



Picloram

Roadside Vegetation Management Herbicide Fact Sheet



This fact sheet was developed by Oregon State University and Intertox, Inc. to assist interested parties in understanding the risks associated with pesticide use in Washington State Department of Transportation's (WSDOT) Integrated Vegetation Management program. WSDOT updated in 2017 to reflect current products and usage.

Introduction

Picloram is an herbicide used to control general woody plants and a wide range of broad-leaf weeds but not mustards (crucifers). Picloram does not harm most grasses. Picloram's potassium salt formulation is the active ingredient (24.4%) in the herbicide product **Tordon** used by the Washington Department of Transportation (WSDOT) for selective broadleaf treatment of hard-to-control noxious weed species. Picloram also has agricultural and forestry uses.

Application Rates and Use Patterns on Highway Rights-of-Way

Typical rights-of-way application rates range from 16 to 64 ounces of product per acre, or a maximum of about 1 pound of picloram per acre. Applicators use truck-mounted handguns and hose reels or backpack sprayers to apply Tordon from April to September. Because applications are directed only onto target vegetation, the total amounts applied in any given acre are far less than these maximums. Tordon products are used primarily on the east side of the state with extra care to avoid root zones of desirable trees. WSDOT workers applied 517 pounds of picloram statewide during 2016.

Laboratory Testing: Before pesticides are registered by the U.S. Environmental Protection Agency (EPA), they must undergo laboratory testing for short-term (acute) and long-term (chronic) health effects. Laboratory animals are purposely fed doses high enough to cause toxic effects. These tests help scientists determine how chemicals might affect humans, domestic animals, or wildlife in cases of overexposure. Pesticide products used according to label directions are unlikely to cause toxic effects. The amount of pesticide that people and pets may be exposed to is low compared to the doses fed to laboratory animals.

Risk Assessments

WSDOT assessed potential risks to humans, wildlife, and aquatic (water) animals in association with the use of picloram in their Integrated Vegetation Management (IVM) program. The risks described below are associated with the use of Tordon in which picloram is the only active ingredient.

Human Health Effects

The U.S. Environmental Protection Agency (EPA) classifies Tordon as toxicity class II (moderate toxicity) with a signal word of CAUTION. (See Toxicity Category and Signal Word table.)

Acute toxicity: The potassium salt of picloram has low toxicity if people accidentally eat, touch, or inhale residues. It is slightly irritating to the eyes and non-irritating to the skin; however, it is a skin sensitizer. (See Laboratory Testing text box.)

Chronic toxicity: The picloram acid formulation (instead of picloram potassium salt) caused changes in the livers of rats fed moderate to high doses for 2 years.

Toxicity Category and Signal Word

	High Toxicity (<i>Danger</i>)	Moderate Toxicity (<i>Warning</i>)	Low Toxicity (<i>Caution</i>)	Very Low Toxicity (<i>Caution</i>)
Oral LD50	Less than 50 mg/kg	50-500 mg/kg	500-5000 mg/kg	Greater than 5000 mg/kg
Dermal LD50	Less than 200 mg/kg	200-2000 mg/kg	2000-5000 mg/kg	Greater than 5000 mg/kg
Inhalation LC50	Less than 0.05 mg/l	0.05-0.5 mg/l	0.5-2.0 mg/l	Greater than 2.0 mg/l
Eye Effects	Corrosive	Irritation persisting for 7 days	Irritation reversible in 7 days	Minimal effects, gone in 24 hrs
Skin Effects	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation

Highlighted categories specify the range for picloram use cited in this fact sheet.

Reproductive effects: Picloram caused reduced fertility when high doses were fed to rats over three generations. It had no effect on reproduction, growth, or survivability of the offspring when fed to rats over two generations. Offspring of laboratory rats and rabbits exposed to picloram salts during pregnancy showed no birth defects. These findings suggest that picloram is unlikely to cause reproductive effects in humans when workers apply it at label directed rates.

Carcinogenic effects: Picloram caused weak cancer effects in the livers of rats and mice given high doses, but it did not cause cancer effects in other studies. Some studies show evidence that picloram causes mutations, while others do not. The EPA lists picloram as Group D, not classifiable as a human carcinogen.

Fate in humans and animals: When given to human volunteers, picloram was rapidly absorbed through the gastrointestinal tract with half the dose excreted in the urine in 1 day. It does not absorb through the skin in significant amounts. Rats excreted doses of picloram in the urine and feces in 48 hours. It does not accumulate (build up) in fat. Picloram does not contaminate milk when fed to cows in low doses. High doses do result in measurable residues in the milk, but these residues quickly drop once picloram is removed from the diet.

LD50/LC50: Acute toxicity is commonly measured by the lethal dose (LD) or lethal concentration (LC) that causes death in 50 percent of treated laboratory animals. LD50 indicates the dose of a chemical per unit body weight of an animal and is expressed as milligrams per kilogram (mg/kg). LC50 is the concentration of a chemical per volume of air or water and is expressed as milligrams per liter (mg/L). Chemicals are highly toxic when the LD50 or LC50 value is small and practically nontoxic when the value is large. However, the LD50 and LC50 do not reflect potential health effects such as cancer, birth defects, or reproductive toxicity that may occur at levels of exposure below those that cause death.

Wildlife and Aquatic Effects

Effects on mammals: Picloram is slightly to practically non-toxic to mammals if eaten. The LD50s for various mammals are 5,000 to 8,200 milligrams per kilogram (mg/kg) in rats, 2,000 to 4,000 mg/kg in mice, 2000 mg/kg in rabbits, and about 3,000 mg/kg in guinea pigs. The LD50 for

Wildlife Toxicity Category

Risk Category	Mammals	Birds	Fish or Aquatic Insects
	Acute Oral or Dermal LD ₅₀ (mg/kg)	Acute Oral LD ₅₀ (mg/kg)	Acute LC ₅₀ (mg/L)
Practically nontoxic	>2,000 ¹	>2,000	>100 ²
Slightly toxic	501-2,000	501-2,000	>10-100
Moderately toxic	51-500	51-500	>1-10
Highly toxic	10-50	10-50	0.1-1
Very highly toxic	<10	<10	<0.1

¹Highlighted categories specify the range for picloram use cited in this fact sheet.

²The toxicity of picloram to fish and aquatic insects varies depending on the specific fish or insect species that is exposed.

rabbits exposed by skin contact is greater than 3,980 mg/kg. (See LD50/LC50 text box and Wildlife Toxicity Category table.)

Effects on birds: Picloram is practically non-toxic to birds. LD50s for various bird species are greater than 5,000 mg/kg for bobwhite quail, 2,510 mg/kg for mallard ducks, 6,000 mg/kg for chickens, and greater than 2,000 mg/kg for pheasants.

Effects on fish: Picloram is moderately toxic to fish. LC50 concentrations for various fish species are 19.3 mg/L for rainbow trout, 14.5 mg/L for bluegill sunfish, and 55 mg/L for fathead minnows. There is little evidence that it bioaccumulates (builds up) in fish.

Effects on aquatic insects: Picloram ranges from practically non-toxic to moderately toxic in aquatic (water) insects. The LC50 for *Daphnia magna* (water fleas) exposed for 48 hours is 68.3 mg/L and for *Gammarus lacustris* (crustaceans) exposed for 96 hours is 27 mg/L.

Environmental Fate

The half-life of picloram ranges from 20 to 300 days with a typical time of 90 days. (See Half-life text box.) It is moderately to highly persistent in soils and has the potential to contaminate groundwater. The half-life of picloram in water is 2.6 days. Picloram is readily absorbed (taken in) by roots and leaves and is easily translocated (moved) throughout plant tissues.

Human Health Risk Assessment

WSDOT evaluated several human exposure scenarios, including workers who prepare, load, and apply the herbicide, and members of the public who may be exposed when they walk, hike, or jog in sprayed vegetation, or who pick or eat drift-contaminated berries or vegetables. For each exposure scenario, WSDOT evaluated conditions of average exposure and extremely conservative conditions of maximum exposure.

Picloram poses a negligible risk of adverse non-cancer effects to WSDOT workers and the public under conditions of average exposure. All hazard quotients are below 1. For the maximum exposure scenarios, picloram poses a low risk of adverse non-cancer effects to the public for adults and children who eat drift-contaminated garden vegetables with hazard quotients of 1.0 and 1.4, respectively. Hazard quotients for all other public exposure scenarios are less than 1. (See Human Cancer/Non-cancer text box and Human Risk Classification for Average Exposure Scenarios table.) Picloram poses a low non-cancer risk to workers making broadcast hydraulic spray applications with a hazard quotient of 1.3. Picloram poses a negligible risk to workers making directed foliar applications. The hazard quotient is less than 1.

Half-life is the time required for half of the compound to degrade.

1 half-life	= 50% degraded
2 half-lives	= 75% degraded
3 half-lives	= 88% degraded
4 half-lives	= 94% degraded
5 half-lives	= 97% degraded

Remember: the amount of a chemical remaining after a half-life will always depend on the amount of the chemical originally applied.

Human Cancer/Non-cancer Risk Classification:

Scientists estimate non-cancer health risks by generating a hazard quotient (HQ). This number is the exposure divided by the toxicity. When the HQ is less than 1, exposures are unlikely to cause any adverse health effects. When the HQ is greater than 1, potential non-cancer health effects may be possible. Risk assessments for chemicals that cause cancer (carcinogens) estimate the probability of an individual developing cancer over a lifetime. Cancer risks estimated in this way are very conservative, and actual cancer risks are likely to be much lower. Cancer risk estimates of less than 1 in 100,000 are within the range considered negligible by most regulatory agencies.

Human Risk Classifications for Average Exposure Scenarios

Hazard Quotient (Non-cancer Risk)	Cancer Risk	Potential Risks and Management Priority
Less than 1	Less than 1 in 100,000	Negligible ¹
Between 1 and 10	Between 1 in 10,000 and 1 in 100,000	Low
Between 10 and 100	Between 4 in 1,000 and 1 in 10,000	Moderate
Greater than 100	Greater than 4 in 1,000	High

¹Negligible risks involving picloram are associated with average exposure scenarios for WSDOT workers and the public.

Wildlife Risk Assessment

Wildlife risk assessment considers pesticide behavior in the environment and routes of exposure. Indirect exposure to mammals and birds can occur when they eat contaminated prey or vegetation. Direct exposure can occur when mammals and birds contact pesticide residues with their skin or eyes or when they inhale vapors or particulates. WSDOT's current application rates and use patterns for picloram pose a negligible risk to mammals. Estimated dietary exposures for rats, mice, and meadow voles are approximately 400 to 3,500 times lower than the rat LD50 of 5,000 mg/kg. Estimated dietary exposures of picloram to quail, marsh wrens, and American robins are approximately 100 to 1,100 times lower than the mallard duck LD50 of 2,510 mg/kg. WSDOT's current application rates and use patterns for picloram pose a negligible risk to bobwhite quail and a low risk to marsh wrens and American robins.

Aquatic Risk Assessment

WSDOT takes extra precautions applying herbicides near open water, wetlands, and wellhead protection zones. However, contamination may result from application drift, rainfall runoff, or residue leaching through the soil into groundwater. Fish and aquatic insect exposure to picloram occurs primarily through direct contact with contaminated surface waters. Picloram does not bioaccumulate (build up) in fish and aquatic insects. The risk to fish and aquatic insects from WSDOT's current application rates and use patterns for picloram is low in all areas of the state except the Puget Sound Trough where the risk is moderate.

Additional Resources

- National Pesticide Information Center 1-800-858-PEST (7378) and <http://npic.orst.edu>
- Extension Toxicology Network (EXTOXNET) <http://extoxnet.orst.edu>
- Washington State Department of Transportation, Roadside Maintenance Branch 1-360-705-7865
- Washington Department of Agriculture, Pesticide Management Division 1-877-301-4555 (toll free)