	107-21-1	0.196
ethylene oxide	--	75-21-8	0.377
formaldehyde	--	50-00-0	0.421
hexachlorobiphenyl	2,2',4,4',5'5'-hexachloro-1,1-biphenyl	35065-27-1	0.761
hydroxy compounds ^b	--	N/A	0.377
isopropanol	isopropyl alcohol; 2-propanol	67-63-0	0.196
ketones ^b	--	N/A	0.326
methane	--	74-82-8	0.007
methyl ethyl ketone	MEK	78-93-3	0.473
methyl mercaptan	--	74-93-1	0.377
naphthalene	--	91-20-3	0.761
non methane VOC ^b	--	N/A	0.416
PAH ^b	PAC; polycyclic aromatic hydrocarbons	N/A	0.761
pentane	--	109-66-0	0.408
petrol ^b	gasoline	N/A	0.398
phenol	--	108-95-2	0.761
phthalic acid anhydride	phthalic anhydride	85-44-9	0.761
propane	--	74-98-6	0.42
propene	propylene	115-07-1	1.03
propionaldehyde	propanal	123-38-6	0.603

Table K-4. Photochemical oxidant creation potentials (POCP)

Chemical/Material	Synonym(s)	CAS #	POCP ^a
styrene	vinyl benzene	100-42-5	0.761
terpentine ^b	--	N/A	0.377
tetrachloromethane	carbon tetrachloride	56-23-5	0.021
toluene	--	108-88-3	0.563
trichloroethene	trichloroethylene	79-01-6	0.066
vinyl acetate	--	108-05-4	0.223
vinyl chloride	--	75-01-4	0.021

Source: Heijungs *et al.* 1992.

-- represents no data.

Table K-5. Acidification potentials (AP)

Chemical	Synonym(s)	CAS #	AP ^a
ammonia	NH ₃	7664-41-7	1.88 ^b
hydrochloric acid	HCl	7647-01-0	0.88 ^b
hydrofluoric acid	hydrogen fluoride, HF	7664-39-3	1.6 ^b
nitric oxide	NO	10102-43-9	1.07 ^b
nitrogen dioxide	NO ₂	10102-44-0	0.7 ^b
nitrogen oxides	NO _x	N/A	0.7 ^b
sulfur dioxide	SO ₂	7446-09-5	1 ^b
sulfur oxides	SO _x	N/A	1 ^b
sulfur trioxide	SO ₃	7446-11-9	0.80 ^c
nitric acid	HNO ₃	7697-37-2	0.51 ^c
sulfuric acid	H ₂ SO ₄	7664-93-9	0.65 ^c
phosphoric acid	H ₃ O ₄ P	7664-38-2	0.98 ^c
hydrogen sulfide	H ₂ S	7783-06-4	1.88 ^c

^a Ratios per equal weights, compared to SO₂, SO_x = 1 for emissions to air.

^b Source: Heijungs *et al.* 1992.

^c Source: Hauschild and Wenzel 1997.

Table K-6. Eutrophication potential nutrient enrichment chemicals

Chemical/Parameter (releases to water)	Synonym	CAS #	EP ^a
COD	chemical oxygen demand	N/A	0.022 ^b
ammonia	NH ₃	7664-41-7	0.33 ^b
ammonium ion	NH ₄ ⁺	N/A	0.33 ^b
total nitrogen	N	N/A	0.42 ^b
phosphate	PO ₄ ⁻³	N/A	1.0 ^b
total phosphorus	P	N/A	3.06 ^b
nitrate	NO ₃ ⁻	NA	0.10 ^c

^a Ratios per equal weights, compared to phosphate = 1.

^b Source: Heijungs *et al.* 1992.

^c Source: Lindfors *et al.* 1995.

NOTE: Eutrophication potentials for releases to air are available but not used in this methodology because partitioning between air and water phases is not considered in this methodology.

Table K-7. Odor threshold values (OTV)

Chemical	Synonym(s)	CAS #	OTV (mg/m ³)
acetaldehyde	ethanal	75-07-0	0.00027 ^a
acetic acid	succinate	64-19-7	0.061 ^a
acetonitrile	methyl cyanide	75-05-8	<67 ^b
acetophenone	acetylbenzene	98-86-2	1.5 ^b
acrolein	2-propenal	107-02-8	0.069 ^a
acrylic acid	propenoic acid	79-10-7	0.27 ^b
acrylonitrile	vinyl cyanide	107-13-1	3.4 ^b
ammonia	NH ₃	7664-41-7	1.0 ^a
aniline	--	62-53-3	38 ^b
benzene	--	71-43-2	108 ^b
benzyl chloride	alpha-chlorotoluene	100-44-7	0.21 ^b
1,3-butadiene	butadiene	106-99-0	1 ^b
butanal	butyraldehyde	123-72-8	0.00084 ^a
butanoic acid	butyric acid	107-92-6	0.00035 ^a
1-butanol	butyl alcohol, -	71-36-3	0.077 ^a
2-butanone	methyl ethyl ketone	78-93-3	0.68 ^a
n-butylacetate	--	123-86-4	0.031 ^a
butylacrylate	--	141-32-2	0.0015 ^a
n-butylpropionate	--	590-01-2	0.086 ^a
carbon disulfide	CS ₂	75-15-0	0.18 ^a
carbon tetrachloride	tetrachloromethane	56-23-5	884 ^b
carbonyl sulfide	carbon oxysulfide	463-58-1	0.25 ^b
chlorine	--	7782-50-5	0.23 ^b
2-chloroacetophenone	phenyl chloromethyl ketone	532-27-4	0.1 - 0.7 ^b
chlorobenzene	--	108-90-7	1.0 ^a
chloroform	trichloromethane	67-66-3	650 ^b
m-cresol	3-methylphenol	108-93-4	0.00022 - 0.035 ^b
cumene	isopropylbenzene	98-82-8	0.04 ^b
decaline	veraline (-)form	14727-56-1	2.8 ^a
p-dichlorobenzene	1,4-dichlorobenzene	106-46-7	0.73 ^b
dichloromethane	methylene chloride	75-09-2	640 ^a
diethylamine	--	109-89-7	0.09 ^a
dimethylamine	--	124-40-3	0.0014 ^a
1,2-dimethylbenzene	o-xylene	95-47-6	0.78 ^a
1,3-dimethylbenzene	m-xylene	108-38-3	0.54 ^a
1,4-dimethylbenzene	p-xylene	106-42-3	0.52 ^a
1,1-dimethylhydrazine	N,N-dimethylhydrazine	57-14-7	15 - 65 ^b
dioxane	1,4-diethylene dioxide; 1,4-dioxane	123-91-1	2.9 ^b

Table K-8. Chemicals in the CDP inventory classified as potentially toxic

Cas #	Material	Chronic							Aquatic ecotoxicity	
		oral SF (mg/kg-day) ⁻¹	inhal SF (mg/kg-day) ⁻¹	WOE (EPA & IARC)(a)	oral NOAEL (b) (mg/kg-day)	inhal NOAEL (b) (mg/m ³)	oral LOAEL (b,c) (mg/kg-day)	inhal LOAEL (b,c) (mg/m ³)	fish LC50 (mg/L)	fish NOAEL (mg/L)
8486041	PPE [Polyphenylene ether]	--	--	--	--	--	--	--	XX	XX
123-38-6	Propionaldehyde	X	X	SAR3	X	200	X	X	44.0	11.0
115-07-1	Propylene	X	X	SAR0	X	9375	X	X	5.0	1.0
108-32-7	Propylene carbonate	--	--	--	--	--	--	--	XX	XX
57-55-6	propylene glycol	--	--	--	X	170	X	X	XX	XX
108-65-6	propylene glycol monomethyl ether acetate [1-Methoxy-2-propyl Acetate (glycol ether)]	--	--	--	--	--	--	--	XX	XX
129-00-0	Pyrene (category: PAH)	X	X	D	75	X	X	X	XX	XX
68784-83-8 (d)	Red phosphors	--	--	--	--	--	--	--	XX	XX
No CAS#	Red phosphors (Y ₂ O ₃ .S.Eu)	--	--	--	--	--	--	--	XX	XX
No CAS #	Rubidium (Rb ⁺)	--	--	--	--	--	--	--	--	--
7440-20-2	Scandium (Sc)	--	--	--	--	--	--	--	XX	XX
7782-49-2	Selenium (Se)	X	X	D	1.50e-02	X	X	X	XX	XX
7440-21-3	Silicon (Si)	--	--	--	--	--	--	--	XX	XX
7440-22-4	Silver	X	X	D	X	X	1.40e-02	X	4.00e-03	0.001
no CAS#	Silver compounds [Silver (Ag ⁺)]	X	X	D	X	X	1.40e-02	X	12.0	0.001
10588-01-9	Sodium Dichromate	X	X	3	X	X	0.18	0.25	XX	XX
2151247	Sodium Dichromate Dihydrate (VI)	--	--	--	--	--	--	--	XX	XX
13472-35-0	sodium dihydrogen phosphate dihydrate	--	--	--	--	--	--	--	XX	XX
7681-52-9	Sodium Hypochlorite	X	X	3	2.1	X	X	X	XX	XX
7681-57-4	Sodium Metabisulfite	X	X	3	--	--	--	--	XX	XX
7775-27-1	Sodium Persulfate	--	--	--	--	--	--	--	XX	XX
No CAS #	Strontium (Sr II)	--	--	--	190	X	X	X	--	--
7440-24-6	Strontium (Sr)	--	--	--	190	X	X	X	XX	XX
1633-05-2	Strontium carbonate	--	--	--	190	X	X	X	XX	XX
100-42-5	Styrene	X	X	C,2B	100	565	X	X	4.0	0.44
7446-09-5	Sulfur dioxide	X	X	3	X	0.104	X	X	XX	XX
2551-62-4	sulfur hexafluoride	--	--	--	--	--	--	--	XX	XX

Table K-8. Chemicals in the CDP inventory classified as potentially toxic

Cas #	Material	Chronic							Aquatic ecotoxicity	
		oral SF (mg/kg-day) ⁻¹	inhal SF (mg/kg-day) ⁻¹	WOE (EPA & IARC)(a)	oral NOAEL (b) (mg/kg-day)	inhal NOAEL (b) (mg/m ³)	oral LOAEL (b,c) (mg/kg-day)	inhal LOAEL (b,c) (mg/m ³)	fish LC50 (mg/L)	fish NOAEL (mg/L)
no CAS#	sulfur oxides (SO _x)	--	--	--	--	--	--	--	XX	XX
7664-93-9	sulfuric acid	X	X	1	X	0.1	X	X	31.0	2.0
10124-29-5	Sulfuric acid, aluminum salt	--	--	--	X	X	154	X	XX	XX
127-18-4	tetrachloroethylene	5.20e-02	2.00e-03	B2,2B	14	740.2	X	X	17.0	2.0
109-99-9	Tetrahydrofuran (THF)	--	--	--	782	0.2	X	X	XX	XX
75-59-2	Tetramethyl ammonium hydroxide (TMAH)	--	--	--	--	--	--	--	XX	XX
7440-28-0	Thallium (Tl)	--	--	--	--	--	--	--	XX	XX
7440-29-1	Thorium (Th)	X	X	A	--	--	--	--	XX	XX
7440-31-5	Tin (Sn)	--	--	--	--	--	--	--	626.0	62.6
No CAS #	Tin (Sn ⁺⁺ , Sn ⁴⁺)	--	--	--	--	--	--	--	626.0	62.6
7440-32-6	Titanium	X	X	C	X	0.8	1146	X	--	--
7550-45-0	Titanium tetrachloride	--	--	--	X	9.00e-03	X	X	25.0	1.0
108-88-3	Toluene	X	X	D,3	100	411.1	X	X	34.0	4.0
1025-15-6	triallyl isocyanurate	--	--	--	--	--	--	--	XX	XX
79-01-6	trichloroethylene (TCE)	1.10e-02	6.00e-03	B2,3	24	586.6	X	X	44.0	8.0
75-69-4	Trichlorofluoromethane (CFC 11)	--	--	--	X	X	349	X	XX	XX
1330-78-5	Tricresyl phosphate	--	--	--	--	--	--	--	XX	XX
112-27-6	Triethylene Glycol	--	--	--	X	X	1200	X	8.81e+04	8,810
115-86-6	Triphenyl phosphate	--	--	--	--	--	--	--	XX	XX
7440-33-7	Tungsten (W)	--	--	--	--	--	--	--	XX	XX
1344-59-8	U ₃ O ₈ (yellowcake)	--	--	--	--	--	--	--	XX	XX
7440-61-1	Uranium (U)	X	X	A1	0.2	X	X	X	XX	XX
7440-62-2	Vanadium (V)	--	--	--	3.00e-03	X	X	X	XX	XX
No CAS #	Vanadium (V ³⁺ , V ⁵⁺)	--	--	--	--	--	--	--	--	--
108-05-4	Vinyl acetate	X	X	SAR0	100	176	X	X	100	25.0
75-01-4	Vinyl chloride	1.4	3.08e-02	A,1	X	6.98e+04	X	X	143	36.0
1330-20-7	Xylene (C ₂ H ₃ O) [mixed isomers]	X	X	D	179	X	X	X	13	1.0
7440-66-6	Zinc (Zn)	X	X	D	0.9	X	1	X	9.00e-02	0.036
No CAS #	Zinc (Zn ⁺⁺)	--	--	--	--	--	--	--	17.0	--

Table K-8. Chemicals in the CDP inventory classified as potentially toxic

Cas #	Material	Chronic							Aquatic ecotoxicity	
		oral SF (mg/kg-day) ⁻¹	inhal SF (mg/kg-day) ⁻¹	WOE (EPA & IARC)(a)	oral NOAEL (b) (mg/kg-day)	inhal NOAEL (b) (mg/m ³)	oral LOAEL (b,c) (mg/kg-day)	inhal LOAEL (b,c) (mg/m ³)	fish LC50 (mg/L)	fish NOAEL (mg/L)
14940-68-2	Zircon sand [Zircon (Zr)]	--	--	--	--	--	--	--	XX	XX
7440-67-7	Zirconium (Zr)	--	--	--	3,494	X	X	X	XX	XX

Key:

(a)=See Table 3-3 in Section 3.1.2.12 for a description of WOE classifications.

(b)=only lowest value of the NOAEL (or LOAEL/10) is used to calculate chronic, non-cancer effects

(c)=LOAEL only needed if no NOAEL found

(d)=CAS # was provided by a company, but could not be confirmed.

XX=aquatic toxicity data not needed because there are no waterborne releases of this chemical in the CDP LCIs.

X=data not needed because other data are provided to calculate impact score (e.g., LOAEL not needed if NOAEL provided, and WOE used if SF not available).

SAR0=not a probable carcinogen based on structure-activity relationship (SAR) evaluation.

SAR1=possible carcinogen based on SAR evaluation.

-- =no data available, defaulted to mean hazard value (see Section 3.1.2.12 for an explanation of hazard values).

Sources:

- Oral and inhalation slope factors (SF): Integrated Risk Information System (IRIS) or Health Effects Assessment Summary Tables (HEAST) (EPA, 1994) as cited in Risk Assessment Information System (RAIS): http://risk.lsd.ornl.gov/rap_hp.shtml.
- Weight of Evidence (WOE): IRIS Web site (<http://www.epa.gov/IRIS>).
- Oral no observable adverse effect level (NOAEL), inhalation NOAEL, oral lowest observable adverse effect level (LOAEL) and inhalation LOAEL: IUCLID, 1996; HEAST, 1994; Kincaid and Geibig, 1998; EPA, 2000a; SRC, 2000; EPA, 2000b; Geibig and Swanson, 2000; Sax and Lewis, 1987; NIOSH, 1978; EPA, 1984; and EPA, 1987.
- Fish LC50 and fish NOAEL: EPA, 2001; HSDB; Davis et al. 1994, Appendix E; and Geiger et al., 1984, 1985, 1986, 1988, 1990.

Table K-9. List of Materials Excluded from Toxic Classification

CAS #	Material	Reason for Exclusion ^a
NA	ABS plastic	judgment
21645-51-2	Aluminium Hydroxide (Al(OH) ₃)	GRAS
10043-01-3	Aluminium Sulfate (Al ₂ (SO ₄) ₃)	GRAS
10043-01-3	Aluminum Sulfate (Al ₂ (SO ₄) ₃)	GRAS
7440-37-1	Argon (Ar gas)	judgment
1302-78-9	Bentonite (Al ₂ O ₃ .4SiO ₂ .H ₂ O, in ground)	judgment
NA	BOD (Biological Oxygen Demand)	judgment
106-97-8	Butane (n-C ₄ H ₁₀)	GRAS
25167-67-3	Butene (1-CH ₃ CH ₂ CHCH ₂)	judgment
7440-70-2	Calcium (Ca)	judgment
No CAS #	Calcium (Ca ⁺⁺)	judgment
10043-52-4	Calcium Chloride (CaCl ₂)	judgment
1305-62-0	Calcium hydroxide [Ca(OH) ₂ , hydrated lime]	judgment
7778-18-9	Calcium Sulfate	judgment
124-38-9	Carbon Dioxide (CO ₂)	judgment
NA	Carbonate ion [Carbonates (CO ₃ ⁻⁻ , HCO ₃ ⁻ , CO ₂)]	judgment
NA	COD (Chemical Oxygen Demand)	judgment
16887-00-6	Chloride (Cl ⁻)	judgment
1318-74-7	Clay (in ground)	judgment
NA	Dissolved solids	judgment
No CAS #	Dolomite (CaCO ₃ .MgCO ₃ , in ground)	judgment
26265-08-7	Epoxy resin (PC Board-epoxy resin)	judgment
141-78-6	Ethyl acetate (C ₄ H ₈ O ₂)	GRAS
64-17-5	Ethanol (Ethyl Alcohol)	GRAS
7705-08-0	Ferric chloride (FeCl ₃)	GRAS
NA	Ferrite	judgment
No CAS #	Glass	judgment
7440-59-7	Helium (He)	GRAS
NA	Nonmethane hydrocarbons	judgment
NA	Hydrocarbons (unspecified)	judgment
1333-74-0	Hydrogen gas (H ₂)	judgment
14380-61-1	Hypochlorite (ClO ⁻)	judgment
20461-54-5	Iodide (I ⁻)	judgment
7553-56-2	Iodine (I)	judgment
7439-89-6	Iron (Fe)	judgment
No CAS #	Iron (Fe ⁺⁺ , Fe ³⁺)	judgment
7720-78-7	Iron Sulfate (FeSO ₄ , ore)	judgment
8008-20-6	Kerosene	judgment

Table K-9. List of Materials Excluded from Toxic Classification

CAS #	Material	Reason for Exclusion ^a
7439-90-9	Krypton Gas	judgment
No CAS #	Lignite (in ground)	judgment
1305-78-8	Lime	judgment
471-34-1	Limestone (CaCO ₃ , in ground)	judgment
7439-95-4	Magnesium (Mg)	judgment
No CAS #	Magnesium cmpds [Magnesium (Mg ⁺⁺)]	judgment
7440-01-9	Neon	judgment
7727-37-9	Nitrogen	GRAS
74-98-6	n-propane [Propane (C ₃ H ₈)]	GRAS
NA	Oil & grease	judgment
No CAS #	Olivine ((Mg,Fe) ₂ SiO ₄ , ore)	judgment
144-62-7	Oxalic Acid (C ₂ H ₂ O ₄)	judgment
7782-44-7	Oxygen (O ₂)	judgment
NA	Phosphates (PO ₄ -3)	judgment
9011-87-4	Poly(methyl methacrylate) [PMMA (Acrylic resin)]	judgment
25971-63-5	Polycarbonate resin	judgment
NA	Polycyclic Aromatic Hydrocarbons (PAH, unspecified)	judgment
9002-88-4	polyethylene (PE) foam, cushion	judgment
No CAS #	Polyimide Resin	judgment
9003-53-6	Polystyrene [Styrene, polymer (C ₈ H ₈)]	judgment
7440-09-7	Potassium (K)	judgment
No CAS #	Potassium (K ⁺)	judgment
584-08-7	Potassium carbonate (K ₂ CO ₃)	judgment
7447-40-7	Potassium Chloride (KCl, as K ₂ O, in ground)	judgment
79-09-4	Propionic Acid (CH ₃ CH ₂ COOH)	GRAS
1332-09-8	Pumice	judgment
1309-36-0	Pyrite (FeS ₂ , ore)	judgment
14808-60-7	Silica sand [Silicon dioxide (SiO ₂)]	GRAS
7440-23-5	Sodium (Na)	judgment
No CAS #	Sodium (Na ⁺)	judgment
497-19-8	Sodium carbonate (Na ₂ CO ₃ , soda ash)	judgment
7647-14-5	Sodium Chloride (NaCl, in ground or in sea)	GRAS
1310-73-2	Sodium hydroxide (NaOH)	judgment
9003-55-8	Styrene-butadiene copolymers (C ₁₂ H ₁₄)	judgment
14808-79-8	Sulfates (SO ₄ --)	judgment
18496-25-8	Sulfides (S--)	judgment
14265-45-3	Sulfites (SO ₃ --)	judgment
7704-34-9	Sulfur	judgment

Table K-9. List of Materials Excluded from Toxic Classification

CAS #	Material	Reason for Exclusion ^a
NA	Suspended Solids	judgment
14807-96-6	Talcum (4SiO ₂ .3MgO.H ₂ O, ore)	judgment
No CAS #	TOCs (Total organic compounds)	judgment

^a NOTES:

- (1) GRAS = Generally Regarded as Safe by the U.S. Food and Drug Administration.
- (2) Some materials were excluded based on judgement if they are nutrients: calcium, chloride, iodine, iron, magnesium, phosphorous, potassium, sodium (per the Risk Assessment Guidance for Superfund [RAGS], EPA/540/1-89/002, December 1989 and the RAGS Region IV update).
- (3) This list was reviewed by the U.S. EPA DFE Workgroup (Appendix C, Table C-2).

Table K-10. Chemicals used to calculate mean slope factor values for calculating carcinogenic hazard value

Chemical	CAS #	Oral Slope Factor (mg/kg-day) ⁻¹	Inhalation Slope Factor (mg/kg-day) ⁻¹
Acephate	30560-19-1	8.70E-03	
Acetaldehyde	75-07-0		7.70E-03
Acrylamide	79-06-1	4.50E+00	4.50E+00
Acrylonitrile	107-13-1	5.40E-01	2.40E-01
Alachlor	15972-60-8	8.00E-02	
Aldrin	309-00-2	1.70E+01	1.70E+01
Aniline	62-53-3	5.70E-03	
Aramite	140-57-8	2.50E-02	2.50E-02
Aroclor 1016	12674-11-2	4.00E-01	4.00E-01
Aroclor 1016	12674-11-2	2.00E+00	2.00E+00
Aroclor 1221	11104-28-2	4.00E-01	4.00E-01
Aroclor 1221	11104-28-2	2.00E+00	2.00E+00
Aroclor 1232	11141-16-5	4.00E-01	4.00E-01
Aroclor 1232	11141-16-5	2.00E+00	2.00E+00
Aroclor 1242	53469-21-9	4.00E-01	4.00E-01
Aroclor 1242	53469-21-9	2.00E+00	2.00E+00
Aroclor 1248	12672-29-6	4.00E-01	4.00E-01
Aroclor 1248	12672-29-6	2.00E+00	2.00E+00
Aroclor 1254	11097-69-1	4.00E-01	4.00E-01
Aroclor 1254	11097-69-1		2.00E+00
Aroclor 1260	11096-82-5	4.00E-01	4.00E-01
Aroclor 1260	11096-82-5	2.00E+00	2.00E+00
Arsenic, Inorganic	7440-38-2	1.50E+00	5.00E+01
Atrazine	1912-24-9	2.22E-01	
Azobenzene	103-33-3	1.10E-01	1.10E-01
Benz[a]anthracene	56-55-3	7.30E-01	3.10E-01
Benzene	71-43-2	5.50E-02	2.90E-02
Benzidine	92-87-5	2.30E+02	2.30E+02
Benzo[a]pyrene	50-32-8	7.30E+00	3.10E+00
Benzo[b]fluoranthene	205-99-2	7.30E-01	3.10E-01
Benzo[k]fluoranthene	207-08-9	7.30E-02	3.10E-02
Benzotrichloride	98-07-7	1.30E+01	
Benzyl Chloride	100-44-7	1.70E-01	
Beryllium and compounds	7440-41-7	4.30E+00	8.40E+00
Bis(2-chloro-1-methylethyl)ether (Technical)	108-60-1	7.00E-02	3.50E-02
Bis(2-chloroethyl)ether	111-44-4	1.10E+00	1.10E+00
Bis(2-ethylhexyl)phthalate	117-81-7	1.40E-02	

Table K-10. Chemicals used to calculate mean slope factor values for calculating carcinogenic hazard value

Chemical	CAS #	Oral Slope Factor (mg/kg-day)⁻¹	Inhalation Slope Factor (mg/kg-day)⁻¹
Bis(chloromethyl)ether	542-88-1	2.20E+02	2.20E+02
Bromodichloromethane	75-27-4	6.20E-02	
Bromoform	75-25-2	7.90E-03	3.90E-03
Butadiene, 1,3-	106-99-0		1.80E+00
Cadmium (Diet)	7440-43-9		6.10E+00
Cadmium (Water)	7440-43-9		6.10E+00
Captafol	2425-06-1	8.60E-03	
Captan	133-06-2	3.50E-03	
Carbazole	86-74-8	2.00E-02	
Carbon Tetrachloride	56-23-5	1.30E-01	5.30E-02
Chloranil	118-75-2	4.03E-01	
Chlordane	057-74-9	3.50E-01	1.30E+00
Chloro-2-methylaniline HCl, 4-	3165-93-3	4.60E-01	
Chloro-2-methylaniline, 4-	95-69-2	5.80E-01	
Chlorobenzilate	510-15-6	2.70E-01	2.70E-01
Chlorodibromoethane	73506-94-2	8.40E-02	
Chloroform	67-66-3	6.10E-03	8.10E-02
Chloromethane	74-87-3	1.30E-02	6.30E-03
Chloronitrobenzene, o-	88-73-3	2.50E-02	
Chloronitrobenzene, p-	121-73-3	1.80E-02	
Chloroethalonil	1897-45-6	1.10E-02	
Chromium VI (chromic acid mists)	18540-29-9		4.10E+01
Chromium VI (particulates)	18540-29-9		4.10E+01
Chrysene	218-01-9	7.30E-03	3.10E-03
Coke Oven Emissions	8007-45-2		2.20E+00
Crotonaldehyde, trans-	123-73-9	1.90E+00	
Cyanazine	21725-46-2	8.40E-01	
Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	2.30E-02	
DDD	72-54-8	2.40E-01	
DDE	72-55-9	3.40E-01	
DDT	50-29-3	3.40E-01	3.40E-01
Di(2-ethylhexyl)adipate	103-23-1	1.20E-03	
Diallate	2303-16-4	6.10E-02	
Dibenz[a,h]anthracene	53-70-3	7.30E+00	3.10E+00
Dibromo-3-chloropropane, 1,2-	96-12-8	1.40E+00	2.40E-03
Dibromochloromethane	124-48-1	8.40E-02	
Dibromoethane, 1,2-	106-93-4	8.50E+01	7.60E-01

Table K-10. Chemicals used to calculate mean slope factor values for calculating carcinogenic hazard value

Chemical	CAS #	Oral Slope Factor (mg/kg-day)⁻¹	Inhalation Slope Factor (mg/kg-day)⁻¹
Dichloro-2-butene, 1,4-	764-41-0		9.30E+00
Dichlorobenzene, 1,4-	106-46-7	2.40E-02	
Dichlorobenzidine, 3,3'-	91-94-1	4.50E-01	
Dichloroethane, 1,2-	107-06-2	9.10E-02	9.10E-02
Dichloroethylene, 1,1-	75-35-4	6.00E-01	1.20E+00
Dichloropropane, 1,2-	78-87-5	6.80E-02	
Dichloropropene, 1,3-	542-75-6	1.00E-01	1.40E-02
Dichlorvos	62-73-7	2.90E-01	
Dieldrin	60-57-1	1.60E+01	1.60E+01
Diethylstilbesterol	56-53-1	4.70E+03	4.90E+02
Dimethoxybenzidine, 3,3'-	119-90-4	1.40E-02	
Dimethylaniline HCl, 2,4-	21436-96-4	5.80E-01	
Dimethylaniline, 2,4-	095-68-1	7.50E-01	
Dimethylbenzidine, 3,3'-	119-93-7	9.20E+00	
Dimethylhydrazine, 1,1-	57-14-7	3.00E+00	1.72E+01
Dinitrotoluene Mixture, 2,4/2,6-	25321-14-6	6.80E-01	
Dinitrotoluene, 2,4-	121-14-2	6.80E-01	
Dinitrotoluene, 2,6-	606-20-2	6.80E-01	
Dioxane, 1,4-	123-91-1	1.10E-02	
Diphenylhydrazine, 1,2-	122-66-7	8.00E-01	8.00E-01
Direct Black 38	1937-37-7	8.60E+00	
Direct Blue 6	2602-46-2	8.10E+00	
Direct Brown 95	16071-86-6	9.30E+00	
Epichlorohydrin	106-89-8	9.90E-03	4.20E-03
Ethyl Acrylate	140-88-5	4.80E-02	
Ethylbenzene	100-41-4		3.85E-03
Ethylene Oxide	75-21-8	1.02E+00	3.50E-01
Ethylene Thiourea	96-45-7	1.10E-01	
Folpet	133-07-3	3.50E-03	
Fomesafen	72178-02-0	1.90E-01	
Formaldehyde	50-00-0		4.50E-02
Furazolidone	67-45-8	3.80E+00	
Furium	531-82-8	5.00E+01	
Furmecyclox	60568-05-0	3.00E-02	
Heptachlor	76-44-8	4.50E+00	4.50E+00
Heptachlor Epoxide	1024-57-3	9.10E+00	9.10E+00
Hexachlorobenzene	118-74-1	1.60E+00	1.60E+00

Table K-10. Chemicals used to calculate mean slope factor values for calculating carcinogenic hazard value

Chemical	CAS #	Oral Slope Factor (mg/kg-day)⁻¹	Inhalation Slope Factor (mg/kg-day)⁻¹
Hexachlorobutadiene	87-68-3	7.80E-02	7.80E-02
Hexachlorocyclohexane, Alpha-	319-84-6	6.30E+00	6.30E+00
Hexachlorocyclohexane, Beta-	319-85-7	1.80E+00	1.80E+00
Hexachlorocyclohexane, Gamma-	58-89-9	1.30E+00	
Hexachlorocyclohexane, Technical	608-73-1	1.80E+00	1.80E+00
Hexachlorodibenzo-p-dioxin, Mixture	19408-74-3	6.20E+03	4.55E+03
Hexachloroethane	67-72-1	1.40E-02	1.40E-02
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	1.10E-01	
HpCDD, 2,3,7,8-	37871-00-4	1.50E+03	1.50E+03
HpCDF, 2,3,7,8-	38998-75-3	1.50E+03	1.50E+03
HxCDD, 2,3,7,8-	34465-46-8	1.50E+04	1.50E+04
HxCDF, 2,3,7,8-	55684-94-1	1.50E+04	1.50E+04
Hydrazine	302-01-2	3.00E+00	1.70E+01
Hydrazine Sulfate	10034-93-2	3.00E+00	1.70E+01
Indeno[1,2,3-cd]pyrene	193-39-5	7.30E-01	3.10E-01
Isophorone	78-59-1	9.50E-04	
Methoxy-5-nitroaniline, 2-	99-59-2	4.60E-02	
Methyl Hydrazine	60-34-4	3.00E+00	1.72E+01
Methyl-5-Nitroaniline, 2-	99-55-8	3.30E-02	
Methylaniline Hydrochloride, 2-	636-21-5	1.80E-01	
Methylene Chloride	75-09-2	7.50E-03	1.65E-03
Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	1.30E-01	1.30E-01
Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	4.60E-02	
Methylenebisbenzenamine, 4,4'-	101-77-9	2.50E-01	
Mirex	2385-85-5	1.80E+00	
Nickel Refinery Dust	NA		8.40E-01
Nickel Subsulfide	12035-72-2		1.70E+00
Nitrofurazone	59-87-0	1.50E+00	
Nitropropane, 2-	79-46-9	9.50E+00	9.40E+00
Nitrosodiethanolamine, N-	1116-54-7	2.80E+00	
Nitrosodiethylamine, N-	55-18-5	1.50E+02	1.50E+02
Nitrosodimethylamine, N-	62-75-9	5.10E+01	5.10E+01
Nitroso-di-N-butylamine, N-	924-16-3	5.40E+00	5.40E+00
Nitroso-di-N-propylamine, N-	621-64-7	7.00E+00	
Nitrosodiphenylamine, N-	86-30-6	4.90E-03	
Nitrosomethylethylamine, N-	10595-95-6	2.20E+01	
Nitroso-N-ethylurea, N-	759-73-9	1.40E+02	

Table K-10. Chemicals used to calculate mean slope factor values for calculating carcinogenic hazard value

Chemical	CAS #	Oral Slope Factor (mg/kg-day) ⁻¹	Inhalation Slope Factor (mg/kg-day) ⁻¹
Nitrosopyrrolidine, N-	930-55-2	2.10E+00	2.10E+00
OCDD	3268-87-9	1.50E+02	1.50E+02
OCDF	39001-02-0	1.50E+02	1.50E+02
PeCDD, 2,3,7,8-	36088-22-9	7.50E+04	7.50E+04
PeCDF, 1,2,3,7,8-	57117-41-6	7.50E+04	7.50E+04
PeCDF, 2,3,4,7,8-	57117-31-4	7.50E+03	7.50E+03
Pentachloronitrobenzene	82-68-8	2.60E-01	
Pentachlorophenol	87-86-5	1.20E-01	
Phenylenediamine, o-	95-54-5	4.70E-02	
Phenylphenol, 2-	90-43-7	1.94E-03	
Polybrominated Biphenyls	59536-65-1	8.90E+00	
Polychlorinated Biphenyls (high risk)	1336-36-3	2.00E+00	2.00E+00
Polychlorinated Biphenyls (low risk)	1336-36-3	4.00E-01	4.00E-01
Polychlorinated Biphenyls (lowest risk)	1336-36-3	7.00E-02	
Prochloraz	67747-09-5	1.50E-01	
Propylene Oxide	75-56-9	2.40E-01	1.30E-02
Quinoline	91-22-5	1.20E+01	
Simazine	122-34-9	1.20E-01	
Sodium Diethyldithiocarbamate	148-18-5	2.70E-01	
Stirofos (Tetrachlorovinphos)	961-11-5	2.40E-02	
TCDD, 2,3,7,8-	1746-01-6	1.50E+05	1.50E+05
TCDF, 2,3,7,8-	51207-31-9	1.50E+04	1.50E+04
Tetrachloroethane, 1,1,1,2-	630-20-6	2.60E-02	2.60E-02
Tetrachloroethane, 1,1,2,2-	79-34-5	2.00E-01	2.00E-01
Tetrachloroethylene	127-18-4	5.20E-02	2.00E-03
Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	2.00E+01	
Toluene-2,4-diamine	95-80-7	3.20E+00	
Toluidine, o- (Methylaniline, 2-)	95-53-4	2.40E-01	
Toluidine, p-	106-49-0	1.90E-01	
Toxaphene	8001-35-2	1.10E+00	1.10E+00
Trichloroaniline HCl, 2,4,6-	33663-50-2	2.90E-02	
Trichloroaniline, 2,4,6-	634-93-5	3.40E-02	
Trichloroethane, 1,1,2-	79-00-5	5.70E-02	5.70E-02
Trichloroethylene	79-01-6	1.10E-02	6.00E-03
Trichlorophenol, 2,4,6-	88-06-2	1.10E-02	1.00E-02
Trichloropropane, 1,2,3-	96-18-4	7.00E+00	
Trifluralin	1582-09-8	7.70E-03	

Table K-10. Chemicals used to calculate mean slope factor values for calculating carcinogenic hazard value

Chemical	CAS #	Oral Slope Factor (mg/kg-day)⁻¹	Inhalation Slope Factor (mg/kg-day)⁻¹
Trimethyl Phosphate	512-56-1	3.70E-02	
Trinitrotoluene, 2,4,6-	118-96-7	3.00E-02	
Vinyl Bromide	593-60-2		1.10E-01
Vinyl Chloride	75-01-4	1.40E+00	3.08E-02
geometric mean		0.71	1.70
count (n)		175	105

blank=no data

Source: Risk Assessment Information System (RAIS), http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_9801 (downloaded 11/00): IRIS/HEAST Slope Factors.

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APPENDIX K

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