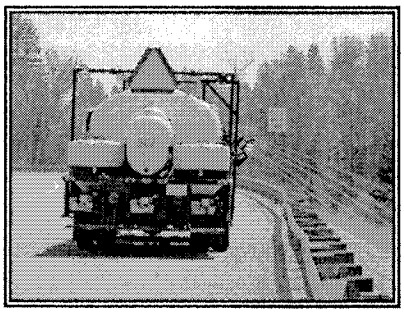
Washington State
Department of Transportation



Triclopyr

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.

Introduction

Triclopyr is an herbicide that controls woody plants and broadleaf weeds. Triclopyr mimics a plant growth hormone and causes uncontrolled and disorganized plant growth that leads to plant death. Triclopyr is the active ingredient in the herbicide product **Garlon** used by the Washington State Department of Transportation (WSDOT) along right-of-ways primarily for the control of brush and small undesirable trees. This product is also commonly used in forestry, on industrial lands, rangelands, and parklands for selective control of both woody and broadleaf plants.

WSDOT assessed the potential risks to humans, wildlife, and aquatic animals exposed to triclopyr in their Integrated Vegetation Management (IVM) program. Evaluating potential risks takes into account both the toxicity of a pesticide and the characteristics of possible exposure.

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.

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

Typical rights-of-way application rates for **Garlon** range from 64 to 128 ounces of product per acre, or a maximum of about 4 pounds of active ingredient per acre. Applicators use truck-mounted handguns, hose reels, or side booms to apply Garlon from April to November. WSDOT workers applied about 5,150 pounds of triclopyr statewide during 2002.

Human Health Effects

The U.S. Environmental Protection Agency (EPA) classifies Garlon 4 as toxicity class III (low toxicity) with a signal word of CAUTION. They classify Garlon 3A as toxicity class I (high toxicity) with a signal word of DANGER.

Acute toxicity: Triclopyr has low toxicity if individuals accidentally eat, touch, or inhale residues. Triclopyr is slightly irritating to the eyes, nonirritating to the skin, and causes skin sensitization. The herbicide formulation Garlon 3A may cause irreversible damage to the eyes.

Chronic toxicity: Triclopyr caused only slight changes in kidney weight and pigment deposition when fed to rats and dogs for one or two years at moderate doses. It caused changes in body weight, urine parameters, and thymus size when fed to mice for 2 years at moderate to high doses.

Toxicity Category and Signal Word

	High Toxicity (*Danger*)	Moderate Toxicity (*Warning*)	Low Toxicity (*Caution*)	Very Low Toxicity (*Caution*)
Oral LD50	Less than 50 mg/kg	50-500 mg/kg	500-5000 mg/kg [1]	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 [2]	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

[1]Highlighted categories specify the range for triclopyr use cited in this fact sheet.
[2]The High Toxicity classification is specific to the triclopyr formulation in Garlon 3A; it is severely corrosive to the eyes.

Reproductive effects: Triclopyr did not affect reproduction, growth, or survivability of the offspring when fed to rats over three generations at moderate doses. Higher doses of triclopyr caused decreases in litter size, weight gain, and survivability in the pups of rats fed for two generations. The offspring of laboratory rats exposed to triclopyr during pregnancy showed some delay in bone formation but no other birth defects. In rabbits fed high doses, offspring showed some decrease in body weight and survivability and increases in skeletal changes.

Carcinogenic effects: Rats fed triclopyr in the diet for two years at moderate doses showed no increase in the number of tumors. It caused an increase in lung tumors in mice fed high doses. The EPA lists triclopyr as a Group D human carcinogen (not classifiable as to human carcinogenicity).

Fate in humans and animals: Animals rapidly eliminate triclopyr in the urine. At high oral doses, animals eliminate some triclopyr in the feces. Half-lives for elimination of triclopyr from mammals are 14 hours (dog) and <24 hours (monkeys). The half-life in humans is approximately 5 hours.

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: Triclopyr is slightly toxic to mammals. The rat LD50 ranges from 630 milligrams per kilogram (mg/kg) to 729 mg/kg. The LD50 for rabbits is 550 mg/kg and for guinea pig is 310 mg/kg. The LD50 for alternate formulations of triclopyr is greater than 2,000 mg/kg. The LD50 for rabbits exposed by skin contact is greater than 4,000 mg/kg.

Effects on birds: Triclopyr is practically nontoxic to birds. The LD50 for mallard ducks is 1,698 mg/kg and for bobwhite quail is 2,935 mg/kg. The LC50 for birds fed triclopyr for 8 days are >5,600 mg/kg (mallard), 2,935 mg/kg (bobwhite quail), and 3,278 mg/kg (Japanese quail).

Effects on fish: Triclopyr is practically non-toxic to highly toxic to fish depending on the formulation. Triclopyr has a LC50 of 117 mg/L in rainbow trout and 148 mg/L in bluegill sunfish

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	>2,000	>100
Slightly toxic	501-2,000 [1]	501-2,000	>10-100
Moderately toxic	51-500	51-500	>1-10
Highly toxic	10-50	10-50	0.1-1 [2]
Very highly toxic	<10	<10	<0.1

[1]Highlighted categories specify the range for triclopyr use cited in this fact sheet.
[2]Toxicity of triclopyr to fish is highly dependent on the specific form of the chemical.

after 96 hours of exposure to the triclopyr and its amine salt formulation. Triclopyr in the ester formulation has an LC50 of 0.74 mg/L for rainbow trout and 0.87 mg/L for bluegill sunfish after 96 hours of exposure.

Effects on aquatic insects: Triclopyr amine salt is practically non-toxic to aquatic (water) insects.

Environmental Fate

The half-life of triclopyr in soils ranges from 30 to 90 days with a typical time of 46 days. (See Half-life text box). Half-lives are longer in cold, dry conditions. Microbes break it down. Triclopyr does not bind tightly to soil particles and is highly mobile in the environment, with the potential to contaminate groundwater. Triclopyr absorbs into the roots and leaves of treated plants and is readily translocated (easily moves throughout) through plant parts.

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 Health Risk Assessment

WSDOT evaluated several human exposure scenarios, including adults and children eating drift-contaminated garden vegetables or children directly touching drift-contaminated berries or sprayed vegetation. For each exposure scenario, WSDOT evaluated conditions of average exposure and extremely conservative conditions of maximum exposure. (See Human Cancer/Non-cancer text box and Human Risk Classifications under Conditions of Average Exposure Scenarios). Triclopyr poses a negligible risk of adverse non-cancer effects to the public under conditions of average exposure. All hazard quotients are below 1. For maximum exposure scenarios, triclopyr poses a potential low to high risk of adverse non-cancer effects in public exposure scenarios. Hazard quotients range from 1.1 for adults who contact sprayed vegetation to 132 for children who ingest drift-contaminated berries. Triclopyr poses a potential low risk to workers engaged in broadcast hydraulic spray applications under average exposure scenarios. The hazard quotient for this scenario is 4. Triclopyr poses a potential high non-cancer risk to workers engaged in broadcast hydraulic spray applications under maximum exposure conditions; the hazard quotient is 108.

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 under Conditions of Average Exposure

Hazard Quotient (Non-cancer Risk)	Cancer Risk	Potential Risks and Management Priority
Less than 1	Less than 1 in 100,000	**Negligible**
Between 1 and 10	Between 1 in 10,000 and 1 in 100,000	**Low**[1]
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**

Note: Highlighted categories specify the range of potential risk for specific exposure scenarios involving triclopyr.
[1]Low risks involving triclopyr are specific to WSDOT workers making broadcast applications.

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 triclopyr pose a low to

moderate risk to mammals. Estimated dietary exposures for rats, mice and meadow voles are approximately 13 to 113 times lower than the rat LD50 of 630 mg/kg. Estimated dietary exposures for bobwhite quail, marsh wrens and American robins are 17 to 190 times lower than the mallard LD50 of 1,698 mg/kg. WSDOT's current use of triclopyr poses a low risk to quail, and a moderate 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 triclopyr occurs primarily through direct contact with contaminated surface waters. WSDOT's current application rates and use patterns for triclopyr pose a low risk to fish and aquatic animals in all areas of the state.

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)