oxyfluorfen

Review Date: 7/15/2010
CAS #: 42874-03-3

Type	Pre-emergent and post emergent contact herbicide for annual weed control
Controls	Broadleaf and grassy weeds in tree fruit, nut, vine, and vegetable crops, ornamentals, landscapes and other non-crop areas.
Mode of Action	Oxyfluorfen inhibits the production of a chlorophyll enzyme which results in an accumulation of chemicals that disrupt cell membrane integrity in the presence of light.

Thurston County Review Summary:

Herbicides containing oxyfluorfen as an active ingredient fail Thurston County's review criteria. Oxyfluorfen is rated high in hazard due to being listed as a possible human carcinogen by the EPA. The risk to occupational applicators and handlers was considered high in hazard until the EPA required additional protective equipment be worn which greatly reduced the potential exposures. Risk to residential applicators and to people contacting treated vegetation in residential settings is considered low in hazard.

Oxyfluorfen is considered high in hazard for persistence although low in hazard for moving off the site of application and moderate in hazard for bioaccumulation. The risk to non-target organisms is considered moderate for certain aquatic organisms when these herbicides get into waterbodies. The EPA tried to mitigate these risks by requiring a 25 foot buffer around water bodies. The risk to birds and terrestrial animals is only a concern when certain crops are sprayed.

MOBILITY

Property	Value	Reference	Rating
Solubility (mg/L)	0.116	1	Low
Soil Sorption (Kd=mL/g)	99.4	1	Low
Organic Sorption (Koc=mL/g)	12,233	1	Low

Mobility Summary:

Oxyfluorfen is not very soluble in water and can be expected to adhere stongly to all soil types (especially soil with organic matter). The hazard for oxyfluorofen to move off the site of application with rain or irrigation water is rated low.

PERSISTENCE

Property	Value	Reference	Rating
Vapor Pressure (mm Hg)	0.00000025	2	High
Biotic or Aerobic Half-life (days)	>290	2	High
Abiotic Half-life (days)	186	1	High
Terrestrial Field Test Half-life (days)	73	1	High
Hydrolysis Half-life (days)	stable	1	High
Anaerobic Half-life (days)	554 to 604	2	High
Aquatic Field Test Half-life (days)	Very dependent on light	1	Low to High

Persistence Summary:

All routes of potential degradation (except photolysis in clear water - which can be rapid) indicates that oxyfluorfen is high in hazard for persistence.

BIOACCUMULATION

Property	Value	Reference	Rating
Bioaccumulation Factor	Not found		
Bioconcentration Factor	1637	1	Moderate
Octanol/Water Partition Coefficient	4.68	1	Moderate - high

Bioaccumulation Summary:

Oxyfluorfen adheres strongly to fats and oils and is considered a moderate hazard for bioaccumulation.

ACUTE TOXICITY HAZARD - ECOTOXICITY

Test Subject	Value	Reference	Rating
Mammalian (LD50)	>5,000 mg/kg/day	1	Low
Avian (LD50)	> 947 mg/kg	1	Moderate
Honey bee or insect (LD50)	>100 ug/bee	1	Low
Annelida -worms (LC50)	>1,000 mg/kg	1	Low
Fish (LC50)	0.25	1	High
Crustacean (LC50)	0.72	1	High
Mollusk (LC50)	Not found		
Amphibian (LD50 or LC50)	Not found		

Acute Toxicity Summary:

Single dose toxicity testing indicates that oxyfluorfen is low in toxicity to mammals, bees, and worms, moderately toxic to birds, and highly to very highly toxic to fish and other aquatic organisms. The risk to non-target terrestrial organisms from short-term exposures is considered low by the EPA, but, longer exposures to non-target organisms is of some concern when these herbicides are sprayed on certain crops. Although there is a potential exposure scenario that is of concern for these non-target organisms, the scenario of spraying crops is not applicable to uses proposed by Thurson County government or residential uses and are not used in rating these herbicides.

The EPA believes there is little risk to fish from short-term exposures from oxyfluorfen herbicide use, but there is some concern for certain herbicidal uses for long-term exposures to fish, and for short-term and long-term exposures to aquatic invertebrates. To mitigate these ecological risks, the EPA lowered the maximum application rates for crops (1.5 pounds a.i./acre/application) and ornamentals (2 pounds a.i./acre/application)as well as requiring a 25 foot buffer around waterbodies. The risk to non-target organisms is considered moderate.

ACUTE TOXICITY - Risk Assessment

Subject and Scenario	Dose of Concern	Exposure	Margin of Safety	Route	Reference	Rating
Adult using RTU trigger pump sprayer	0.3 mg/kg/day	0.0035 mg/kg/day	85	Skin absorption	2	Low
Adult mix/load liquid into right-of-way sprayer	0.3 mg/kg/day	0.43 mg/kg/day	None	Skin absorption	2	High
Post application exposures were not calculated						
Post application exposures were not calculated						

Acute Toxicity Risk Assessment Summary

Short-term exposures to oxyfluorfen after herbicidal use are considered to be insignificant by the EPA and so risk assessments for such exposures were not calculated. Residential uses of oxyfluorfen herbicides are limited to spot spraying (not broadcast applications) - therefore, expected exposures are minimal.

The combined exposure scenario for residential applicators (worst-case applicator exposure was from a hand trigger pump using a "ready-to-use" spray) also included dietary and drinking water inputs (water from a contaminated surface water body). The combined eposure was calculated to be 85 times below the EPA calculated level of concern and is rated low in hazard.

All short-term scenarios for occupational mixing and handling of liquid formulations exceed the EPA's level of concern when no gloves are worn (except loading a backpack sprayer). When chemically resistent gloves are worn the EPA's level of concern is not exceeded (although the calculation was not shown and cannot be rated by the County system). The product labels require, at the least, the use of gloves for mixing and handling the liquid formulations and the resulting exposures are expected to be at least 5 times less than the EPA's dose of concern (which would rate as moderate to low in hazard).

CHRONIC TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Category C	"possible human carcinogen"	2	High
Mutagenicity	- -	Mixed results	1	Low
Neurotoxicity - (NOAEL)	- -	"no indication of neurotoxicity"	2	Low
Endocrine Disruption	Not listed	- -	3	Low
Developmental Toxicity (NOAEL)	32 mg/kg/day (LOAEL)	clinical signs at maternally toxic (LOAEL)	2	Check risk
Reproductive Toxicity (NOAEL)	Maternally toxic doses	Decreased live pups per litter	2	Check risk
Chronic Toxicity (NOAEL)	3 mg/kg/day	Alterations in blood (anemia) and liver	2	Check risk

Chronic Toxicity Summary:

Oxyfluorfen is listed in the EPA' cancer category "C" as a possible human carcinogen (which fails Thurston County's review criteria for being too high in hazard). Older mutagenicity studies using a 72% active ingredient solution produced gene mutations although the more recent study using 98% active ingredient did not produce gene mutations. Developmental and reproductive toxicity occurred at maternally toxic doses and there does not appear to be an increase in susceptability from prenatal or postnatal exposures to oxyfluorfen.

CHRONIC TOXICITY - Risk Assessment

Subject and Scenario	Dose of Concern	Exposure	Margin of Safety	Route	Reference	Rating
Adult mix/load liquid into right-of-way sprayer	0.107 mg/kg/day	0.37 mg/kg/day	None	Skin absorption	2	High
Combined routes of exposure were not calculated						
Women (13-50 years old)	300 ppb (level of concern)	7.1 ppb	42	Drinking treated surface water	2	Low
Children 1-6 years old	0.03 mg/kg/day	<0.00012mg/kg/day	>100	Eating treated crops	2	Low

Chronic Toxicity Risk Assessment Summary:

Long-term exposures to residential users of oxyfluorfen are not expected by the EPA so they did not calculate long-term risk assessments for skin absorption exposures from applying and contacting treated vegetation. Long-term exposures from eating treated food and drinking contaminated surface water is less than 3% of the dose of concern and are considered low in hazard.

Potential intermediate-term exposures (less than a lifetime but more than one week in duration) to occupational handlers and applicators can exceed the EPA's level of concern without any gloves. The label on liquid formulations requires personal protective equipment (specific glove requirements) be worn to lessen these potential exposures. The EPA did not present the exposure data for when gloves are worn - so the data cannot be rated. It is assumed that the exposures would be moderate to low in hazard.

Potential lifetime exposures to occupational handlers/applicators were compared to cancer risks and were mitigated with label requirements for personal protective equipment. Thurston County rating system does not evaluate risk for cancer potential - all active ingredients that are known or possible human carcinogens are considered high in hazard and fail the County review criteria.

DegradationProducts:

"No degradates were identified, and therefore, only the parent, oxyfluorfen, is of toxicological concern for risk assessment." Reference 2

In an aqueous photolysis study, oxyfluorfen degraded >10% to 2-chloro-1-(3-ethoxy-4-hydroxyphenol)-4-(trifluoromethyl) benzene. Reference 2

Comments:

Oxyfluorfen is a slight eye and dermal irritant and is not a dermal sensitizer (Reference 2).

References

1. International Union of Pure & Applied Chemistry (IUPAC). Pesticide Properties Database (Accessed 7/2/2010). http://sitem.herts.ac.uk/aeru/iupac/
2. USEPA. Prevention, Pesticide and Toxic Substances. EPA738-R-02-014 October 2002. Reregistration Eligibility Decision (RED) Oxyfluorfen.
3. Illinois EPA. "Endocrine Disruptors Strategy" February 1997.