

Type	Systemic terrestrial herbicide.
Controls	Broadleaf weed control in turf.
Mode of Action	Inhibits the production of an enzyme required to make specific amino acids vital for plant life.

**Thurston County Review Summary:**

Penoxsulam as an active ingredient in terrestrial herbicides is rated low in hazard and passes Thurston County's pesticide review criteria.

Penoxsulam is rated high in hazard for chemical mobility, moderate for persistence, and low for bioaccumulation potential. The risk of toxicity to non-target organisms and to people from exposures to penoxsulam after a terrestrial application is rated low in hazard. Risk to applicators applying to less than 100 acres is also rated low in hazard.

**MOBILITY**

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	410 mg/L	1	Moderate
Soil Sorption (Kd=mL/g)	1.4	3	High
Organic Sorption (Koc=mL/g)	87 - 2,156	1	Moderate to high

**Mobility Summary:**

Penoxsulam is moderately soluble in water and adheres moderately to some soil types and poorly to other soil types. The hazard for penoxsulam to move off the site of application with rain or irrigation water is rated high.

**PERSISTENCE**

Property	Value	Reference	Value Rating
Vapor Pressure (mm Hg)	0.0000000000000072	4	High
Biotic or Aerobic Half-life (days)	33 to 117 (soil)	1	Moderate to high
Photolysis Half-life (days)	1.5 to 14.2 (water)	1	Low to moderate
Terrestrial Field Test Half-life (days)	18.8 (soil)	1	Moderate
Hydrolysis Half-life (days)	Stable	1	High
Anaerobic Half-life (days)	5 to 10 (sediment)	1	Low to moderate
Aquatic Field Test Half-life (days)	11 to 29	1	Moderate

**Persistence Summary:**

On land, penoxulam is likely to degrade to half of the applied concentration between 7 and 60, days which is rated moderate in hazard for chemical persistence.

**BIOACCUMULATION**

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	3	4	Low
Octanol/Water Partition Coefficient	log Kow = 0.345	4	Low

**Bioaccumulation Summary:**

Bioaccumulation studies with crayfish indicated that there was a small amount of accumulation that was quickly eliminated from the crayfish when they were moved to clean water (Reference 2). In rat metabolism testing, >90% of administered penoxsulam was eliminated from their bodies within 48 hours (Reference 4). Penoxsulam is rated low in hazard for the potential to bioaccumulate in fish or animals.

# ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Toxicity Rating
Mammalian (LD50)	>5,000 mg/kg	2	Low
Avian (LD50)	4,310 mg/kg	2	Low
Honey bee or insect (LD50)	>100 ug/bee	3	Low
Annelida -worms (LC50)	>1,000 mg/kg	3	Low
Fish (LC50)	>102 mg/L	2	Low
Crustacean (LC50)	>98 mg/L	2	Low
Mollusk (LC50)	127 mg/L	2	Low
Amphibian (LD50 or LC50)	Value not found		

## Acute Toxicity Testing and Ecotoxicity Summary:

Single-dose toxicity testing indicates that penoxsulam is low in toxicity to animals, birds, parasitic wasps, honeybees, worms, fish and other aquatic organisms (References 2 and 3). Risk to non-target organisms were assessed for aquatic applications of penoxsulam in rice fields. The assessment included birds that eat insects, birds that eat vegetation, birds that eat a combined diet, and fish eating birds. The assessment for birds concluded that the risk from potential penoxsulam exposures from aquatic applications was low. A risk assessment was also performed for small mammals that eat vegetation, mammals that eat aquatic invertebrates, and mammals that eat fish and amphibians. The risk to mammals from potential penoxsulam exposures from aquatic applications was low (Reference 1). Penoxsulam is low in toxicity to fish and other aquatic organisms and the maximum concentration allowed for use in waterbodies is several hundred times less than the lethal dose for any of the fish or aquatic organisms tested (References 2 and 3). The hazard to non-target organisms from aquatic applications of penoxsulam is rated low.

# ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Risk Rating
Child	Hand & object to mouth + soil ingestion	0.178 mg/kg/day	0.0011 mg/kg/day	160	5	Low
Adult applying to turf grass	Inhalation	0.178 mg/kg/day	0.0000032 mg/kg/day	56,000	5	Low
Applicator spraying 123 acre field at max rate	All routes	0.18 mg/kg/day	0.026 mg/kg/day	7	6	Moderate
Adult bystander	Dermal	0.18 mg/kg/day	0.00036 mg/kg/day	500	6	Low

## Acute Toxicity Risk Assessment Summary:

Based on registered uses and low to moderate chemical persistence, the EPA determined that potential exposures were either short-term or intermediate-term in duration (Reference 5). There was no toxicity observed from penoxsulam exposures to the skin so, risk assessments were performed for exposures from ingestion and inhalation (References 1 and 5).

The potential exposure to a child from hand-to-mouth and object-to-mouth activities within a treated area of turf grass is rated low in hazard (160 times less than the dose of concern).

The risk to an applicator making a treatment to turf grass was assessed for all types of application methods (backpack sprayer, groundboom, handgun sprayer, cyclone push spreader, etc.) and the method with the highest exposure was from the cyclone push spreader. The potential exposure to an applicator applying to 0.5 acres of turf grass with a cyclone push spreader was rated very low in hazard.

The occupational applicator assessment assumed that the applicator treated 50 hectares (123 acres) in a day using tractor mounted equipment. The potential exposure to the applicator was 14.4 % of the dose of concern and is rated moderate in hazard (less than 10% of the dose of concern is low hazard and greater than 50% is rated high in hazard). The risk to the applicator is rated low in hazard when the application area is less than 100 acres. The potential exposure to a bystander standing 5 meters from the field being applied to was 500 times less than the dose of concern and is rated low in hazard.

# CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Suggestive evidence	Insufficient to assess human potential	1	N/A
Mutagenicity	Value not found	Negative results	1	Low
Neurotoxicity - (NOAEL)	30 mg/kg/day	No toxicologically significant evidence	6	Low
Endocrine Disruption	30 mg/kg/day	Delayed preputial separation	2	Use risk rating
Developmental Toxicity (NOAEL)	25 mg/kg/day	Increased abortions and resorptions	1	Use risk rating
Reproductive Toxicity (NOAEL)	30 mg/kg/day	Delayed preputial separation	1	Use risk rating
Chronic Toxicity (NOAEL)	5 mg/kg/day (dog)	Glomerulonephropathy	6	Use risk rating

## Chronic Toxicity Hazard Summary:

Reproductive and developmental toxicity was observed at concentrations that resulted in maternal toxicity (Reference 1). The reproductive toxicity effects were attributed to maternal toxicity (Reference 6). Toxic effects observed in testing indicates the potential for endocrine disruption and that the EPA may require further testing (Reference 2).

# CHRONIC HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Risk Rating
Applicator exposures were not evaluated						
Post-application exposures were not evaluated						
Post-application exposures were not evaluated						
Combined exposures were not evaluated						

## Chronic Toxicity Risk Assessment Summary:

Long-term (life long) non-dietary exposures are not expected from penoxsulam herbicide use so risk from long-term exposures were not evaluated.

## Metabolites and Degradation Products:

In water, sunlight will change penoxsulam to (5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)sulfamic acid, 5,8-dimethoxy[1,2,4]triazolo[1,5-c]pyrimidin-2-amine, 5-OHAminoTP, BSA, 2-amino TCA, D1, D2, 2-(2,2-difluoroethoxy)-N-(1H-1,2,4-triazol-3-yl)-6-(trifluoromethyl)benzenesulfonamide and 3-({[2-(2,2-difluoroethoxy)-?-hydroxy-6-(trifluoromethyl)phenyl]sulfonyl}amino)-1H-1,2,4-triazole-5-carboxylic acid (References 1 and 3).

## Comments:

Penoxsulam is considered a slight skin irritant but not an eye irritant or a skin sensitizer (Reference 1).

## References

1. New York State Department of Environmental Conservation. Division of Solid and Hazardous Materials, Bureau of Pesticides Management. Letter to Mr. Jim Baxter, Dow AgroSciences, LLC. Re: Registration of the Pesticide Product Sapphire (EPA Reg. No. 62719-547) Containing the New Active Ingredient Penoxsulam (Active Ingredient Code 119031). November 24, 2008.
2. Washington State Department of Ecology. Environmental Impact Statement for Penoxsulam, Imazamox, Bispyribac-sodium, Flumioxazin, & Carfentrazone-ethyl. Addendum to the Final Supplemental Environmental Impact Statement for Freshwater Aquatic Plant Management. October 2011.
3. International Union of Pure & Applied Chemistry. Pesticide Properties Database. Penoxsulam (Ref: XDE 638). Date accessed 7/1/2014.
4. National Library of Medicine. TOXNET, Toxicology Data Network. Hazardous Substance Database. Penoxsulam. Last Review Date: Reviewed by SRP on 5/12/2011.
5. USEPA. Office of Prevention, Pesticides and Toxic Substances. Occupational and Residential Exposure Assessment for Use of Penoxsulam to Control Aquatic Weeds in and Around Slow-moving and Quiescent Bodies of Water and Broadleaf Weeds in Turfgrass, Residential Lawns, Golf Courses, Sport Fields and Sod Farms. May 23, 2007.
6. European Food Safety Authority. CONCLUSION ON PESTICIDE PEER REVIEW, Peer review of the pesticide risk assessment of the active substance penoxsulam. (Question No EFSA-Q-2009-312) Issued on 31 August 2009.