Washington State Department of Transportation

Diflufenzopyr

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

Diflufenzopyr is a semicarbazone herbicide used for selective broadleaf weed control. Diflufenzopyr is an auxin transport inhibitor, disrupting the delicate auxin balance needed for plant growth. Diflufenzopyr (21.4%) is combined with the active ingredient dicamba (55.0%) in the product **Overdrive**. According to the product label, **Overdrive** also contains 23.6% other ingredients (unspecified). The Washington State Department of Transportation (WSDOT) uses this product for selective nuisance and noxious weed control. Diflufenzopyr also has agricultural uses.

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

A typical rights-of-way application rate for **Overdrive** is 0.5 pounds of product—or about 0.35 pounds of the active ingredients diflufenzopyr and dicamba—per acre. Applicators use truck-mounted hand-guns, hose reels, or backpack sprayers to apply a single application of **Overdrive** during 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 did not apply any of diflufenzopyr statewide during the reporting year of 2016.

Human Health Effects

The U.S. Environmental Protection Agency (EPA) classifies **Overdrive** as category III (Low Toxicity) with a signal word of

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.

CAUTION (see "Toxicity Category and Signal Word" table).

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 diflufenzopyr cited in this fact sheet.

Acute toxicity: Diflufenzopyr has low toxicity if individuals accidentally eat residues and very low toxicity if it is inhaled or gets on skin. Diflufenzopyr has caused mild irritation to the skin and eyes of rabbits, and can cause sensitization in guinea pigs.

Chronic toxicity: In long-term studies, rats given high doses of diflufenzopyr experienced blood abnormalities, reduced body weights and decreased food efficiency. No treatment-related effects were seen in mice exposed to high doses of diflufenzopyr.

Reproductive effects: In a two-generation study in rats, reproductive effects were seen at high doses of diflufenzopyr. At high doses of diflufenzopyr in pregnant rats and rabbits, abnormal bone development and skeletal variations were seen in offspring.

Carcinogenic effects: No data on potential carcinogenic effects of diflufenzopyr were identified. Studies show that diflufenzopyr is not mutagenic. U.S. EPA classifies diflufenzopyr as not likely to be carcinogenic.

Fate in humans and animals: Rats rapidly excrete diflufenzopyr unchanged in urine and feces. Diflufenzopyr does not bioaccumulate (build up) in mammals.

Wildlife and Aquatic Effects

Effects on mammals: Diflufenzopyr is considered practically non-toxic to small mammals based on acute oral toxicity studies. For technical grade diflufenzopyr, LD50 values were >5,000 mg/kg for both male and female rats. Acute oral LD50 values for formulated product were 4,800 and 3,300 mg/kg for male and female rats, respectively. Acute dermal LD50 values in male and female rabbits were >5,000 mg/kg for both technical grade and formulated product. Acute inhalation studies in rats resulted in an LC50 value of >2,930 mg/m^3 for technical grade diflufenzopyr and >5,210 mg/m^3 for manufacturing use product.

Effects on birds: Diflufenzopyr is practically non-toxic to birds based on an acute oral LD50 >2,250 mg/kg for unspecified avian species.

Effects on fish and aquatic insects: U.S. EPA characterizes diflufenzopyr as slightly toxic to practically non-toxic for both freshwater and marine/estuarine organisms. For freshwater organisms, LC50 values ranged from 15 to >135 mg/L. The LC50 values for marine/estuarine organisms ranged from 18.9 to >138

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

mg/L (U.S. EPA 1999). The species tested in these studies was not provided and additional toxicity data were not identified.

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 diflufenzopyr in soils is 87 days (see "Half-life" text box). Microbes and sunlight break down diflufenzopyr in the environment. Diflufenzopyr's potential to leach to groundwater is low; surface runoff potential is high, and potential for loss on eroded soil is low. Diflufenzopyr has moderate volatility and the potential for loss to the atmosphere is moderate. Diflufenzopyr does not bioconcentrate (build up) through the food chain. Plants readily take up diflufenzopyr through the leaves and roots. Diflufenzopyr is translocated (moved throughout) to other plant parts.

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).

The combination of diflufenzopyr and dicamba 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. Neither diflufenzopyr nor dicamba are regulated as carcinogens.

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

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 diflufenzopyr are expected to pose an insignificant risk to mammals. The estimated dietary exposures to rats, mice and meadow vole based on maximum label use would be 6,900, 810, and 1,100-fold lower, respectively, than the acute dietary LD50 for diflufenzopyr. The estimated dietary exposures of diflufenzopyr to quail, marsh wren, and American robin based on maximum label

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 diflufenzopyr.

application rates would be 2,900, 320, and 250-fold lower, respectively, than the acute dietary LD50 for bobwhite quail. These estimated dietary exposures are considered an insignificant risk to quail, 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 diflufenzopyr occurs primarily through direct contact with contaminated surface waters or sediment. Diflufenzopyr does not bioaccumulate (build up) in aquatic animals and is not persistent in the environment. Due to its low toxicity, limited persistence and relatively low application rate, the estimated risk to fish and aquatic invertebrates from the application of diflufenzopyr at levels established by WSDOT is low in all physiographic provinces of the state examined.

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)