Washington State Department of Transportation

Fluroxypyr

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

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Fluroxypyr is a pyridinoxy acid herbicide used to control annual and perennial broadleaf weeds and woody brush. Fluroxypyr induces auxin-type responses in susceptible annual and perennial broadleaf weeds (auxin being a type of plant growth hormone). Fluroxypyr is one of the active ingredients in **Vista**. According to the product label, **Vista**. Fluroxypyr is combined with dicamba and 2,4-D in the herbicide **E-2** The Washington State Department of Transportation (WSDOT) uses this product for selective nuisance and noxious weed control. Fluroxypyr also has agricultural and urban uses.

WSDOT assessed the potential risks to human, wildlife, and aquatic animals exposed to fluroxypyr 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.

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

Typical rights-of-way application rates for **Vista** range from 6 to 23 ounces of product—or a maximum of about 0.5 pounds of the active ingredient fluroxypyr—per acre. E-2 has maximum rate per application at 80 ounces per acre. Applicators use truck-mounted hand-guns, hose reels, or backpack sprayers to make a single application of **Vista** in the spring or summer. Most applications are directed onto individual target plants. In some cases, when applied over wide-spread infestations, applications may be made through truck- or tractor-mounted booms. WSDOT workers applied about 6491 active pounds of fluroxypyr statewide during 2016.

Human Health Effects

The U.S. Environmental Protection Agency (EPA) classifies **Vista** and **E-2** as a category II (Moderate Toxicity) with a signal word of WARNING because it causes substantial but temporary eye injury and is harmful if swallowed or absorbed through the skin (see "Toxicity Category and Signal Word" table).

Acute toxicity: Fluroxypyr has low toxicity if individuals accidentally eat residues or get them on their skin, and very low toxicity if it is inhaled. Rabbits exposed on the skin have slight irritation which is usually resolvable by 48 hours. Fluroxypyr applied to the eyes of rabbits resulted in severe irritation which resolved in three weeks. Fluroxypyr does not result in sensitization in guinea pigs.

Chronic toxicity: In rats and mice fed fluroxypyr for 2 years, kidney abnormalities (and decreased body weight gain in male mice) were observed at high doses. No effect was seen in dogs.

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

Note: Highlighted categories specify the range for fluroxypyr cited in this fact sheet.

Reproductive effects: In studies with rats, reproductive and developmental effects were observed at high doses of fluroxypyr. An increased incidence of abortion was found in rabbits exposed to fluroxypyr to an unspecified period of time.

Carcinogenic effects: No data on potential carcinogenic effects of fluroxypyr were identified. It does not appear that fluroxypyr is mutagenic. Fluroxypyr is considered not likely to be a human carcinogen by U.S. EPA.

Fate in humans and animals: Fluroxypyr is rapidly metabolized and excreted primarily as expired carbon dioxide, and to a lesser degree as metabolites in urine and feces. Fluroxypyr does not bioaccumulate (build up) in mammals.

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: Fluroxypyr was found to be practically non-toxic to small mammals based on acute oral and dermal toxicity studies. An acute oral LD50 of >5,000 mg/kg was reported for rats. Elsewhere, an acute LD50 of 2,405 was reported. Via the dermal route, an LD50 of >2,000 mg/kg was reported in rats. Via inhalation, an LC50 of >2,000 mg/m^3 was reported for rats. Elsewhere, an LC50 of >296 mg/m^3 was reported for rats exposed via inhalation for 4 hours.

Effects on birds: Fluroxypyr is practically non-toxic to avian species based on acute exposure of bobwhite quail and mallard ducks that resulted in LD50 values >2,000 mg/kg. Following a subacute 5-day exposure, an LC50 of >5,000 mg/kg was reported.

Effects on fish: Acute toxicity tests evaluated by U.S. EPA indicate that fluroxypyr is slightly toxic to practically

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	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 fluroxypyr cited in this fact sheet. The toxicity of fluroxypyr to wildlife receptors varies by species.

non-toxic to freshwater fish. For bluegill sunfish, a 96-hour LC50 >14.3 mg/L was reported. For rainbow trout, 96-hour LC50 values ranged from 13.4 mg/L to >100 mg/L.

Effects on aquatic insects: Results from toxicity testing conducted on *Daphnia magna* indicate that fluroxypyr is practically non-toxic to this species of invertebrate. The 48-hour EC50 for this toxicity test was >100 mg/L. Some estuarine/marine invertebrates were reported to be more sensitive to the toxicity of fluroxypyr and related compounds. Fluroxypyr acid was highly toxic to eastern oyster with 96-hour LC50/EC50 = 0.068 mg/L. Fluroxypyr 1-methyleptyl ester was slightly toxic to the eastern oyster with 96-hour LC50/EC50 = 51 mg/L. This compound was practically non-toxic to grass shrimp with a 96-hour LC50/EC50 >120 mg/L

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.

Environmental Fate

A typical half-life for fluroxypyr in soils is 36 days (see "Half-life" text box). Microbes and sunlight break down fluroxypyr in the environment. Fluroxypyr's potential to leach to groundwater is intermediate; surface runoff potential is high, and potential for loss on eroded soil is low. Fluroxypyr has moderate volatility and the potential for loss to the atmosphere is moderate. Fluroxypyr does not bioconcentrate (build up) through the food chain. Plants take up fluroxypyr through the leaves and roots. Fluroxypyr is translocated (moved throughout) to other plant parts.

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, the potential for non-cancer health effects should be considered. 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

Human Health Risk Assessment

WSDOT evaluated several human exposure scenarios, including workers applying herbicides and the public (adults and children) picking and eating drift-contaminated berries, eating drift-contaminated garden vegetables, and walking through sprayed vegetation. For each exposure scenario, WSDOT evaluated conditions of average exposure and extremely conservative conditions of maximum exposure (see "Human Cancer/Non-cancer Risk Classification" text box and "Human Risk Classification for Average Exposure Scenarios" table).

Fluroxypyr is expected to pose negligible potential risks of adverse non-cancer effects to WSDOT workers and the public under conditions of average and maximum exposure. All hazard quotients are below 1. Fluroxypyr is not regulated as a carcinogen.

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**
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**

Note: Highlighted categories specify the range of potential risk for specific exposure scenarios involving fluroxypyr.

Wildlife Risk Assessment

Wildlife risk assessment considers herbicide 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 herbicide residues with their skin or eyes or when they inhale vapors or particulates. WSDOT's current application rates and use patterns for fluroxypyr are expected to pose an insignificant risk to mammals. The estimated dietary exposures to rats, mice and meadow vole from maximum label application rates would be 6,900, 800 and 1,100-fold lower, respectively, than the acute dietary LD50 for fluroxypyr. The estimated dietary exposures of fluroxypyr to quail, marsh wren, and American robin from WSDOT's current application practices would be 3,600, 400 and 320-fold lower, respectively, than the acute dietary LD50 for bobwhite quail. These estimated dietary exposures are considered insignificant for quail and low for wren and robin.

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 fluroxypyr occurs primarily through direct contact with contaminated surface waters and sediment. Due to its relatively low toxicity, persistence and application rate, the estimated risk to fish from fluroxypyr applied at levels established by WSDOT was calculated to be low in all physiographic provinces of the state examined, except in the Puget Trough, where the risk was characterized as slight. The relative risks to aquatic invertebrates from fluroxypyr are estimated to be slight in all physiographic provinces of the state examined except for the Columbia Plateau and Blue Mountain regions, where risks are low.

Additional Resources

- National Pesticide Information Center 1-800-858-PEST (7378) and http://npic.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)