

## 8. REGULATIONS AND ADVISORIES

The international, national, and state regulations and guidelines pertaining to dichlorobenzenes in air, water, and other media are summarized in Table 8-1.

ATSDR has derived an MRL of 2 ppm for acute-duration inhalation exposure to 1,4-DCB. The acute inhalation MRL is based on a NOAEL of 15 ppm for irritant effects in humans exposed to 1,4-DCB in the workplace (Hollingsworth et al. 1956). An uncertainty factor of 10 for human variability was applied.

ATSDR has derived an MRL of 0.2 ppm for intermediate-duration inhalation exposure to 1,4-DCB. The intermediate inhalation MRL is based on benchmark dose analysis of liver weight increases in male rats exposed to 1,4-DCB vapors for 6 hours/day for 15 weeks (Tyl and Neeper-Bradley 1989). The resulting  $BMCL_{1sd}$  of 92.45 ppm was duration-adjusted from intermittent to continuous exposure, converted to a human equivalent concentration (23 ppm), and divided by an uncertainty factor of 100 (10 for extrapolating from animals to humans and 10 for human variability).

ATSDR has derived an MRL of 0.01 ppm for chronic-duration inhalation exposure to 1,4-DCB. The chronic inhalation MRL is based on benchmark dose analysis of incidences of nasal lesions in female rats exposed to 1,4-DCB vapors for 6 hours/day, 5 days/week for 104 weeks (Aiso et al. 2005b). The resulting  $BMCL_{10}$  of 9.51 ppm was duration-adjusted from intermittent to continuous exposure, converted to a human equivalent concentration (0.27 ppm), and divided by an uncertainty factor of 30 (3 for extrapolating from animals to humans and 10 for human variability).

ATSDR has derived an MRL of 0.7 mg/kg/day for acute-duration oral exposure to 1,2-DCB. The acute oral MRL is based on benchmark dose analysis of liver weight increases in female rats administered 1,2-DCB by daily oral gavage for 10 days (Robinson et al. 1991). The resulting  $BMDL_{1sd}$  of 67.73 mg/kg/day was divided by an uncertainty factor of 100 (10 for extrapolating from animals to humans and 10 for human variability).

ATSDR has derived an MRL of 0.6 mg/kg/day for intermediate-duration oral exposure to 1,2-DCB. The intermediate oral MRL is based on benchmark dose analysis of liver weight increases in female rats administered 1,2-DCB by oral gavage on 5 days/week for 13 weeks (NTP 1985). The resulting  $BMDL_{1sd}$  of 89.27 mg/kg/day was duration-adjusted from intermittent to daily exposure (63.76 mg/kg/day) and

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divided by an uncertainty factor of 100 (10 for extrapolating from animals to humans and 10 for human variability).

ATSDR has derived an MRL of 0.3 mg/kg/day for chronic-duration oral exposure to 1,2-DCB. The chronic oral MRL is based on benchmark dose analysis of incidences of kidney lesions in male mice administered 1,2-DCB by oral gavage on 5 days/week for 103 weeks (NTP 1985). The resulting BMDL<sub>10</sub> of 43.04 mg/kg/day was duration-adjusted from intermittent to daily exposure (30.74 mg/kg/day) and divided by an uncertainty factor of 100 (10 for extrapolating from animals to humans and 10 for human variability).

ATSDR has derived an MRL of 0.4 mg/kg/day for acute-duration oral exposure to 1,3-DCB. The acute oral MRL is based on benchmark dose analysis of liver weight increases in female rats administered 1,3-DCB by oral gavage for 10 days (McCauley et al. 1995). The resulting BMDL<sub>1sd</sub> of 36.32 mg/kg/day was divided by an uncertainty factor of 100 (10 for extrapolating from animals to humans and 10 for human variability).

ATSDR has derived an MRL of 0.02 mg/kg/day for intermediate-duration oral exposure to 1,3-DCB. The intermediate oral MRL is based on benchmark dose analysis of incidences of pituitary lesions in male rats administered 1,3-DCB by daily oral gavage for 90 days (McCauley et al. 1995). The resulting BMDL<sub>10</sub> of 2.1 mg/kg/day was divided by an uncertainty factor of 100 (10 for extrapolating from animals to humans and 10 for human variability).

ATSDR has derived an MRL of 0.07 mg/kg/day for intermediate-duration oral exposure to 1,4-DCB. The intermediate oral MRL is based on benchmark dose analysis of serum alkaline phosphatase levels in female dogs administered 1,4-DCB by capsule on a presumed 5 days/week for 6 months (Naylor and Stout 1996). The resulting BMDL<sub>1sd</sub> of 9.97 mg/kg/day was duration-adjusted from intermittent to daily exposure (7 mg/kg/day) and divided by an uncertainty factor of 100 (10 for extrapolating from animals to humans and 10 for human variability).

ATSDR has derived an MRL of 0.07 mg/kg/day for chronic-duration oral exposure to 1,4-DCB. The chronic oral MRL is based on benchmark dose analysis of serum alkaline phosphatase levels in female dogs administered 1,4-DCB by capsule on a presumed 5 days/week for 1 year (Naylor and Stout 1996). The resulting BMDL<sub>1sd</sub> of 10 mg/kg/day was duration-adjusted from intermittent to daily exposure

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(7 mg/kg/day) and divided by an uncertainty factor of 100 (10 for extrapolating from animals to humans and 10 for human variability).

EPA has verified an oral reference dose (RfD) of 0.09 mg/kg/day for 1,2-DCB based on a NOAEL of 85.7 mg/kg/day for kidney effects in rats and an uncertainty factor of 1,000 (IRIS 2005). EPA also verified an inhalation reference concentration (RfC) of 0.8 mg/m<sup>3</sup> (0.1 ppm) for 1,4-DCB based on a NOAEL of 75 mg/m<sup>3</sup> for liver effects in rats and an uncertainty factor of 100 (IRIS 2005).

EPA has determined that 1,2-DCB and 1,3-DCB are not classifiable as to human carcinogenicity and assigned them cancer weight-of-evidence classification Group D (IRIS 2005). IARC similarly determined that 1,2-DCB and 1,3-DCB are not classifiable as to carcinogenicity to humans (Group 3) (IARC 1999). IARC additionally determined that 1,4-DCB is possibly carcinogenic to humans (Group 2B) (IARC 1999). The Department of Health and Human Services (DHHS) concluded that 1,4-DCB is reasonably anticipated to be a human carcinogen (NTP 2005).

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**Table 8-1. Regulations and Guidelines Applicable to Dichlorobenzenes**

Agency	Description	Information	Reference
<u>INTERNATIONAL</u>			
Guidelines:			
IARC	Carcinogenicity classification		
	1,2-Dichlorobenzene	Group 3 <sup>a</sup>	IARC 1999
	1,3-Dichlorobenzene	Group 3 <sup>a</sup>	
1,4-Dichlorobenzene	Group 2B <sup>b</sup>		
WHO	Air quality guideline	No data	WHO 2000
	Drinking water guideline		
	1,2-Dichlorobenzene	1 mg/L <sup>c</sup>	WHO 2004
1,3-Dichlorobenzene	Toxicological data are insufficient to permit derivation of health-based guideline value		
1,4-Dichlorobenzene	0.3 mg/L <sup>c</sup>		
<u>NATIONAL</u>			
Regulations and Guidelines:			
a. Air			
ACGIH	TLV (8-hour TWA)		
	1,2-Dichlorobenzene	25 ppm	ACGIH 2003
	STEL	50 ppm	
	Carcinogenicity classification	A4 <sup>d</sup>	
1,4-Dichlorobenzene	10 ppm		
EPA	Carcinogenicity classification	A3 <sup>e</sup>	
	Hazardous air pollutant		EPA 2004h
NIOSH	1,4-Dichlorobenzene	Yes	42USC7412
	REL (10-hour TWA)		
	1,2-Dichlorobenzene (ceiling limit)	50 ppm	NIOSH 2004
	1,4-Dichlorobenzene	Carcinogen	
	IDLH		
	1,2-Dichlorobenzene	200 ppm	
OSHA	1,4-Dichlorobenzene	150 ppm	
	PEL (8-hour TWA) for general industry		OSHA 2004c
	1,2-Dichlorobenzene (ceiling limit)	50 ppm	29CFR1910.1000,
	1,4-Dichlorobenzene	75 ppm	Table Z-1
	PEL (8-hour TWA) for construction industry		OSHA 2004b
	1,2-Dichlorobenzene (ceiling limit)	50 ppm	29CFR1926.55,
	1,4-Dichlorobenzene	75 ppm	Appendix A

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**Table 8-1. Regulations and Guidelines Applicable to Dichlorobenzenes**

Agency	Description	Information	Reference
<u>NATIONAL</u> (cont.)			
	PEL (8-hour TWA) for shipyard industry		OSHA 2004a
	1,2-Dichlorobenzene (ceiling limit)	50 ppm	29CFR1915.1000,
	1,4-Dichlorobenzene	75 ppm	Table Z
b. Water			
EPA	Designated as a hazardous substances pursuant to Section 311(b) of the Clean Water Act		EPA 2004m 40CFR116.4
	1,2-Dichlorobenzene	Yes	
	1,4-Dichlorobenzene	Yes	
	Drinking water standard		EPA 2004g 40CFR141.32
	1,2-Dichlorobenzene	0.6 mg/L	
	1,4-Dichlorobenzene	0.075 mg/L	
	Drinking water standards and health advisories		
	1,2-Dichlorobenzene and 1,3-dichlorobenzene		EPA 2004a
	1-Day HA for a 10-kg child	9 mg/L	
	10-Day HA for a 10-kg child	9 mg/L	
	DWEL	3 mg/L	
	Lifetime HA (70-kg adult)	0.6 mg/L	
	1,4-Dichlorobenzene		
	1-Day HA for a 10-kg child	11 mg/L	
	10-Day HA for a 10-kg child	11 mg/L	
	DWEL	4 mg/L	
	Lifetime HA (70-kg adult)	0.075 mg/L	
	MCL		EPA 2004f 40CFR141.61
	1,2-Dichlorobenzene	0.6 mg/L	
	1,4-Dichlorobenzene	0.075 mg/L	
	MCLG		EPA 2004d 40CFR141.50
	1,2-Dichlorobenzene	0.6 mg/L	
	1,4-Dichlorobenzene	0.075 mg/L	
FDA	Bottled water		FDA 2003 21CFR165.110
	1,2-Dichlorobenzene	0.6 mg/L	
	1,4-Dichlorobenzene	0.075 mg/L	
c. Food			
	No data		
d. Other			
EPA	Carcinogenicity classification		IRIS 2004
	1,2-Dichlorobenzene	Group D <sup>f</sup>	
	1,3-Dichlorobenzene	Group D <sup>f</sup>	
	1,4-Dichlorobenzene	No data	
	RfC		

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**Table 8-1. Regulations and Guidelines Applicable to Dichlorobenzenes**

Agency	Description	Information	Reference	
NATIONAL <i>(cont.)</i>	1,2-Dichlorobenzene	No data		
	1,3-Dichlorobenzene	No data		
	1,4-Dichlorobenzene	$8 \times 10^{-1}$ mg/m <sup>3</sup>		
	EPA	RfD		
		1,2-Dichlorobenzene	$9 \times 10^{-2}$ mg/kg/day	IRIS 2004
		1,3-Dichlorobenzene	No data	
		1,4-Dichlorobenzene	No data	
		Community right-to-know; toxic chemical release reporting; effective date		EPA 2004j 40CFR372.65
		1,2-Dichlorobenzene	01/01/1987	
		1,3-Dichlorobenzene	01/01/1987	
		1,4-Dichlorobenzene	01/01/1987	
		Hazardous waste identification		
		1,2-Dichlorobenzene	U070	EPA 2004c 40CFR261, Appendix VIII
		1,3-Dichlorobenzene	U071	
	1,4-Dichlorobenzene	U072		
	Chemical information rules; manufacturers reporting period for 1,2-dichlorobenzene and 1,4-dichlorobenzene		EPA 2004k 40CFR712.30	
	Effective date	08/04/1995		
	Sunset date	10/03/1995		
	Superfund; reportable quantity			
	1,2-Dichlorobenzene <sup>g</sup>	100 pounds	EPA 2004b 40CFR302.4	
	1,3-Dichlorobenzene <sup>h</sup>	100 pounds		
	1,4-Dichlorobenzene <sup>i</sup>	100 pounds		
NTP	Carcinogenicity classification			
	1,2-Dichlorobenzene	No data		
	1,3-Dichlorobenzene	No data	NTP 2005	
	1,4-Dichlorobenzene	Reasonably anticipated to be a human carcinogen		
<u>STATE</u>				
a. Air	No data			
b. Water				
	Drinking water standards and guidelines		HSDB 2005	
Arizona	1,2-Dichlorobenzene	620 µg/L		
	1,3-Dichlorobenzene	620 µg/L		
	1,4-Dichlorobenzene	75 µg/L		
California	1,3-Dichlorobenzene	130 µg/L		
	1,4-Dichlorobenzene	5 µg/L		

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Agency	Description	Information	Reference
Florida	1,3-Dichlorobenzene	10 µg/L	
<i>STATE (cont.)</i>			
Maine	1,2-Dichlorobenzene	63 µg/L	
	1,4-Dichlorobenzene	21 µg/L	
Massachusetts	1,4-Dichlorobenzene	5 µg/L	
Minnesota	1,2-Dichlorobenzene	600 µg/L	
	1,4-Dichlorobenzene	10 µg/L	
New Jersey	1,2-Dichlorobenzene	600 µg/L	
	1,3-Dichlorobenzene	600 µg/L	
Wisconsin	1,3-Dichlorobenzene	1,250 µg/L	
c. Food	No data		
d. Other	No data		

<sup>a</sup>Group 3: Not classifiable as to its carcinogenicity to humans.

<sup>b</sup>Group 2B: Possibly carcinogenic to humans.

<sup>c</sup>Concentrations of the substance at or below the health-based guideline value may affect the appearance, taste or odor of the water, leading to consumer complaints.

<sup>d</sup>Group A4: Not classifiable as a human carcinogen.

<sup>e</sup>Group A3: Confirmed animal carcinogen with unknown relevance to humans.

<sup>f</sup>Group D: Not classifiable as to human carcinogenicity.

<sup>g</sup>Designated as a hazardous substance pursuant to Section 311(b)(2) of the Clean Water Act, Section 307(a) of the Clean Water Act, and Section 3001 of RCRA.

<sup>h</sup>Designated as a hazardous substance pursuant to Section 307(a) of the Clean Water Act and Section 3001 of RCRA.

<sup>i</sup>Designated as a hazardous substance pursuant to Section 311(b)(2) of the Clean Water Act, Section 307(a) of the Clean Water Act, Section 112 of the Clean Air Act, and Section 3001 of RCRA.

ACGIH = American Conference of Governmental Industrial Hygienists; CFR = Code of Federal Regulations; DWEL = drinking water equivalent level; EPA = Environmental Protection Agency; FDA = Food and Drug Administration; HA = health advisory; HSDB = Hazardous Substances Data Bank; IARC = International Agency for Research on Cancer; IDLH = immediately dangerous to life or health; IRIS = Integrated Risk Information System; MCL = maximum contaminant level; MCLG = maximum contaminant level goal; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = permissible exposure limit; RCRA = Resource Conservation and Recovery Act; REL = recommended exposure limit; RfC = reference concentration; RfD = reference dose; STEL = short-term exposure limit; TLV = threshold limit values; TWA = time-weighted average; USC = United States Codes; WHO = World Health Organization