cypermethrin

Review Date: 10/11/2012
CAS #: 52315-07-8

Type	Insecticide - synthetic pyrethroid that works on contact and by ingestion.
Controls	Ants, roaches, fleas, termites, and other insects.
Mode of Action	Alters nerve function by modifying the sodium channels in the nerve membranes (Reference 2).

Thurston County Review Summary:

Cypermethrin is rated high in hazard and products containing it fail Thurston County's pesticide review criteria. It is rated high in hazard because the EPA classified cypermethrin in Category C as a possible human carcinogen.

Zeta-cypermethrin is an enriched formulation of cypermethrin and the EPA determined that the toxicological effects for the chemicals are the same. Thurston County is using the same review and outcome for zeta-cypermethrin as it did for the review of cypermethrin.

MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	0.0076	2	Low
Soil Sorption (Kd=mL/g)	11,875	3	Low
Organic Sorption (Koc=mL/g)	20,800 to 385,000	2	Low

Mobility Summary:

Cypermethrin is not soluble in water and is expected to adhere strongly to all soil types. The hazard for cypermethrin to move off the site of application with rain or irrigation water is rated low.

PERSISTENCE

Property	Value	Reference	Value Rating
Vapor Pressure (mm Hg)	0.000000003	2	High
Biotic or Aerobic Half-life (days)	60	3	Moderate - high
Abiotic Half-life (days)	13 (Photolysis in water)	3	Moderate
Terrestrial Field Test Half-life (days)	69	3	High
Hydrolysis Half-life (days)	179	3	High
Anaerobic Half-life (days)	17 (aquatic)	2	Moderate
Aquatic Field Test Half-life (days)	3 to 9	2 and 3	Low to moderate

Persistence Summary:

Cypermethrin is not expected to dissipate into the air after application and is likely to take up to 60 days to degrade to half of the applied concentration (on land). Cypermethrin is degraded mainly by a combination of breakdown by sunlight and by soil microbes, if it moves off the site of application bound to sediment (through erosion) then it may get into water bodies where it will degrade more rapidly. The hazard for chemical persistence is rated moderate. Indoors, cypermethrin is rated high in persistence because it is likely to degrade more slowly without direct sunlight and microbial degradation.

BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	488 to 1204	2 and 3	Moderate
Octanol/Water Partition Coefficient	log Kow = 6.6	2	High

Bioaccumulation Summary:

The octanol/water partition coefficient (log Kow = 6.6) indicates that cypermethrin has a strong affinity to bind to organic solvents and therefore has the potential to accumulate in fish or animal tissue. A bioconcentration factor ranging from 488 to 1,204 indicates a moderate potential for accumulation. Metabolism studies with rats indicate that cypermethrin is quickly absorbed and then excreted from animals. Up to 80% of administered cypermethrin is excreted within one day and essentially all of it is eliminated within 8 days. Due to the quick elimination of cypermethrin, the hazard for bioaccumulation is rated moderate.

ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Value Rating
Mammalian (LD50)	247 mg/kg	2	Moderate
Avian (LD50)	>2,000 mg a.i./kg-bw	2	Low
Honey bee or insect (LD50)	0.023 - 0.56 ug/bee	2	Very high
Annelida -worms (LC50)	26.09 ug/cm2 (contact)	2	"Very toxic"
Fish (LC50)	0.00039 mg/L	2	Very high
Crustacean (LC50)	0.0000039 mg/L	2	Very high
Mollusk (LC50)	Value not found		
Amphibian (LD50 or LC50)	Value not found		

Acute Toxicity Testing and Ecotoxicity Summary:

Single-dose toxicity testing indicates that cypermethrin is very toxic to fish, aquatic invertebrates, bees and other beneficial insects, and worms, but it is moderately toxic to animals and low in toxicity to birds (Reference 2). The EPA's ecological risk assessment evaluated risk from maximum use rates for agriculture settings because residential uses were too difficult to model [(however, they stated that there is potential for residential uses to create runoff into water bodies that could cause aquatic toxicity) Reference 2]. The EPA's level of concern for aquatic invertebrates was exceeded for many agricultural application scenarios. Thurston County does not rate the hazards associated with agricultural uses but this information is provided because applications to a residential area (neighborhood) or large turf applications could have pesticide runoff similar to those from an agricultural setting. Risk to bees and other beneficial insects is considered high and usage of cypermethrin on foliage is considered very toxic to bees (Reference 2). Risk to birds from post-application exposures is rated low, although the EPA noted that an incident was reported in which about 5,000 sparrows were injured from eating insects that were sprayed with cypermethrin on an agricultural field. Short-term risk to animals is rated low from agricultural uses but potential long-term exposures to small animals that eat an entire diet of treated short grass exceeds the EPA's level of concern - it is unknown how well this risk relates to non-agricultural settings. Overall, the risk to non-target birds and animals from a one-time residential application or expected County uses is rated low although, there is concern over broadcast applications to turf, bare soil, or hardscapes (cement, decks, etc.) where cypermethrin can runoff into a waterbody and cause risk to fish or other aquatic organisms or ongoing applications to the same area throughout a season.

ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Adult spraying 1 aerosol can	Inhalation	0.027 mg/kg/day	0.00017 mg/kg/day	160	5	Low
Child's ingesting from crack/crevice treatment	Oral	0.1 mg/kg/day	0.01 mg/kg/day	9	5	Moderate
Child's hand/object mouth activity on treated turf	Oral	0.1 mg/kg/day	0.0083 mg/kg/day	12	5	Low
Child's hand/object mouth after indoor fogger	Oral	0.1 mg/kg/day	0.0007 mg/kg/day	140	5	Low

Acute Toxicity Risk Assessment Summary:

For human risk assessment, the EPA determined that all short-term skin contact exposures are not of concern for residential applicators because there were no toxicological endpoints of concern observed in animal testing (Reference 2). The EPA determined that the risk to residential applicators (not occupational) is below their level of concern, although risk to occupational applicators that mix and apply liquid formulations for hand-held equipment exceeds their level of concern and requires the use of chemically resistant gloves (occupational risk is detailed in the chronic risk assessment section found below). The EPA concluded that there are no human exposures of concern from residential applications of Ready-To-Use products (foggers, aerosols, liquids, etc). Thurston County rates all potential residential applicator exposures as low in hazard.

All post-application exposures from outdoor applications of cypermethrin products are rated low in hazard (calculated with turf grass application rates of 0.44 pounds of active ingredient per acre). Potential indoor exposures to a child from incidental oral ingestion following a crack and crevice treatment is more than 10% of the EPA's dose of concern and is rated moderate in hazard.

CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Category C	Possible human carcinogen	2	High
Mutagenicity	Up to 2500 ug/plate or or 40 mg/kg	"No evidence of mutagenic activity"	4	Low
Neurotoxicity - (NOAEL)	6 mg/kg/day	"Clinical signs"	2	Check risl
Endocrine Disruption	Value not reported	"no evidence or endocrine disruption"	2	Low
Developmental Toxicity (NOAEL)	>30 mg/kg/day	No developmental toxicity	2	Low
Reproductive Toxicity (NOAEL)	7.5 mg/kg/day	Decreased mean litter weight	4	Moderate
Chronic Toxicity (NOAEL)	5 mg/kg/day (oral)	Decreased motor skills	2	Check risk

Chronic Toxicity Hazard Summary:

The EPA classified cypermethrin in Category C as a possible human carcinogen which is rated high in hazard by Thurston County's pesticide review criteria. There was no developmental toxicity observed in toxicity testing and reproductive toxicity was observed at doses that caused systemic toxicity in the parent animals (Reference 2). There is no evidence in toxicological data reviewed by the EPA that cypermethrin causes endocrine disruption or mutagenicity (References 2 and 4).

CHRONIC HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Occupational risks are described in summary						
Occupational risks are described in summary						
Occupational risks are described in summary						
Occupational risks are described in summary						

Chronic Toxicity Risk Assessment Summary:

The EPA does not expect residential uses to create intermediate or long-term exposures so, there is no risk evaluation for residential exposures longer than one week (Reference 2).

Potential occupational exposures range from short-term to long-term (life-long). The EPA calculated and evaluated over 20 potential exposure scenarios for occupational applicators. Without the use of personal protective equipment (gloves or respirator), there were many potential exposures that exceeded the EPA's level of concern. Whenever the level of concern was exceeded, the EPA made a requirement for protective equipment to reduce the potential exposure to below the level of concern. When the recommended (or required) protective equipment is worn, the hazard for the applicator still ranges from high or low in hazard (so wear all required personal protective equipment listed on the product label).

Metabolites and Degradation Products:

Cypermethrin's major chemical degradates are 3-phenoxy benzoic acid, 3-(4-hydroxyphenoxy)benzoic acid, 4-hydroxycypermethrin, 3-(2,2-dichloroethenyl(-2,2-dimethyl cyclopropane carboxylic acid (cis- and trans-), (RS)-Carbamoyl(3-phenoxyphenyl)-methyl (1RS)-cis,trans-3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate, and 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylic acid (Reference 2 and 3).

Comments:

Cypermethrin is an eye irritant (EPA Toxicity Category III), a mild skin irritant (EPA Toxicity Category IV) and a skin sensitizer [(mixed results reported by EPA) Reference 2 and 4].

References

1. USEPA. Office of Pesticides, Prevention and Toxic Substances. Reregistration Eligibility Document for Cypermethrin. June 14, 2006.
2. USEPA. Office of Pesticides, Prevention and Toxic Substances. Reregistration Eligibility Document for Cypermethrin. June 14, 2006. (Revised 1/14/08).
3. International Union of Pure & Applied Chemistry. Pesticide Properties Database. Cypermethrin (Ref: OMS 2002). Accessed 10/12/2012.
4. USEPA. Health Effects Division, Office of Pesticide Programs. CYPERMETHRIN PC Code: 109702 and 129064. Toxicology Disciplinary Chapter for the Reregistration Eligibility Decision Document. July 10, 2003.
5. USEPA. Office of Prevention, Pesticides and Toxic Substances. Cypermethrin and Zeta-Cypermethrin: Occupational and Residential Exposure Assessment for the Reregistration Eligibility Decision Document. October 15, 2004.