Washington State
Department of Transportation

Clopyralid

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

Clopyralid is an herbicide used for selective control of noxious and nuisance weed. Clopyralid mimics a plant growth hormone and causes uncontrolled and disorganized plant growth that leads to plant death. Clopyralid is the sole active ingredient (40.9%) in the herbicide **Transline** and is combined with the active ingredient 2,4-D in the product **Curtail**. Transline and Curtail are used by the Washington State Department of Transportation (WSDOT) for noxious and nuisance weed control. Clopyralid also has agricultural and forestry uses, but it is no longer used in residential settings, (see the section titled Environmental Fate on page 3).

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.

Purpose and Use Patterns on Highway Rights-of-Way

Typical rights-of-way application rates of Transline range from 8 to 16 ounces—or a maximum of about 0.375 pounds of clopyralid—per acre. Curtail is applied at 48 to 64 ounces per acre—or a maximum of about 0.19 pounds of clopyralid per acre. Applicators use truck-mounted handguns or hose reels and backpack sprayers to target weeds with spot applications throughout the growing season from April to September. WSDOT workers applied 452 pounds of clopyralid statewide during 2002.

Risk Assessments

WSDOT assessed potential risks to humans, wildlife, and aquatic organisms from any possible exposure to clopyralid in their Integrated Vegetation Management (IVM) program. The risks presented below are associated with use of the product (Transline) in which clopyralid is the sole active ingredient. Clopyralid is applied at a greater rate in Transline than it is in Curtail, which contains both clopyralid and 2,4-D. Therefore, risks associated with clopyralid are greater for Transline than Curtail (though the overall risks from Curtail are greater due to the presence of 2,4-D). Evaluating potential risks takes into account both the toxicity of a pesticide and the likelihood of exposure.

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	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 clopyralid use cited in this fact sheet.

Human Health Effects

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

Acute toxicity: Clopyralid has low toxicity if individuals accidentally eat, touch, or inhale residues. (See Laboratory Testing text box.) Clopyralid vapors may irritate the eyes, and direct contact may cause very slight but temporary eye injury. It is not a skin sensitizer or irritant.

Chronic toxicity: Clopyralid causes only slight changes in body, liver, and kidney weight and some changes in stomach tissue structure when fed to rats for 2 years at moderate to high doses.

Reproductive effects: Clopyralid does not affect the reproduction, growth, or survivability of the offspring when fed to rats over two generations. High-dose toxicity studies show slight reductions in body weights in the mothers and changes in liver weights in the offspring. The offspring of laboratory rabbits and rats exposed to clopyralid during pregnancy show no signs of birth defects. These findings suggest that when workers apply clopyralid at recommended levels, it is unlikely to cause reproductive effects in humans.

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 non-toxic 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.

Carcinogenic effects: Rats and mice fed moderate to high doses of clopyralid for 2 years show no increased incidence of tumors. This evidence suggests that clopyralid is not carcinogenic. Numerous studies of clopyralid show no evidence that it causes mutations. The EPA lists clopyralid as a Group E human carcinogen (no evidence of carcinogenicity).

Fate in humans and animals: Rats rapidly excrete clopyralid through the urine. Fecal elimination is a minor path. Clopyralid passes through the body unchanged.

Wildlife Effects

Effects on mammals: Clopyralid is practically non-toxic to mammals. The acute LD50 for rats fed clopyralid ranges from 4,300 to 5,000 mg/kg. (See LD50/LC50 text box and Wildlife Toxicity Category table.) Formulated Transline has low acute toxicity through skin contact. The LD50 for rabbits exposed by skin contact is >5000 mg/kg. Clopyralid has very low acute toxicity when inhaled. The LC50 value for rats exposed to clopyralid in the air is >3.0 mg/L. Clopyralid does not cause birth defects in the offspring of pregnant laboratory animals exposed to low or moderate doses, doses that are three to four times higher than label application rates. Long-term, low-dose (chronic) exposure to the skin or eyes may be more toxic than short-term, high-dose (acute) exposures. Clopyralid does not bioaccumulate (is not stored) in the tissues of exposed land animals.

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 non-toxic	>2,000	>2,000	>100
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

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

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.

Effects on birds: Clopyralid is slightly toxic to birds. The LD50 for mallard ducks and bobwhite quail fed clopyralid is 2000 mg/kg. Chronic clopyralid exposure did not cause significant effects to bobwhite quail embryos.

Effects on fish: Clopyralid is practically non-toxic to fish. The LC50 is 125 mg/L for bluegill sunfish and 104 mg/L for rainbow trout. The chronic exposure (96 hours) LC50 for bluegill and rainbow trout is >100 mg/L.

Effects on aquatic insects: Clopyralid is practically non-toxic to aquatic (water) insects. The LC50 for water fleas (*Daphnia*) exposed to clopyralid for 48 hours is >100 mg/L.

Environmental Fate

The half-life of clopyralid in soils ranges from 14 to 56 days with a typical time of 40 days. (See Half-life text box.) Microbes break down clopyralid in soils. Carbon dioxide is the major breakdown product.

Small amounts of clopyralid added to leaf materials have no affect on the leaf breakdown. Clopyralid is very stable in compost and can be present in levels that will harm plants. Clopyralid is no longer used for lawn and garden applications because of the potential for contamination of compost through recycling of waste material.

Clopyralid is classified as very mobile. However, field studies show that clopyralid has minimal potential to contaminate groundwater through leaching.

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. Based on these exposure scenarios, clopyralid poses a negligible risk to workers and the public under both average and maximum exposure conditions (see Human Cancer/Non-cancer text box and Human Risk Classification table).

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**

[1]Highlighted categories specify the range of potential risk for specific exposure scenarios involving clopyralid.

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 clopyralid residues with their skin or eyes or when they inhale clopyralid vapors or particulates. WSDOT's low application rates and limited use of clopyralid pose a negligible risk to wildlife. Estimated dietary doses to rats, mice, and meadow voles are approximately 1,000 to 8,000 times lower than the rat LD50 of 4,300 mg/kg. Estimated dietary doses to quail, marsh wren, and the American robin are approximately 200 to 2,400 times lower that the LD50 of 2,000 mg/kg. Clopyralid does not bioaccumulate in wildlife. Persistence of the compound in the environment could result in low-level, long-term exposures under some scenarios.

Aquatic Risk Assessment

WSDOT takes extra precautions when applying herbicides near open water, wetlands, or wellhead protection zones. However, water contamination may result from application drift, rainfall runoff, or residue leaching through the soil into shallow groundwater. Aquatic animal exposure to clopyralid occurs when they come into direct contact with contaminated surface waters. Clopyralid is practically non-toxic to fish and aquatic insects. (See Wildlife Toxicity Category table.) WSDOT's low application rates and limited use of clopyralid throughout the state pose a low risk to fish and aquatic insects. Clopyralid does not bioaccumulate in aquatic animals; therefore, the risk to fish that eat exposed aquatic insects or other contaminated food sources is low.

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)