

## 8. REGULATIONS AND ADVISORIES

The international and national regulations and guidelines regarding barium and barium compounds in air, water, and other media are summarized in Table 8-1.

ATSDR has derived an intermediate-duration oral MRL of 0.2 mg barium/kg/day for barium. This MRL is based on a NOAEL of 65 mg barium/kg/day and a LOAEL of 115 mg barium/kg/day for increased kidney weight in female rats (NTP 1994) and an uncertainty factor of 100 (10 to account for animal to human extrapolation, and 10 for human variability) and modifying factor of 3 to account for the lack of an adequate developmental toxicity study

ATSDR has derived a chronic-duration oral MRL of 0.2 mg barium/kg/day for barium. The MRL is based on a BMDL<sub>05</sub> of 61 mg barium/kg/day for nephropathy in male mice (NTP 1994) and an uncertainty factor of 100 (10 to account for animal to human extrapolation and 10 for human variability) and modifying factor of 3 to account for the lack of an adequate developmental toxicity study.

EPA (IRIS 2006) has derived an oral reference dose (RfD) for barium of 0.2 mg/kg/day, based on a BMDL<sub>05</sub> of 63 mg/kg/day for nephropathy in male mice (NTP 1994) and an uncertainty factor of 300 (10 to account for animal to human extrapolation, 10 for human variability, and 3 for database deficiencies, particularly the lack of a two-generation reproductive toxicity study and an adequate investigation of developmental toxicity). EPA (IRIS 2006) has not recommended an inhalation reference concentration (RfC) for barium at this time.

Using their 1986 guidelines, EPA has determined that barium is not classifiable as a human carcinogen and has assigned it the cancer classification, Group D (IRIS 2006). Using their recent guidelines, EPA determined that barium is considered not likely to be carcinogenic to humans following oral exposure and its carcinogenic potential cannot be determined following inhalation exposure (IRIS 2006).

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**Table 8-1. Regulations and Guidelines Applicable to Barium and Barium Compounds**

Agency	Description	Information	Reference
<b>INTERNATIONAL</b>			
Guidelines:			
IARC	Carcinogenicity classification	No data	IARC 2004
WHO	Air quality guidelines	No data	WHO 2000
	Drinking water quality guidelines	0.7 mg/L	WHO 2004
<b>NATIONAL</b>			
Regulations and Guidelines:			
a. Air			
ACGIH	TLV (TWA)		ACGIH 2004
	Barium and soluble compounds (as Ba)	0.5 mg/m <sup>3</sup>	
	Barium sulfate	10 mg/m <sup>3</sup>	
NIOSH	REL (TWA)		NIOSH 2005a, 2005b
	Barium chloride <sup>a</sup>	0.5 mg/m <sup>3</sup>	
	Barium sulfate	10 mg/m <sup>3</sup> (total) 5.0 mg/m <sup>3</sup> (respiratory)	
	IDLH		
	Barium chloride	50 mg/m <sup>3</sup>	
	Barium sulfate	No data	
OSHA	PEL (8-hour TWA) for general industry		OSHA 2005c 29 CFR 1910.1000
	Barium, soluble compounds (as Ba)	0.5 mg/m <sup>3</sup>	
	Barium sulfate	15 mg/m <sup>3</sup> (total dust) 5.0 mg/m <sup>3</sup> (respirable fraction)	
	PEL (8-hour TWA) for construction industry		OSHA 2005b 29 CFR 1926.55
	Barium, soluble compounds (as Ba)	0.5 mg/m <sup>3</sup>	
	PEL (8-hour TWA) for shipyard industry		OSHA 2005a 29 CFR 1915.1000
	Barium, soluble compounds (as Ba)	0.5 mg/m <sup>3</sup>	
	Barium sulfate	15 mg/m <sup>3</sup> (total dust) 5.0 mg/m <sup>3</sup> (respirable fraction)	
b. Water			
EPA	Drinking water standards and health advisories		EPA 2004
	1-day health advisory for a 10-kg child	0.7 mg/L	
	10-day health advisory for a 10-kg child	0.7 mg/L	

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Agency	Description	Information	Reference
<b>NATIONAL (cont.)</b>			
	National primary drinking water standards		EPA 2002a
	MCLG	2.0 mg/L	
	MCL	2.0 mg/L	
	Reportable quantities of hazardous substances (barium cyanide) designated pursuant to Section 311 of the Clean Water Act	10 pounds	EPA 2005b 40 CFR 117.3
	Water quality criteria for human health consumption of:		EPA 2002b
	Water + organism	1.0 mg/L	
	Organism only	No data	
c. Food			
FDA	Bottled drinking water	2.0 mg/L	FDA 2004 21 CFR 165.110
d. Other			
ACGIH	Carcinogenicity classification	A4 <sup>b</sup>	ACGIH 2004
EPA	Carcinogenicity classification	Group D <sup>c</sup>	IRIS 2006
	RfC	Not recommended at this time	
	RfD	0.2 mg/kg/day	
NTP	Carcinogenicity classification	No data	NTP 2005

<sup>a</sup>The REL also applies to other soluble barium compounds (as Ba) except barium sulfate.

<sup>b</sup>A4: not classifiable as a human carcinogen

<sup>c</sup>Group D: not classifiable as to human carcinogenicity

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; IARC = International Agency for Research on Cancer; IDLH = immediately dangerous to life or health; 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; REL = recommended exposure limit; RfC = inhalation reference concentration; RfD = oral reference dose; TLV = threshold limit values; TWA = time-weighted average; WHO = World Health Organization