

## 8. REGULATIONS AND ADVISORIES

Sulfur mustard is on the list of chemicals appearing in "Toxic Chemicals Subject to Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986" (EPA 1987). Available information on regulations and standards is presented in Table 8-1.

ATSDR has derived an acute inhalation MRL of  $0.0007 \text{ mg/m}^3$  for sulfur mustard based on a minimal LOAEL of  $0.06 \text{ mg/m}^3$  for ocular effects in humans that were exposed to sulfur mustard vapors 8 hours/day, for 3 days (Guild et al. 1941). The LOAEL was duration-adjusted to a time-weighted average (TWA) of  $0.02 \text{ mg/m}^3$  and an uncertainty factor of 30 (3 for use of a minimal LOAEL and 10 for human variability) was applied to the TWA minimal LOAEL to derive the MRL (see Appendix A for details).

ATSDR has derived an intermediate-duration inhalation MRL of  $0.00002 \text{ mg/m}^3$  for sulfur mustard based on a NOAEL of  $0.001 \text{ mg/m}^3$  for ocular effects in dogs that were exposed to sulfur mustard vapors 24 hours/day, 5 days/week, for up to a year (McNamara et al. 1975). The NOAEL was duration-adjusted to a daily TWA of  $0.0007 \text{ mg/m}^3$  and an uncertainty factor of 30 (3 for extrapolation from animals to humans and 10 for human variability) was applied to the TWA NOAEL to derive the MRL (see Appendix A for details).

ATSDR has derived an acute oral MRL of  $0.0005 \text{ mg/kg/day}$  ( $0.5 \text{ } \mu\text{g/kg/day}$ ) for sulfur mustard based on a LOAEL of  $0.5 \text{ mg/kg/day}$  for inflamed mesenteric lymph nodes in rat dams and reduced ossification in fetuses that were exposed for 10 days (DOA 1987). The test material was administered by gavage in oil on gestation days 6–15. An uncertainty factor of 1,000 (10 for use of a LOAEL, 10 for extrapolation from animals to humans, and 10 for human variability) was applied to the LOAEL to derive the MRL (see Appendix A for details).

An intermediate-duration oral MRL for sulfur mustard of  $0.00007 \text{ mg/kg/day}$  ( $0.07 \text{ } \mu\text{g/kg/day}$ ) was based on a TWA LOAEL of  $0.02 \text{ mg/kg/day}$  for gastrointestinal effects in rats exposed by gavage for a 21-week period (Sasser et al. 1996a). An uncertainty factor of 300 (10 for use of a LOAEL, 3 for extrapolation from animals to humans, and 10 for human variability) was applied to the TWA LOAEL to derive the MRL (see Appendix A for details).

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**Table 8-1. Regulations and Guidelines Applicable to Sulfur Mustard**

Agency	Description	Information	References
<u>INTERNATIONAL</u>			
Guidelines:			
IARC	Carcinogenicity classification	Group 1 <sup>a</sup>	IARC 2001
<u>NATIONAL</u>			
Regulations and Guidelines:			
a. Air			
ACGIH	TLV-TWA	No data	
NIOSH	REL	No data	
OSHA	PEL (TWA)	No data	
b. Water			
c. Food			
d. Other			
BEA	Chemical Weapons Convention requirements; schedules of chemicals		BEA 2001 15CFR745
DOS	International traffic in arms regulations; United States munitions list; chemical agents		DOS 2001 22CFR121.7
DOT	Hazardous materials table		DOT 2001 49CFR172.101
EPA	CERCLA; reportable quantity	500 pounds	EPA 2001a 40CFR355 Appendix B
	Groundwater protection standards at inactive uranium processing sites		EPA 2001b 40CFR192, Appendix I
	SARA; extremely hazardous substance (TPQ)	500 pounds	EPA 2001a 40CFR355, Appendix B
	RCRA; identification and listing as hazardous waste		EPA 2001c 40CFR261, Appendix VIII
	Toxic chemical release reporting; Community Right-to-Know; effective date	01/01/87	EPA 2001d 40CFR372.65
NTP	Carcinogenic classification	Known to be a human carcinogen	NTP 2001
OSHA	Meets criteria for proposed medical records rule		OSHA 1982
VA	Claims based on chronic effects of exposure		VA 2001 38CFR3.316

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**Table 8-1. Regulations and Guidelines Applicable to Sulfur Mustard**

Agency	Description	Information	References
<u>STATE</u>			
Regulations and Guidelines:			
a. Air			
Colorado	Air contaminant emission notice		BNA 2001
Connecticut	HAP		BNA 2001
Maryland	Toxic air pollutant	Known human carcinogen	BNA 2001
b. Water			
New York	Water regulation		BNA 2001
	TPQ	1 pound	
	RQ	1 pound	
c. Food			
d. Other			
Alabama	Identification and listing of hazardous waste		BNA 2001
Arkansas	Identification and listing of hazardous waste		BNA 2001
California	Chemical known to cause cancer or reproductive toxicity; initial appearance of chemical on list	02/27/87	BNA 2001
	Hazardous substance list		BNA 2001
Colorado	Identification and listing of hazardous waste		BNA 2001
District of Columbia	Identification and listing of hazardous waste		BNA 2001
Delaware	Reportable quantity	1 pound	BNA 2001
Florida	Toxic substances in the workplace		BNA 2001
Georgia	Regulated substance and soil concentration that trigger notification		BNA 2001
Illinois	Identification and listing of hazardous waste		BNA 2001
Kentucky	Extremely hazardous substance (TPQ)	500 pounds	BNA 2001
	Identification and listing of hazardous waste		BNA 2001
Louisiana	Hazardous waste		BNA 2001
Maine	Identification and listing of hazardous waste		BNA 2001
Massachusetts	Containers adequately labeled pursuant to federal law		BNA 2001
Massachusetts	Oil and hazardous material list		BNA 2001
Maryland	Identification and listing of hazardous waste		BNA 2001

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**Table 8-1. Regulations and Guidelines Applicable to Sulfur Mustard**

Agency	Description	Information	References
<i>STATE (cont.)</i>			
Michigan	Identification and listing of hazardous waste		BNA 2001
Minnesota	Hazardous constituent		BNA 2001
Nebraska	Hazardous constituent		BNA 2001
New Jersey	Discharge of oil and other hazardous substances		BNA 2001
North Dakota	Identification and listing of hazardous waste		BNA 2001
Ohio	Toxic release inventory rules		BNA 2001
Oregon	Toxic use reduction and hazardous reduction regulations		BNA 2001
South Carolina	Identification and listing of hazardous waste		BNA 2001
Tennessee	Identification and listing of hazardous waste		BNA 2001
Vermont	Hazardous waste management regulation		BNA 2001
Washington	Dangerous waste regulations		BNA 2001
Wisconsin	Identification and listing of hazardous waste		BNA 2001
Wyoming	Identification and listing of hazardous waste		BNA 2001

<sup>a</sup>Group 1: Carcinogenic to humans

ACGIH = American Conference of Governmental Industrial Hygienists; BEA = Bureau of Export Administration; BNA = Bureau of National Affairs; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; CFR = Code of Federal Regulations; DOS = Department of State; DOT = Department of Transportation; EPA = Environmental Protection Agency; HAP = hazardous air pollutant; IARC = International Agency for Research on Cancer; NIOSH = National Institute of 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 = relative exposure limit; RQ = reportable quantity; SARA = Superfund Amendments and Reauthorization Act; TPQ = threshold planning quantity; TLV = threshold limit values; TWA = time-weighted average; VA = Department of Veteran Affairs

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ATSDR has not derived a chronic oral MRL for sulfur mustard because a chronic bioassay was not located.

The acute exposure guideline levels (AEGs) for sulfur mustard, which were developed by the National Advisory Committee for Acute Exposure Guideline Levels for Hazardous Substances, are presented in Table 8-2. A more detailed discussion of these AEGs is presented in Appendix D.

The Army has recommended sulfur mustard airborne exposure limits for agent workers (WPL) and the general population (GPL) for chronic exposures to provide adequate protection during the limited time of potential exposure prior to the completion of the Chemical Stockpile Demilitarization Program (USACHPPM 2000a, 2003). For the general population, a sulfur mustard GPL of  $0.00002 \text{ mg/m}^3$  as a 24-hour TWA, 7 days/week, has been established. For agent workers, the WPL established for sulfur mustard as an 8-hour TWA, 5 days/week, is  $0.0004 \text{ mg/m}^3$ . In addition, the Army has established a Short Term Exposure Limit (STEL) of  $0.003 \text{ mg/m}^3$  and an Immediately Dangerous to Life and Health (IDLH) value of  $2.0 \text{ mg/m}^3$  for sulfur mustard agents. Previously established airborne exposure limits for sulfur mustard agents were promulgated by the Centers for Disease Control and Prevention (CDC) in 1988 (DHHS 1988).

The International Agency for Research on Cancer (IARC) has classified sulfur mustard as carcinogenic to humans (Group 1), based on sufficient evidence for carcinogenicity to humans and limited evidence for carcinogenicity to animals (IARC 1975, 1987, 2001).

The U.S. Army has derived health-based environmental screening levels (HBESLs) for sulfur mustard (USACHPPM 1999) as shown in Table 8-3. Ongoing evaluations of alternative approaches for quantitatively estimating noncancer and cancer risk may result in changes to these values (USACHPPM 2000a).

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**Table 8-2. Acute Exposure Guideline Level (AEGL) Values for Sulfur Mustard (ppm [mg/m<sup>3</sup>])**

Classification	10-minute	30-minute	1-hour	4-hour	8-hour	End point (reference)
AEGL-1	0.06 ppm (0.40)	0.02 ppm (0.13)	0.01 ppm (0.067)	0.003 ppm (0.017)	0.001 ppm (0.008)	Conjunctival injection and minor discomfort with no functional decrement in volunteers (Anderson 1942)
AEGL-2	0.09 ppm (0.60)	0.03 ppm (0.20)	0.02 ppm (0.10)	0.004 ppm (0.025)	0.002 ppm (0.013)	Well-marked generalized conjunctivitis, edema, photophobia, and eye irritation in volunteers (Anderson 1942)
AEGL-3	0.59 ppm (3.9)	0.41 ppm (2.7)	0.32 ppm (2.1)	0.08 ppm (0.53)	0.04 ppm (0.27)	Lethality estimate in mice (Kumar and Vijayaraghavan 1998)

Source: NAC/AEGL 2001

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**Table 8-3. U.S. Army Toxicity Values for Sulfur Mustard**

Parameter	Value	Units
Oral reference dose	0.000007	mg/kg/day
Inhalation reference dose	0.00003	mg/kg/day
Cancer potency oral slope factor	7.7	(mg/kg/day) <sup>-1</sup>
Cancer potency inhalation unit risk	0.085	(μg/m <sup>3</sup> ) <sup>-1</sup>
Cancer potency inhalation slope factor	300	(mg/kg/day) <sup>-1</sup>

Source: USACHPPM 1999

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On October 17, 1986, the President signed into law the Superfund Amendments and Reauthorization Act of 1986 (SARA). This act amended the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), commonly known as "Superfund". The Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) was included under Title III of SARA.

EPA has established a reportable quantity (RQ) for sulfur mustard of 500 pounds under the CERCLA section 103, codified at 40 CFR part 302, in addition to the requirements of 40 CFR part 355, and regulates it as a hazardous constituent of waste under the Resource Conservation and Recovery Act (RCRA, 40 CFR 261).

EPA regulates sulfur mustard under the SARA, subjecting it to reporting requirements. Emergency response plans are required under SARA if the threshold planning quantity (TPQ) of 500 pounds is exceeded.

Under EPCRA, release of sulfur mustard must be reported according to EPA toxic chemical release reporting regulations (40 CFR 372.65).

Sulfur mustard is included as a constituent regulated under the groundwater protection standards for inactive uranium processing sites (40 CFR 192).

OSHA regulates sulfur mustard under the Hazard Communication Standard and as a chemical hazard in laboratories.

The Department of Veterans Affairs regulates compensation based on chronic effects of exposure to sulfur mustard (38 CFR 3.316).