

Sulfentrazone

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

Sulfentrazone is an aryl triazolinone herbicide used for pre-emergent control of certain broadleaf weeds, grasses and sedges. Sulfentrazone inhibits photosynthesis in plants. Sulfentrazone is the only active ingredient (75%) in the herbicide **Portfolio 4F**. According to the product label, Portfolio 4F also contains 25% other ingredients (unspecified). The Washington State Department of Transportation (WSDOT) is considering the use of Portfolio for total control of broadleaf weeds and grasses. Sulfentrazone also has agricultural uses.

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

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

WSDOT is currently evaluating the use of Portfolio 4F for maintenance of a bare ground strip at the edge of pavement. If used by WSDOT in the future, Portfolio 4F would be applied at 0.5 pounds of product—or a maximum of about 0.375 pounds of the active ingredient sulfentrazone—per acre. Applicators would use truck-mounted booms placed 18" above the ground to make a single application of sulfentrazone in the spring.

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.

Human Health Effects

The U.S. Environmental Protection Agency (EPA) classifies Portfolio 4F as category III (Low Toxicity) with a signal word of CAUTION because it causes moderate eye irritation and is harmful if inhaled, swallowed, or absorbed through the skin (see "Toxicity Category and Signal Word" table).

Acute toxicity: Sulfentrazone has low toxicity if it is eaten or gets on the skin, and very low toxicity if inhaled. In rabbits, sulfentrazone caused eye irritation which resolved within 24 hours and did not irritate the skin. Sulfentrazone did not cause skin sensitization in guinea pigs.

Chronic toxicity: Dogs fed sulfentrazone for one year had blood abnormalities at high doses. Mice fed sulfentrazone for 18 months showed blood toxicity at high doses.

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

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

Reproductive effects: In a developmental study in rats, mothers experienced spleen abnormalities and fetuses had decreased weight and retardation of skeletal development at moderate doses. In a 2-generation rat reproduction study, no reproductive or developmental effects were seen at moderate doses, but no dose ranges or adverse effects at higher doses were provided.

Carcinogenic effects: Sulfentrazone does not appear to be carcinogenic in rats, mice or dogs. U.S. EPA considers sulfentrazone not likely to be a human carcinogen.

Fate in humans and animals: Rats rapidly excrete sulfentrazone metabolites primarily in urine. Sulfentrazone does not bioaccumulate (build up) in mammals.

Wildlife and Aquatic Effects

Effects on mammals: Sulfentrazone is practically non-toxic to small mammals based on an acute oral LD50 of 2,855 mg/kg for rats. Formulated product reportedly had similar toxicity to the active ingredient. Via the dermal route, an LD50 of >2,000 mg/kg was reported in rats. Following inhalation exposure, an LD50 of >4,130 mg/m³ was reported.

Effects on birds: U.S. EPA's review of toxicity data indicates sulfentrazone is practically non-toxic to birds with an LD50 >2,250 mg/kg following acute oral exposure. An additional dietary study reported an LD50 >5,620 ppm. Bird species tested were not identified.

Effects on fish: Acute toxicity tests reviewed by U.S. EPA indicate that sulfentrazone is practically non-toxic to slightly toxic in fish. The LC50 for rainbow trout was >120 mg/L; for bluegill sunfish, an LC50 of 94 mg/L was reported.

Effects on aquatic insects: U.S. EPA reported that sulfentrazone is slightly toxic to aquatic invertebrates on an acute basis, although specific acute test results were not provided.

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

Environmental Fate

A typical half-life for sulfentrazone in soils is 541 days (see “Half-life” text box). Microbes and sunlight break down sulfentrazone in the environment. Sulfentrazone’s potential to leach to groundwater is high; surface runoff potential is high, and potential for loss on eroded soil is intermediate. Sulfentrazone has low volatility and the potential for loss to the atmosphere is low. Sulfentrazone does not bioconcentrate (build up) through the food chain. Sulfentrazone is adsorbed through the roots and 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).

Sulfentrazone 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. Sulfentrazone is not regulated as a carcinogen.

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 proposed application rates and use patterns for sulfentrazone would be expected to pose an insignificant risk to mammals. The estimated dietary exposures to rats, mice, and meadow vole from the maximum label application rate would be 5,400, 630, and 830-fold lower, respectively, than the acute dietary LD50 for sulfentrazone. The estimated dietary exposures of sulfentrazone to quail, marsh wren, and American robin based on the maximum label application rate would be 2,700, 300, and 240-fold lower, respectively, than the acute dietary LD50 for bobwhite quail. These exposures are considered to result in risks that are insignificant for quail and wren, and low for robin.

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, 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 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 sulfentrazone.

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 sulfentrazone occurs primarily through direct contact with contaminated surface waters and sediment. Sulfentrazone is persistent and highly mobile and has a strong potential to migrate off site. The estimated risks to fish and aquatic invertebrates from application of sulfentrazone at levels established by WSDOT were low in all physiographic provinces, except for the Puget Trough, where the risk was considered slight. The limited risk from sulfentrazone is due to its relatively low toxicity and application rate.

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)