

8. REGULATIONS AND ADVISORIES

International, national, and state regulations and advisories regarding atrazine in air, water, and other media are summarized in Table 8-1. These values have been established because of the potential for atrazine to cause adverse health effects in exposed people.

The EPA (IRIS 2002) has calculated a chronic oral Reference Dose (RfD) for atrazine of 3.5×10^{-2} mg/kg/day based on a NOAEL of 3.5 mg/kg/day for decreased body weight gain in rats exposed for their lifetimes to 70 ppm atrazine in the diet. The NOAEL of 3.5 mg/kg/day atrazine was divided by uncertainty factors of 10 for extrapolation from animals to humans and 10 for human variability in sensitivity. EPA has not derived a Reference Concentration (RfC) for chronic inhalation or done a carcinogenicity assessment for lifetime exposure.

No inhalation MRLs have been derived for atrazine due to lack of data. An MRL of 0.01 mg/kg/day has been derived for acute-duration oral exposure (14 days or less) to atrazine based on a NOAEL of 1 mg/kg/day for decreased body weight gain in pregnant rabbits exposed to atrazine on gestational days 7–19 (Infurna et al. 1988) and an uncertainty factor of 100 (10 for extrapolation from animals to humans and 10 for human variability).

An MRL of 0.003 mg/kg/day has been derived for intermediate-duration oral exposure (15–365 days) to atrazine based on a LOAEL from a 19-day study in which pigs that were administered 1 mg/kg/day atrazine in the diet had decreased levels of estradiol-17 β (E₂), resulting in delayed onset of estrus (Gojmerac et al. 1999). The MRL of 0.003 mg/kg/day was calculated by dividing the LOAEL of 1 mg/kg/day by an uncertainty factor of 300 (10 to account for the use of a LOAEL for delayed onset of estrus, 10 for extrapolation from animals to humans, and 3 for human variability). An uncertainty factor of 3 for human variability was used instead of 10 because the critical effect was identified in a sensitive population (young, developing female pigs). The existing database on the chronic-duration oral toxicity of atrazine was considered inadequate for MRL derivation.

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Table 8-1. Regulations and Guidelines Applicable to Atrazine

Agency	Description	Information	Reference
<u>INTERNATIONAL</u>			
Guidelines:			
IARC	Carcinogenicity classification	Group 3 ^a	IARC 2001
WHO	Drinking water guideline	2 µg/L	WHO 2001
<u>NATIONAL</u>			
Regulations and Guidelines:			
a. Air:			
ACGIH	TLV–TWA	5 mg/m ³	ACGIH 2000
NIOSH	REL (TWA)	5 mg/m ³	NIOSH 2001
OSHA	PEL (8-hour TWA)	5 mg/m ³	OSHA 2001
b. Water			
EPA	Drinking water standards	3 µg/L	EPA 2001e 40CFR141.32 (e)(28)
	Drinking water standards		EPA 2002b
	DWEL	1.0 mg/L	
	MCLG	3 µg/L	EPA 2001d 40CFR141.50
	MCL	3 µg/L	EPA 2001c 40CFR141.61
c. Food			
EPA	Tolerances for residues (ppm)		EPA 2001h
	Cattle–fat, meat byproducts, and meat	0.02	40CFR180.220
	Corn, fodder–field, pop, and sweet	15.0	
	Corn, forage–field, pop, and sweet	15.0	
	Corn–fresh and grain	0.25	
	Eggs	0.02	
	Goats–fat, meat byproducts, and meat	0.02	
	Guava	0.05	
	Hogs–fat, meat byproducts, and meat	0.02	
	Horses–fat, meat byproducts, and meat	0.02	
	Macadamia nuts	0.25	
	Milk	0.02	
	Poultry–fat, meat byproducts, and meat	0.02	
	Rye grass, perennial	15.0	
	Sheep–fat, meat byproducts, and meat	0.02	
	Sorghum-fodder and forage	15.0	
	Sorghum-grain	0.25	

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<u>NATIONAL (cont.)</u>			
EPA	Tolerances for residues (ppm)		EPA 2001h
	Sugarcane—fodder and forage	0.25	40CFR180.220
	Wheat—fodder and straw	5.0	
	Wheat, grain	0.25	
	Tolerances for combined residues of atrazine and its metabolites (ppm)		
	Grass, range	4.0	
FDA	Bottled water	3 µg/L	FDA 2000b 21CFR165.110
	Food additives permitted for direct addition to food for human consumption—diethanolamide condensate based on a mixture of saturated and unsaturated soybean oil fatty acids (or stripped coconut fatty acids) as a surfactant in emulsifier blends	Added to the herbicide atrazine for application to corn	FDA 2000a 21CFR172.710
d. Other			
ACGIH	Carcinogenicity classification	A4 ^b	ACGIH 2000
	RfD	3.5x10 ⁻² mg/kg/day	IRIS 2001
	Effluent limitations for BOD5 and TSS		EPA 2001g 40CFR455.20
EPA	Toxic chemical release reporting; Community Right-to-Know; effective date of reporting	01/01/95	EPA 2001i 40CFR372.65
	Standards for hazardous waste TSD facilities—Henry’s law constant less than 0.1 atm m ³ /mol		EPA 2001b 40CFR265 Appendix VI
NRC	Acceptable daily intakes	2.15x10 ⁻² mg/kg/day	HSDB 2001
<u>STATE</u>			
a. Air			
Alaska	Air contaminant standard	5 mg/m ³	BNA 2001
Connecticut	HAP		BNA 2001
	8 Hours	100 µg/m ³	
	30 Minutes	500 µg/m ³	
Hawaii	Air contaminant	5 mg/m ³	BNA 2001
Kentucky	Air quality		BNA 2001
	TAL (8 hours)	20 mg/m ³	
	Significant levels	1.276x10 ⁻³ pounds/hour	
Louisiana	Hazardous waste; air emission standards—compounds with Henry’s law constant less than 0.1 atm m ³ /mol (at 25 °C)		BNA 2001

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<i>STATE (cont.)</i>			
Michigan	PEL (TWA)	5 mg/m ³	BNA 2001
Nebraska	Hazardous waste; organic air emission standards for tanks and containers—compounds with Henry’s law constant less than 0.1 atm m ³ /mol		BNA 2001
New Hampshire	Toxic air pollutant		BNA 2001
	OEL	5 mg/m ³	
	24-Hour AAL	18 µg/m ³	
	Annual AAL	12 µg/m ³	
	24-Hour de minimus	1.67x10 ⁻³ pounds/hour	
New Mexico	Annual de minimus	3.91x10 ¹ pounds/year	BNA 2001
	Toxic air pollutant		
New York	OEL	5 mg/m ³	BNA 2001
	Emissions	0.333 pounds/hour	
	PEL (TWA)	5 mg/m ³	
North Carolina	PEL (TWA)	5 mg/m ³	BNA 2001
Washington	PEL (TWA)	5 mg/m ³	BNA 2001
	Toxic air pollutants ASIL (24-hour average)	17 µg/m ³	BNA 2001
Wisconsin	Emission rate with emission point <25 feet	4.176x10 ⁻¹ pounds/hour	BNA 2001
	Emission rate with emission point >25 feet	1.752 pounds/hour	
b. Water			
Alabama	MCL	3 µg/L	BNA 2001
Alaska	MCL	3 µg/L	BNA 2001
Arizona	Drinking water guideline	3 µg/L	HSDB 2001
	Groundwater protection list		BNA 2001
	Safe drinking water—reporting limit	0.1 µg/L	BNA 2001
California	Drinking water standard	3 µg/L	HSDB 2001
	Pesticide contamination prevention—groundwater protection list		BNA 2001
Colorado	Groundwater quality standards	3 µg/L	BNA 2001
	MCL	3 µg/L	BNA 2001
Connecticut	Standards for quality of public drinking water—MCL	3 µg/L	BNA 2001
Delaware	MCL	3 µg/L	BNA 2001
Florida	Contaminant cleanup target level		BNA 2001
	Freshwater surface water criteria	1.8 µg/L (human health)	
	Marine surface water criteria	1.8 µg/L (human health)	
Georgia	MCL for drinking water	3 µg/L	BNA 2001
Hawaii	MCL	3 µg/L	BNA 2001
Idaho	Groundwater quality standards	3 µg/L	BNA 2001

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Illinois	MCL	3 µg/L	BNA 2001
Kansas	Surface water quality criteria		BNA 2001
	Aquatic life		
	Acute	170 µg/L	
	Chronic	3 µg/L	
	Domestic water supply	3 µg/L	
Kentucky	MCL	3 µg/L	BNA 2001
Maine	Drinking water guideline	3 µg/L	HSDB 2001
	Private water systems		BNA 2001
	Maximum exposure guideline	4.3x10 ⁻² mg/L	
	Action level	2.1x10 ⁻² mg/L	
Maryland	Drinking water	3 µg/L	BNA 2001
Michigan	MCL	3 µg/L	BNA 2001
	Effective date	07/30/92	
Minnesota	Drinking water guideline	20 µg/L	HSDB 2001
Mississippi	Groundwater standards	3 µg/L	BNA 2001
Missouri	MCL	3 µg/L	BNA 2001
Nebraska	Aquatic criteria ^d		BNA 2001
	Acute	330 µg/L	
	Chronic	12 µg/L	
	MCL	3 µg/L	BNA 2001
New Jersey	Groundwater quality criteria	3 µg/L	BNA 2001
	PQL	1 µg/L	
New Mexico	MCL	3 µg/L	BNA 2001
New York	Groundwater effluent limitations— maximum allowable concentration	7.5 µg/L	BNA 2001
	MCL	3 µg/L	BNA 2001
North Dakota	MCL	3 µg/L	BNA 2001
	MCL	3 µg/L	BNA 2001
Ohio	MCL	3 µg/L	BNA 2001
Oklahoma	MCL	3 µg/L	BNA 2001
Rhode Island	Groundwater quality standard	3 µg/L	BNA 2001
	Preventive action limit	1.5 µg/L	
Rhode Island	MCLG	3 µg/L	BNA 2001
	MCL	3 µg/L	
South Carolina	MCL	3 µg/L	BNA 2001
South Dakota	Groundwater quality standards	3 µg/L	BNA 2001
Tennessee	MCL	3 µg/L	BNA 2001
Texas	MCL	3 µg/L	BNA 2001
Utah	Groundwater quality standards	3 µg/L	BNA 2001
	MCL	3 µg/L	BNA 2001
Vermont	Groundwater quality standards		BNA 2001
	Enforcement standard	3 µg/L	
	Preventive action level	1.5 µg/L	
	MCL	3 µg/L	BNA 2001

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Virginia	MCLG	3 µg/L	BNA 2001
	MCL	3 µg/L	
Washington	MCLG	3 µg/L	BNA 2001
	MCL	3 µg/L	
West Virginia	Groundwater standards	Not to exceed 3 µg/L	BNA 2001
Wisconsin	Groundwater quality standards (total chlorinated residues)		BNA 2001
	Enforcement standard ^e	3 µg/L	
	Preventive action limit ^e	0.3 µg/L	
	MCLG ^f	3 µg/L	BNA 2001
	MCL	3 µg/L	
Wyoming	Groundwater standards—MCL	3 µg/L	BNA 2001
c. Food		No data	
d. Other			
Arizona	Soil remediation levels		BNA 2001
	Residential	20.0 mg/kg	
	Non-residential	86.0 mg/kg	
Arkansas	Hazardous waste management—compounds with Henry's law constant less than 0.1 atm m ³ /mol (at 25 °C)		BNA 2001
California	Hazardous substance list		BNA 2001
California	Pesticide registration—active ingredient that have the most significant data gaps, widespread use, and suspected to be hazardous to people		BNA 2001
	Restricted pesticide —agricultural, outdoor institutional, and outdoor industrial uses of pesticides containing atrazine are prohibited in the Pesticide Management Zones		BNA 2001
Colorado	Hazardous waste—compounds with Henry's law constant less than 0.1 atm m ³ /mol (at 25 °C)		BNA 2001
Delaware	Hazardous waste—compounds with Henry's law constant less than 0.1 atm m ³ /mol		BNA 2001
Florida	Toxic substances in the workplace—substance list		BNA 2001
Iowa	Restrictions on distribution and use of pesticides		BNA 2001
Massachusetts	Containers adequately labeled pursuant to federal law		BNA 2001
	Oil and hazardous material list		BNA 2001

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Minnesota	Hazardous substance		BNA 2001
	RfD	3.5×10^{-2} mg/kg/day	BNA 2001
	Health risk limit	20 µg/L	
	Toxic end point	Cardiovascular system	BNA 2001
New Jersey	Hazardous substance		BNA 2001
South Carolina	Hazardous waste—compounds with Henry's law constant less than 0.1 atm m ³ /mol		BNA 2001
	Hazardous substance site remediation goals	3×10^{-3} ppm	BNA 2001
Washington	Pesticide regulation	Restricted use pesticide	BNA 2001
Wisconsin	Hazardous waste—compounds with Henry's law constant less than 0.1 atm m ³ /mol (at 25 °C)		BNA 2001
	Pesticide product restrictions		BNA 2001

^aGroup 3: not classifiable as to its carcinogenicity to humans

^bA4: not classifiable as a human carcinogen

^cGroup C: possible human carcinogen

^dHuman health criteria at 10⁻⁵ risk level for carcinogens based on the consumption of fish and other aquatic organisms.

^eTotal chlorinated atrazine residues includes parent compound and the following metabolites of health concern: 2-chloro-4-amino-6 isopropylamino-s-triazine (formerly deethylatrazine), 2-chloro-4-amino-6-ethylamino-s-triazine (formerly deisopropylatrazine), and 2-chloro-4,6-diamino-s-triazine (formerly diaminoatrazine).

^fAtrazine, total chlorinated residue includes atrazine and its metabolites, diaminoatrazine, diethylatrazine, and deisopropylatrazine.

ACGIH = American Conference of Governmental Industrial Hygienists; AAL = ambient air limits; ASIL = acceptable source impact levels; BOD = biological oxygen demand; BNA = Bureau of National Affairs; CFR = Code of Federal Regulations; DWEL = drinking water equivalent level; EPA = Environmental Protection Agency; FDA = Food and Drug Administration; HAL = health advisory level; HAP = hazardous air pollutant; HSDB = Hazardous Substances Data Bank; IARC = International Agency for Research on Cancer; IRIS = Integrated Risk Information System; MCL = maximum contaminant level; MCLG = maximum contaminant level goal; NIOSH = National Institute for Occupational Safety and Health; OEL = occupational exposure limit; OSHA = Occupational Safety and Health Administration; PEL = permissible exposure limit; PQL = practical quantitation level; REL = recommended exposure limit; RfD = reference dose; TAL = threshold ambient limit; TLV = threshold limit values; TSD = treatment, storage, and disposal; TSS = total suspended solids; TWA = time-weighted average; WHO = World Health Organization

