deltamethrin

Review Date: 05/08/2012

CAS #: 52918-63-5

Type	Broad spectrum insecticide (kills on contact or through ingestion)
Controls	Broad spectrum control of insects (check product labels).
Mode of Action	Affects the sodium channel in the nerve membrane which causes hyperactivity, paralysis, or death.

Thurston County Review Summary:

Deltamethrin is considered high in hazard and insecticide products containing it fail Thurston County's pesticide review criteria. Deltamethrin is rated high in hazard because of the calculated risk to children from potential exposures at labeled use rates. Indoor and outdoor products can result in post-application exposures that are above the EPA's level of concern. Runoff of outdoor products into waterbodies can contribute to levels that are toxic to aquatic organisms.

MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	<0.002 mg/L	4	Low
Soil Sorption (Kd=mL/g)	>3,000	5	Low
Organic Sorption (Koc=mL/g)	>400,000	5	Low

Mobility Summary:

Deltamethrin is not soluble in water and leaching tests with sand showed that even when large amounts of water was poured onto the treated sand, that almost all of the chemical remained in the top inch of soil. Deltamethrin is expected to bind well to all soil types, but binds stronger to soil with organic matter. The hazard for deltamethrin 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)	0.000000015	1	High
Biotic or Aerobic Half-life (days)	33 (soil) 11-14 (lab soil)	2 and 4	Moderate
Abiotic Half-life (days)	18 (soil photolysis)	2	Moderate
Terrestrial Field Test Half-life (days)	14- 231	5	Moderate to high
Hydrolysis Half-life (days)	<33	2	Moderate
Anaerobic Half-life (days)	About 30	2	Moderate
Aquatic Field Test Half-life (days)	<2	1	Low

Persistence Summary:

Deltamethrin is not expected to dissipate into the air when applied to vegetation or soil and is likely to take more than 7 days but less than 60 days to degrade to half of the applied concentration. The hazard for chemical persistence is rated moderate.

BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	698	5	Moderate
Octanol/Water Partition Coefficient	log Kow = 5.4	2	High

Bioaccumulation Summary:

Metabolism studies with rats indicates that deltamethrin is quickly eliminated with most of the administered chemical excreted within 24 hours and less than 2% remaining after 7 days (Reference 2). Bioconcentration studies with fish show that deltamethrin is moderately accumulated (even when they are moved to clean water). The hazard for bioaccumulation is probably low for animals based on rapid elimination but is rated moderate since fish studies show accumulation.

ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Value Rating
Mammalian (LD50)	>5,000 mg/kg (EPA) 87 mg/kg bw (EU	2 and 5	Low
Avian (LD50)	>4,640 mg/kg	1 and 4	Low
Honey bee or insect (LD50)	0.051 µg/bee.	4	High
Annelida -worms (LC50)	> 1290 mg/kg	5	Low
Fish (LC50)	0.0004 mg/L	4	High
Crustacean (LC50)	0.005 mg/L	4	High
Mollusk (LC50)	0.012 mg/L (product)	4	High
Amphibian (LD50 or LC50)	Value not found		

Acute Toxicity Testing and Ecotoxicity Summary:

Oral toxicity testing with deltamethrin varies based on what it is mixed with when administered to test animals - when administered with an oil the LD50 value was 30 mg/kg and with water the LD50 value was >5,000 mg/kg (References 1, 2 and 5). The California EPA reported the LD50 value for rats as >5,000 mg/kg (Reference 2). The World Health Organization evaluated deltamethrin toxicity and noted that it was very highly toxic to bees although they stated that field trials show that deltamethrin products have a bee repellant property that they believe lessens the risk to bees (Reference 4). Deltamethrin is considered low in toxicity to birds but highly toxic to several fish species and other aquatic organisms. Testing with earthworms indicates that there was no observable adverse effects at high agronomic application rates but when the concentrations were increased by 5 to 10 times the highest application rate - there was significant toxic affects noted (Reference 4).

In ecological risk assessments reviewed by the EPA in 1994, 2002, and in 2007 (for expected agricultural uses) there were hazards noted for aquatic organisms in waterbodies adjacent to application areas and for beneficial insects. Although the risk assessments were made for applications to larger areas (agricultural fields), the risk to aquatic organisms from overspray and runoff is still noteworthy as a precaution. Also, many studies have been performed that sampled stream sediments in urban settings and in some areas up to 49% of the samples had detectable levels of deltamethrin. So, even though residential uses may be smaller in scale than a single agricultural application, the combined application potential of an urban area can create deltamethrin runoff into streams at levels that are known to cause aquatic toxicity. Because the concentration of deltamethrin is found in urban streams (indicating residential use) at levels that are known to cause toxicity, the hazard for aquatic toxicity from the use of deltamethrin is rated high in hazard. When the EPA performs all the risk assessments for non-target organisms and shows that this risk is reduced, then the rating will be revised. Risk to beneficial insects is rated high in hazard - but because deltamethrin is an insecticide, beneficial insects can't be counted as a non-target organism for this review rating (instead the applicator needs to take precautions with application timing to reduce the potential to kill bees).

ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Childs sin exposure to treated lawn	Dermal	0.001 mg/kg/day	0.0005 mg/kg/day	2	6	High
Child hand-to-mouth activity on treated lawn	Ingestion	0.001 mg/kg/day	0.0019 mg/kg/day	None	6	High
Child contact with treated pet collar (4% active)	Dermal and oral	0.001 mg/kg/day	0.042 mg/kg/day	None	6	High
Toddler contacting treated surfaces	Ingestion	0.001 mg/kg/day	0.0044 mg/kg/day	None	6	High

Acute Toxicity Risk Assessment Summary:

In reviewing toxicological studies, the EPA determined that there was an age-dependent toxicity associated with deltamehrin (younger animals appeared to be more susceptible to toxicity than older animals). Because of this age-dependent toxicity, the EPA added a 10-times safety factor in risk assessments for potential exposures to children.

The risk assessment calculated for potential oral exposures for a child playing on treated lawn or that eats granular product off of the lawn exceeds the EPA's level of concern and is rated high in hazard. Other post-application exposures of concern were calculated for children's potential exposures to deltamethrin following indoor crack and crevice applications (products containing 0.06% to 0.02% deltamethrin) and children's hand-to-mouth activities with pets wearing a deltamethrin treated pet collar (adult exposure is also rated high in hazard).

CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Group C (IARC) Group D (EPA)	Not classifiable to human carcinogenicity	3	Low
Mutagenicity	In vivo and in vitro tests	Chromosome abberations / sister-chromatid exchange	2 and 4	Moderate
Neurotoxicity - (NOAEL)	1 mg/kg/day	Nerve degeneration	2	Check risk
Endocrine Disruption	Value not reported	Decreased plasma testosterone	2	Moderate
Developmental Toxicity (NOAEL)	4.2 mg/kg/day	Embryonic death, r3etarded fetal growth	2 and 5	Moderate
Reproductive Toxicity (NOAEL)	>5 mg/kg/day	Maternal toxicity at 5 mg/kg/day	5	Low
Chronic Toxicity (NOAEL)	1 mg/kg/day	Nerve degeneration	2	Check risk

Chronic Toxicity Hazard Summary:

Deltamethrin is rated moderate in hazard for the potential to cause mutagenicity - typically this would be rated high in hazard but the positive studies that were reviewed by the California EPA were not able to be validated. Review of several in vivo and in vitro mutagenicity tests by the World Health Organization led to the conclusion that deltamethrin is not mutagenic or clastogenic (Reference 4). Until the positive mutagenicity studies have been shown to meet standard testing guidelines by a regulatory authority, Thurston County will rate the mutagenicity hazard as moderate. California EPA reported reviewing studies showing developmental and reproductive toxicity but, did not report dose concentrations. In a more recent European Union review of developmental toxicity test, the same developmental toxicity was noted as being observed at after maternally toxic concentrations (Reference 5). The hazard rating is low for developmental toxicity but moderate for reproductive toxicity because it was observed along with maternal toxicity. Deltamethrin is not a known endocrine disruptor, but toxicity testing reported by California EPA notes decreased plasma testosterone - which indicates a potential for endocrine disruption.

CHRONIC HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Long-term risk assessments were not calculated						
Long-term risk assessments were not calculated						
Long-term risk assessments were not calculated						
Long-term risk assessments were not calculated						

Chronic Toxicity Risk Assessment Summary:

Deltamethrin is not a very persistent chemical, but it can be used over and over in the same setting. Risk from repeated short-term exposures are a concern because short-term exposures are of concern.

Metabolites and Degradation Products:

Deltamethrin is a metabolite of the pyrethroid tralomethrin. Other known metabolites and degradation chemicals are decamethrin and phenoxybenzoic acid (Reference 2).

Comments:

Deltamethrin is considered a potential eye irritant (EPA Toxicity Category III) but not a skin irritant (EPA Toxicity Category IV) and not a skin sensitizer (Reference 2). Products containing deltamethrin may be very irritating to the eyes and skin due to the addition of other ingredients so, check the product label for user warnings.

References

1. National Pesticide Information Center. Oregon State University. Deltamethrin Technical Fact Sheet. March 2010.
2. California EPA. Department of Pesticide Regulation, Medical Toxicology Branch. Deltamethrin Risk Characterization Document - Volume 1. June 13, 2000.
3. International Agency for Research on Cancer. Agents Classified by the IARC Monographs, Volumes 1-102. (Accessed 5/8/2012). http://monographs.iarc.fr
4. World Health Organization. International Programme on Chemical Safety. Environmental Health Criteria 97. DELTAMETHRIN. Geneva 1990.
5. European Commission. Health & Consumer Protection Directorate - General. Directorate E - Food Safety: plant health, animal health and welfare, international questions. E1 - Plant Health Deltamethrin. 6504/VI/99-final. 17 October 2002.
6. USEPA. Office of Pollution, Pesticides and Toxic Substances. MEMORANDUM: D368592. SUBJECT: Deltamethrin. Human Health Assessment Scoping Document in Support of Registration. 2/17/2010.