8. REGULATIONS AND ADVISORIES

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

ATSDR has derived an acute inhalation MRL of 0.2 mg/m^3 for malathion based on a NOAEL of 65 mg/m^3 for inhibition of erythrocyte cholinesterase activity in rabbits (Weeks et al. 1977). The LOAEL was 123 mg/m^3. An uncertainty factor of 100 was used (10 for animal to human extrapolation and 10 for the protection of sensitive human groups). A conversion factor was used to adjust from intermittent exposure to continuous exposure (6/24hours).

ATSDR has derived an intermediate inhalation MRL of 0.02 mg/m^3 for malathion based on a LOAEL of 100 mg/m^3 for upper respiratory tract effects in rats (Beattie 1994). An uncertainty factor of 1,000 was used (10 for animal to human extrapolation, 10 for the use of a LOAEL, and 10 for the protection of sensitive human groups). A conversion factor was used to adjust from intermittent exposure to continuous exposure (5/7x6/24 hours).

ATSDR has derived an intermediate oral MRL of $2x10^{-2}$ mg/kg/day for malathion based on a NOAEL of 0.23 mg/kg/day for inhibition of plasma and red blood cell cholinesterase activities in humans (Moeller and Rider 1962). The LOAEL was 0.34 mg/kg/day. An uncertainty factor of 10 was used for the protection of sensitive human groups.

ATSDR has derived a chronic oral MRL of $2x10^{-2}$ mg/kg/day for malathion based on a NOAEL of 2 mg/kg/day for inhibition of plasma and red blood cell cholinesterase activities in male rats administered malathion in the diet for 2 years (Daly 1996a). The LOAEL was 29 mg/kg/day. An uncertainty factor of 100 was used (10 for extrapolation from animal to humans and 10 for the protection of sensitive populations).

EPA (IRIS 2003) has derived an RfD of $2x10^{-2}$ mg/kg/day for malathion based on a NOAEL 0.23 mg/kg/day for inhibition of plasma and red blood cell cholinesterase activities in humans (Moeller and Rider 1962). The LOAEL was 0.34 mg/kg/day. An uncertainty factor of 10 was used for the protection of sensitive human groups.

Table 8-1. Regulations and Guidelines Applicable to Malathion

Agency	Description	Information	References
INTERNATIONAL			
Guidelines:			
IARC	Carcinogenicity classification	Group 3[a]	IARC 2001
NATIONAL			
Regulations and Guidelines:			
a. Air			
ACGIH	TLV-TWA[b]	10 mg/m^3	ACGIH 2000
NIOSH	REL (TWA) IDLH	10 mg/m^3 250 mg/m^3	NIOSH 2001
OSHA	PEL (8-hour TWA) General industry (total dust)	15 mg/m^3	OSHA 2001a 29CFR1910.1000 Table Z-1
	PEL (8-hour TWA) Construction industry (total dust)	15 mg/m^3	OSHA 2001b 29CFR1926.55 Appendix A
	PEL (8-hour TWA) Shipyard industry (total dust)	15 mg/m^3	OSHA 2001c 29CFR1915.1000 Table Z
b. Water			
DOT	Marine pollutant		DOT 2001a 49CFR172.101 Appendix B
EPA	Drinking water guideline	0.2 mg/L	HSDB 2001
	Health advisories 1 Day (10-kg child) 10 Day (10-kg child) DWEL Lifetime	 0.2 mg/L 0.2 mg/L 0.7 mg/L 0.1 mg/L	EPA 2000c
	Pesticide chemicals—effluent limitations for BPT		EPA 2001a 40CFR455.20(b)
	Water programs—designation of hazardous substance		EPA 2001b 40CFR116.4
	Water programs—determination of reportable quantity Reportable quantity	 100 pounds	EPA 2001c 40CFR117.3

Table 8-1. Regulations and Guidelines Applicable to Malathion

Agency	Description	Information	References
NATIONAL *(cont.)*			
c. Food			
EPA	Methyl eugenol combination (pesticide) residue tolerances of agricultural commodities; ratio of parts of methyl eugenol to technical malathion is 3:1; eugenol and malathion maximum dosage per application per acre	28.35 g methyl eugenol and 9.45 g malathion	EPA 2001d 40CFR180.1067
	Pesticides—where residues from two or more chemicals in the same class are present in or on a raw agricultural commodity, the tolerance for the total of such residues shall be the same as that for the chemical having the lowest numerical tolerance in this class, unless a higher tolerance level is provided		EPA 2001e 40CFR180.3(e)(5)
	Pesticides—tolerances for residues (ppm)		EPA 2001f 40CFR180.111
	Alfalfa	135	
	Almond hulls	50	
	Almonds	8	
	Almonds, shells	50	
	Apples	8	
	Apricots	8	
	Asparagus	8	
	Avocados	8	
	Barley (grain)	8	
	Beans	8	
	Beets (tops)	8	
	Beets (sugar, roots)	1	
	Beets (sugar tops)	8	
	Birdsfoot trefoil (forage and hay)	135	
	Blackberries	8	
	Blueberries	8	
	Boysenberries	8	
	Carrots	8	
	Cattle (fat, meat byproducts, meat)	4	
	Chayote (fruit and roots)	8	
	Cherries	8	
	Chestnuts	1	
	Clover	135	
	Corn, forage and grain	8	
	Corn, fresh (including sweet)	2	
	Cottonseed	2	

Table 8-1. Regulations and Guidelines Applicable to Malathion

Agency	Description	Information	References
	Pesticides—tolerances for residues (ppm)		
	Cowpea (forage and hay)	135	
	Cranberries	8	
	Cucumbers	8	
	Currants	8	
	Dates	8	
	Dewberries	8	
	Eggplants	8	
	Eggs (from application to poultry)	0.1	
	Figs	8	EPA 2001f
	Filberts	1	40CFR180.111
	Flax seed	0.1	
	Flax straw	1	
	Garlic	8	
	Goats (fat, meat byproducts, meat)	4	
	Gooseberries	8	
	Grapefruit	8	
	Grapes	8	
	Grass (including hay)	135	
	Guavas	8	
	Hogs (fat, meat byproducts, meat)	4	
	Hops	1	
	Horseradish	8	
	Horses (fat, meat byproducts, meat)	4	
	Kumquats	8	
	Leeks	8	
	Lemons	8	
	Lentils	8	
	Lespedeza (hay and straw)	135	
	Lespedeza (seed)	8	
	Limes	8	
	Loganberries	8	
	Lupine (seed)	8	
	Macadamia nuts	1	
	Mangos	8	
	Melons	8	
	Milk, fat (from application to dairy cows)	0.5	
	Mushrooms	8	
	Nectarines	8	
	Oats (grain)	8	
	Okra	8	
	Onions (including green tops)	8	
	Oranges	8	
	Papayas	1	
	Parsnips	8	
	Pesticides—tolerances for		

Table 8-1. Regulations and Guidelines Applicable to Malathion

Agency	Description	Information	References
	residues (ppm)		
	Passion fruit	8	
	Peaches	8	
	Peanut (forage and hay)	135	
	Peanuts	8	
	Pears	8	
	Peas	8	
	Peavine (including hay)	8	
	Pecans	8	
	Peppermint	8	EPA 2001f
	Peppers	8	40CFR180.111
	Pineapple	8	
	Plums	8	
	Potatoes	8	
	Poultry (fat, meat byproducts, meat)	4	
	Prunes	8	
	Pumpkins	8	
	Quinces	8	
	Radishes	8	
	Raspberries	8	
	Rice (grain and wild)	8	
	Rutabagas	8	
	Rye (grain)	8	
	Safflower (seed)	0.2	
	Salsify (including tops)	8	
	Shallots	8	
	Sheep (fat, meat byproducts, meat)	4	
	Sorghum (forage and grain)	8	
	Soybeans (dry and succulent)	8	
	Soybeans (forage and hay)	135	
	Spearmint	8	
	Squash (summer and winter)	8	
	Strawberries	8	
	Sunflower seeds	8	
	Sweet potatoes	1	
	Tangerines	8	
	Tomatoes	8	
	Turnips (including tops)	8	
	Vegetables (leafy, including Brassica)	8	
	Vetch (hay and straw)	135	
	Vetch (seed)	8	
	Walnuts	8	
	Wheat (grain)	8	
USDA	Agriculture—labeling of treated seed shall not be deemed harmful when present at a rate less than indicated	8 ppm	USDA 2001 7CFR201.31a

Table 8-1. Regulations and Guidelines Applicable to Malathion

Agency	Description	Information	References
NATIONAL *(cont.)*			
d. Other			
ACGIH	BEI—organophosphorus cholinesterase inhibitors (cholinesterase activity in red cells)	70% of individual's baseline	ACGIH 1999
ACGIH	Carcinogenicity classification	A4[c]	ACGIH 2000
DOT	Superfund—reportable quantity	100 pounds	DOT 2001b 49CFR172.101 Appendix A
EPA	RfD	$2x10^{-2}$ mg/kg/day	IRIS 2001
	NPDES—permit application testing requirements; toxic pollutants and hazardous substances required to be identified by existing dischargers if expected to be present		EPA 2001g 40CFR122 Appendix D Table V
	Standards for hazardous waste TSD facilities—compounds with Henry's law constant less than 0.1 atm m^3/mol (at 25 °C)		EPA 2001h 40CFR265 Appendix VI
	Superfund—reportable quantity	10 pounds	EPA 2001i 40CFR302.4
	Toxic chemical release reporting; Community Right-to-Know—effective date	01/01/95	EPA 2001j 40CFR372.65
STATE			
Regulations and Guidelines:			
a. Air			
Alaska	Air contaminant standard		BNA 2001
	Total dust	10 mg/m^3	
	Respirable fraction	5 mg/m^3	
California	Airborne contaminant		BNA 2001
Colorado	Standards applicable to surface water		BNA 2001
	Human health based (water supply)	140 µg/L	
	Aquatic life based (chronic)	0.1 µg/L	
Connecticut	HAP—hazard limiting value		BNA 2001
	8 Hours	200 µg/m^3	
	30 Minutes	1,000 µg/m^3	
Hawaii	Air contaminant (PEL-TWA)		BNA 2001
	Total dust	10 mg/m^3	

Table 8-1. Regulations and Guidelines Applicable to Malathion

Agency	Description	Information	References
STATE *(cont.)*			
Idaho	Toxic air pollutant		BNA 2001
	OEL	10 mg/m^3	
	EL	$6.67x10^{-1}$ pounds/hour	
	AAC	0.5 mg/m^3	
Illinois	Toxic air contaminant		BNA 2001
Kentucky	TAL	40 mg/m^3	BNA 2001
	Average time	8 hours	
	Significant levels	$2.551x10^{-3}$ pounds/hour	
Michigan	Air contaminant (PEL-TWA)		BNA 2001
	Total dust	15 mg/m^3	
	Occupational air contaminant		BNA 2001
	MAC	15 mg/m^3	
Montana	Occupational air contaminant[b]	15 mg/m^3	BNA 2001
New Hampshire	Toxic air pollutant		BNA 2001
	OEL	10 mg/m^3	
New Jersey	Toxic air pollutant		BNA 2001
	OEL	10 mg/m^3	
	Emissions	$6.67x10^{-1}$ pounds/hour	
New York	Dangerous air contaminant		BNA 2001
	TLV[b]	15 mg/m^3	
	Total dust		BNA 2001
	Transitional limits (PEL)[b]	15 mg/m^3	
	Final rule limits (TWA)[b]	10 mg/m^3	
North Carolina	General industry standards		BNA 2001
	Total dust	10 mg/m^3	
Oregon	Air contaminant	10 mg/m^3	BNA 2001
South Carolina	Toxic air emissions		BNA 2001
	MAC	100 $\mu g/m^3$	
Texas	TLV[b]	15 mg/m^3	BNA 2001
Washington	Air contaminant (TWA)		BNA 2001
	Total dust	10 mg/m^3	
	Toxic air pollutant		BNA 2001
	ASIL (24-hour average)	33 $\mu g/m^3$	
b. Water			
Alaska	Water quality standards—toxic substance		BNA 2001
Arizona	Drinking water guideline	140 µg/L	HSDB 2001
	Groundwater protection list		BNA 2001
California	Drinking water guideline	160 µg/L	HSDB 2001
Connecticut	Water pollution control—hazardous substance		BNA 2001
Delaware	Surface water quality standards—toxic substance		BNA 2001
	Fresh (chronic)	0.1 µg/L	
	Marine (chronic)	0.1 µg/L	

Table 8-1. Regulations and Guidelines Applicable to Malathion

Agency	Description	Information	References
STATE *(cont.)*			
Florida	Drinking water guideline	140 µg/L	HSDB 2001
	Surface water quality criteria		BNA 2001
	Potable water supply	0.1 µg/L	
	Shellfish propagation or harvesting	0.1 µg/L	
	Predominantly fresh waters	0.1 µg/L	
Georgia	Hazardous site response—groundwater criteria concentration	0.2 mg/L	BNA 2001
Hawaii	Water quality criteria		BNA 2001
	Freshwater (chronic)	0.1 µg/L	
	Saltwater (chronic)	0.1 µg/L	
Kansas	Surface water quality criteria		BNA 2001
	Aquatic life (chronic)	0.1 µg/L	
	Agriculture (livestock)	100 µg/L	
Maine	Drinking water guideline	40 µg/L	HSDB 2001
	Private water systems		BNA 2001
	Maximum exposure guideline	0.04 mg/L	
	Action level	0.02 mg/L	
Massachusetts	Environmental toxicity values		BNA 2001
	Freshwater (chronic)	0.1 µg/L	
	Marine (chronic)	0.1 µg/L	
Minnesota	Water quality standards		BNA 2001
	Drinking water supply	200 µg/L	
	Groundwater	200 µg/L	
	Protection of aquatic life	0.1 µg/L	
Nebraska	Standards for water quality		BNA 2001
	Aquatic life (chronic)	0.1 µg/L	
	Water quality standards for wetlands		BNA 2001
	Aquatic life (chronic)	0.1 µg/L	
Nevada	Standards for toxic materials applicable to designated waters		BNA 2001
	Aquatic life	0.1 µg/L	
New Hampshire	Water quality criteria		BNA 2001
	Fresh (chronic)	0.1 µg/L	
	Marine (chronic)	0.1 µg/L	
New Jersey	Groundwater quality criteria	200 µg/L	BNA 2001
	PQL	5 µg/L	
New York	Groundwater quality standards		BNA 2001
	MAC	7.0 µg/L	
Ohio	Surface water quality standards		BNA 2001
	Outside mixing zoning average	0.1 µg/L	

Table 8-1. Regulations and Guidelines Applicable to Malathion

Agency	Description	Information	References
STATE *(cont.)*			
Oklahoma	Surface water quality criteria		BNA 2001
	Fish and wildlife propagation (chronic)	0.1 µg/L	
Oregon	Water quality		BNA 2001
	Fresh (chronic)	0.1 µg/L	
	Marine (chronic)	0.1 µg/L	
South Dakota	Surface water—toxic pollutant		BNA 2001
Texas	Water quality		BNA 2001
	Freshwater (chronic)	0.01 µg/L	
Utah	Water quality—hazardous substances required to be identified by existing dischargers if expected to be present		BNA 2001
Virginia	Criteria for surface water		BNA 2001
	Freshwater (chronic)	0.1 µg/L	
	Saltwater (chronic)	0.1 µg/L	
Wyoming	Water quality criteria		BNA 2001
	Aquatic life (chronic)	0.1 µg/L	
c. Food		No data	
d. Other			
Alabama	Standards for hazardous waste TSD facilities—compounds with Henry's law constant less than 0.1 atm m^3/mol (at 25 °C)		BNA 2001
Arizona	Soil remediation levels		BNA 2001
	Residential	1,300 mg/kg	
	Non-residential	14,000 mg/kg	
Arkansas	Standards for hazardous waste TSD facilities—compounds with Henry's law constant less than 0.1 atm m^3/mol (at 25 °C)		BNA 2001
California	Chemicals required to have been tested for potential to cause cancer or reproductive toxicity, but which have not been adequately tested as required (data requirements)	Oncogenicity	BNA 2001
	Hazardous substance		BNA 2001
	Pesticide field worker safety—restricted entry intervals		BNA 2001
	Citrus	1 day	
	Grapes	1 day	
	Peaches/nectarines	1 day	
	Pesticide registration—active ingredients		BNA 2001

Table 8-1. Regulations and Guidelines Applicable to Malathion

Agency	Description	Information	References
STATE *(cont.)*			
Colorado	Standards for hazardous waste TSD facilities—compounds with Henry's law constant less than 0.1 atm m^3/mol (at 25 °C)		BNA 2001
Delaware	Standards for hazardous waste TSD facilities—compounds with Henry's law constant less than 0.1 atm m^3/mol (at 25 °C)		BNA 2001
	Reportable quantity	100 pounds	BNA 2001
Florida	Toxic substance in the workplace		BNA 2001
Georgia	Hazardous site response—regulated substance		BNA 2001
Illinois	Standards for hazardous waste TSD facilities—compounds with Henry's law constant less than 0.1 atm m^3/mol (at 25 °C)		BNA 2001
Louisiana	Standards for hazardous waste TSD facilities—compounds with Henry's law constant less than 0.1 atm m^3/mol (at 25 °C)		BNA 2001
Maine	Identification of hazardous waste —hazardous constituent		BNA 2001
	Screening standards for beneficial use (waste concentration)	2,000 mg/kg dry weight	BNA 2001
Massachusetts	Containers adequately labeled pursuant to federal law		BNA 2001
	Human health based toxicity values (chronic oral RfD)	$2.0x10^{-2}$ mg/kg/day	BNA 2001
	Oil and hazardous material		BNA 2001
Michigan	Identification and listing of hazardous waste		BNA 2001
Minnesota	Toxic pollutant and hazardous substance		BNA 2001
Mississippi	Packaging dates for malathion	Must mark all retail containers with a code or batch number from which the date of packaging may be determined	BNA 2001
Nebraska	Standards for hazardous waste TSD facilities—compounds with Henry's law constant less than 0.1 atm m^3/mol (at 25 °C)		BNA 2001
	Pesticide classes	Class III[d]	BNA 2001

Table 8-1. Regulations and Guidelines Applicable to Malathion

Agency	Description	Information	References
STATE *(cont.)*			
New Jersey	Hazardous substance		BNA 2001
New York	Pesticide control—use of chemicals for the control or elimination of aquatic insects	Not to exceed 0.5 pounds/acre (active ingredient)	BNA 2001
	Reportable quantity		BNA 2001
	Air	100 pounds	
	Land/water	1 pound	
South Carolina	Standards for hazardous waste TSD facilities—compounds with Henry's law constant less than 0.1 atm m^3/mol (at 25 °C)		BNA 2001
Tennessee	Standards for hazardous waste TSD facilities—compounds with Henry's law constant less than 0.1 atm m^3/mol (at 25 °C)		BNA 2001
Texas	Risk-based exposure limits—soil dermal contact		BNA 2001
	Gastrointestinal absorption factor	$5.00x10^{-1}$	
	Dermal absorption factor	$1.00x10^{-1}$	
Washington	Hazardous substance required to be identified by existing dischargers if expected to be present		BNA 2001
	Standards for hazardous waste TSD facilities—compounds with Henry's law constant less than 0.1 atm m^3/mol (at 25 °C)		BNA 2001
West Virginia	Hazardous substance required to be identified by existing dischargers if expected to be present		BNA 2001
	RfD	$2.00x10^{-2}$ mg/kg/day	BNA 2001

Table 8-1. Regulations and Guidelines Applicable to Malathion

Agency	Description	Information	References
STATE *(cont.)*			
Wyoming	Standards for hazardous waste TSD facilities—compounds with Henry's law constant less than 0.1 atm m^3/mol (at 25 °C)		BNA 2001

[a]Group 3: not classifiable as to its carcinogenicity to humans
[b]Skin notation: danger of cutaneous absorption
[c]A4: not classifiable as a human carcinogen
[d]Class III: oral LD50 greater than 900 mg/kg^{-1}

AAC = acceptable ambient concentrations; ACGIH = American Conference of Governmental Industrial Hygienists; ASIL = acceptable source impact levels; BEI = biological exposure index; BNA = Bureau of National Affairs; BPT = best practical technology; CFR = Code of Federal Regulations; DOT = Department of Transportation; DWEL = drinking water equivalent level; EL = emissions level; EPA = Environmental Protection Agency; HAP = hazardous air pollutant; HSDB = Hazardous Substances Data Bank; IARC = International Agency for Research on Cancer; IDLH = immediately dangerous to life and health; IRIS = Integrated Risk Information System; MAC = maximum allowable concentration; NIOSH = National Institute of Occupational Safety and Health; NPDES = National Pollutant Discharge Elimination System; OEL = occupational exposure limit; OSHA = Occupational Safety and Health Administration; PEL = permissible exposure limit; PQL = practical quantitation level; REL = recommended exposure limit; RfD = oral reference dose; TAL = threshold ambient limits; TLV = threshold limit value; TSD = treatment, storage, and disposal; TWA = time-weighted average; USDA = United States Department of Agriculture