chlorfenapyr

Review Date: 7/27/2009

Type	Insecticide, miticide, nematicide
Controls	Termites, ants, beetles, bark scorpions, bed bugs, boxelder bugs, centipedes, caterpillars, loopers, cockroaches, earwigs, nematodes, houseflies, crickets, pillbugs, spiders, thrips, and silverfish.
Mode of Action	Chlorfenapyr forms the chemical CL303268 which disrupts ATP production and causes cell death.

Thurston County Review Summary:

Pesticides with chlorfenapyr as an active ingredient fail Thurston County's review criteria due to the following reasons:
1) Chlorfenapyr metabolite AC303268 has a lethal dose concentration that is considered too high in hazard.
2) Chlorfenapyr is rated as high in risk to birds and small animals at expected environmental concentrations.
3) Chlorfenapyr is rated as high in hazard for both persistence and bioaccumulation potential.

MOBILITY

Property	Value	Reference	Rating
Solubility (mg/L)	0.14	2	Low
Soil Sorption (Kd=mL/g)	32 - 155	4	Low to Moderate
Organic Sorption (Koc=mL/g)	12,000	4	Low

Mobility Summary:

Chlorfenapyr is not soluble in water and adheres strongly to nearly all soil types. The hazard for chorfenapyr to move off the site of application is considered low.

PERSISTENCE

Property	Value	Reference	Rating
Vapor Pressure (mm Hg)	0.0000001	1	High
Biotic or Aerobic Half-life (days)	365	4	High
Abiotic Half-life (days)	730	4	High
Terrestrial Field Test Half-life (days)	>365	4	High
Hydrolysis Half-life (days)	"stable"	4	High
Anaerobic Half-life (days)	>365	4	High
Aquatic Field Test Half-life (days)	270	4	High

Persistence Summary:

The persistence hazard for chlorfenapyr in any environment is considered high because it is likely to take over a year for it to degrade to half of the application concentration.

BIOACCUMULATION

Property	Value	Reference	Rating
Bioaccumulation Factor	Not found		
Bioconcentration Factor	Not found		
Octanol/Water Partition Coefficient	log Kow = 4.83	2	Moderate

Bioaccumulation Summary:

The chemical properties of chlorfenapyr indicate that there is a moderate hazard for bioaccumulation based on the chemical's affinity to bind to organic solvents (log Kow = 4.83). In studies, chlorfenapyr did not concentrate in fish tissue but it did metabolize to AC312,094 which concentrated up to 2,300 times. The metabolite is 97% eliminated, through depuration, from the fish 21 days after being moved to clean water (Reference 4). Since chlorfenapyr is very persistent in aquatic environments, organism may not be able to get to "clean" water or sediment, therefore the bioaccumulation hazard is rated as high.

ACUTE TOXICITY

Test Subject	Value	Reference	Rating
Mammalian (LD50)	28.7* (for AC303,268)	4	High
Avian (LD50)	2.2 mg/kg	4	High
Honey bee or insect (LD50)	0.12 ug/bee	5	High
Annelida -worms (LC50)	22 mg/kg-soil	4	High
Fish (LC50)	0.007 mg/L	5	High
Crustacean (LC50)	0.0061 mg/L	5	High
Mollusk (LC50)	Not found		
Amphibian (LD50 or LC50)	Not found		

Acute Toxicity Summary:

Single-dose toxicity testing indicates that chlorfenapyr is moderately toxic to worms and highly toxic to birds, bees, fish and other aquatic organisms. The mode of action for chlorfenapyr involves the chemical to break down to the metabolite AC303,268 which is so highly toxic to mammals (LD50 = 28.7 mg/kg) - that it fails the County review criteria.

ACUTE TOXICITY - Risk Assessment

Subject and Scenario	Dose of Concern	Exposure	Margin of Safety	Route	Reference	Rating
Adult mixing / applying with pressurized handwand	0.1 mg/kg/day	0.0053 mg/kg/day	19	Inhalation	2	Low
Adult mixing / applying with pressurized handwand	0.1 mg/kg/day	0.0045 mg/kg/day	22	Dermal (skin absorption)	2	Low
Adult in greenhouse after foliar insect treatment	0.042 mg/kg/day	0.028 mg/kg/day	1.5	Inhalation	2	High
Aggregate exposure not evaluated						

Acute Toxicity Risk Assessment Summary

The EPA evaluated the risk to humans from chlofenapyr exposures from eating treated crops, drinking contaminated water, and from product mixing and spraying. Due to the types of products that are available, the EPA concluded that drinking water exposures would be negligible (and were not calculated). Thurston County uses would not result in crop treatment, so dietary exposures were not evaluated.

The worst-case exposures to adults mixing and spraying chlorfenapyr insecticides is from the use of a pressurized handwand sprayer. The hazard from this type of exposure, from both inhalation and skin exposures, is rated as low. The post-application exposures to greenhouse workers, after an indoor foliar application of chlorfenapyr for insect control, is rated as high in hazard.

Ecological risk assessments indicate that the concentrations of chlorfenapyr that can be expected after an application exceeds the USEPA's level of concern for non-target toxcity (including death) to birds and small animals, when the application is made to their forage. The EPA reviewer made the following statement; "The fact that these effects occur at chlorfenapyr doses above 0.059 mg/kg -bw/day (NOEL) active ingredient in the diet make chlorfenapyr one of the most reproductively toxic pesticides to avian species that EFED has evaluated." Reference 4

CHRONIC TOXICITY

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Suggestive evidence	Not sufficient to assess human carcinogenicity	2	Moderate
Mutagenicity	Negative	- -	1	Low
Neurotoxicity - (NOAEL)	2.6 mg/kg/day	Nerve disorder	4	Check risk
Endocrine Disruption	Not found			
Developmental Toxicity (NOAEL)	225 mg/kg/day	No adverse effect	2	Low
Reproductive Toxicity (NOAEL)	5 mg/kg/day	Decreased weight gains	2	Check risk
Chronic Toxicity (NOAEL)	2.6 mg/kg/day	Brain lesions	2	Check risk

Chronic Toxicity Summary:

Chemical testing of chlorfenapyr indicates that it is not a mutagen and the USEPA cancer classification is "cannot be determined; suggestive". Reproductive toxicity was observed (decreased weight gains in offspring) at the same dose as maternal toxicity (decreased weight gains in mothers) was seen. Developmental toxicity was not observed at any dose level but neurotoxicity in the form of myelinopathic alterations (nerve disorder) was observed at the same dose as brain lesions and other adverse effects were observed.

CHRONIC TOXICITY - Risk Assessment

Subject and Scenario	Dose of Concern	Exposure	Margin of Safety	Route	Reference	Rating
Adult mixing / applying with pressurized handwand	0.026 mg/kg/day	0.0048 mg/kg/day	5.8	Inhalation	2	Moderate
Adult in greenhouse after foliar insect treatment	0.026 mg/kg/day	0.026 mg/kg/day	None	Inhalation	2	High
Long-term contact exposures are not expected						
Long-term combined exposures are not expected						

Chronic Toxicity Risk Assessment Summary:

The EPA does not believe there is a long-term risk from residential exposures (inhalation or skin contact) or with drinking water ingestion. Thurston County uses are not expected to contaminate food or food crops so exposures from food sources are not applicable.

The risk of toxicity from long-term exposures to applicators using pressurized handwand sprayers are rated as moderate in hazard. The potential long-term exposures to workers in greehouses after a chorfenapyr application is rated as high in hazard.

DegradationProducts:

Chlorfenapyr metabolite AC303268 has an LD50 = 28.7 mg/kg to rats. Soil metabolite is identified as 2-pyrroline-3-carbonitrile,4-bromo-2-(4-chlorophenyl)-5-(trifluoromethyl)-chlorfenapyr.

Comments:

Chlorfenapyr can cause skin and eye irritation (opacity) but is not considered a skin sensitizer.

References

1. USEPA. "Chlorfenapyr; Pesticide Tolerance". Federal Register: January 26, 2005 (Volume 70, Number 16). OPP-2004-0362; FRL-7696-5.
2. USEPA. Prevention, Pesticides and Toxic Substances (7505C), EPA-730-F-00-001."Pesticide Fact Sheet: Chlorfenapyr". Reason for Issuance: New Chemical Registration. Date Issued: January, 2001.
3. USEPA Office of Prevention, Pesticides and Toxic Substances. Memorandum SUBJECT: "Chlorfenapyr- 129093: Health Effects Division Risk Characterization for Use of the New Chemical Chlorfenapyr in/on Cotton (5F4456). PRATS Case Number: 286152. PRATS DP Barcode numbers; D225998, D229102, & D232519. March 10, 1997.
4. USEPA. Environmental Fate and Effects Division. "Chlorfenapyr (Pirate, Alert, AC303,630) Insecticide - Miticide, Environmental Fate and Ecological Effects Assessment and Characterization for a Section 3 for Use on Cotton".
5. International Union of Pure & Applied Chemistry (IUPAC). Pesticide Properties Database, Chlorfenapyr (Ref: MK 242). Http://sitem.herts.ac.uk/aeru/iupac/