trichlorfon

Review Date: 06/20/2013

CAS #: 52-68-6

Type	Organophosphate insecticide with contact and stomach action.
Controls	Insects
Mode of Action	Acetylcholinesterase inhibition

Thurston County Review Summary:

Trichlorfon is rated high in hazard and pesticide products containing it fail Thurston County's pesticide review criteria. Trichlorfon is rated high in hazard because it is known to cause mammalian cell mutations. Risk to birds and small animals can be high in hazard if trichlorfon products are not watered in after they are applied to turf grass. The hazard rating for risk to humans from exposures to trichorfon insecticides ranges from low to moderate depending on application method, please read the acute and chronic risk assessment section for more detail.

MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	120,000	3	High
Soil Sorption (Kd=mL/g)	0.25 to 0.51	2	High
Organic Sorption (Koc=mL/g)	10	3	High

Mobility Summary:

Trichlorfon is soluble in water and is expected to bind poorly to all soil types. The hazard for trichlorfon 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)	0.0000016	3	Moderate
Biotic or Aerobic Half-life (days)	6.4	1	Low
Abiotic Half-life (days)	Stable to photodegradation	1 and 3	High
Terrestrial Field Test Half-life (days)	4.5 to 10	2	Low / moderate
Hydrolysis Half-life (days)	34 (pH = 7)	2	Low
Anaerobic Half-life (days)	1.8	2	Low
Aquatic Field Test Half-life (days)	1.4	1	Low

Persistence Summary:

Trichlorfon breaks down quickly with interaction with water and is expected to degrade to half of the applied concentration within one week. The hazard for chemical persistence is rated low.

BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	0.41	3	Low
Octanol/Water Partition Coefficient	log Kow = 0.43	3	Low

Bioaccumulation Summary:

Trichlorfon is not likely to bind well to fish or animal tissue and the calculated bioconcentration factor indicates a low potential for accumulation. In rat metabolism tests, up to 90% of the administered trichlorfon was excreted within 24 hours. The hazard for trichlorfon to bioaccumulate is rated low.

ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Value Rating
Mammalian (LD50)	136-173 mg/kg	2	Moderate
Avian (LD50)	22.4 mg/kg	2	High
Honey bee or insect (LD50)	59.8 ug/bee	2	Low
Annelida -worms (LC50)	Value not found		
Fish (LC50)	0.43 mg/L	2	High
Crustacean (LC50)	0.36 ug/L (EC50)	2	High
Mollusk (LC50)	>1 ug/L	2	High
Amphibian (LD50 or LC50)	Value not found		

Acute Toxicity Testing and Ecotoxicity Summary:

Single dose toxicity testing indicates that tichlorfon is highly toxic to birds, fish and other aquatic organisms but moderatley toxic to animals. Granular and liquid products used on turf grass at the application rate of 8 pounds of active ingredient per acre (maximum allowable application rate) exceeds the EPA's level of concern for potential exposures to birds that eat the granules or treated grass (Reference 2). The EPA's level of concern is also exceeded for potential exposures to animals that consume granular products applied to turf grass at the maximum application rate, but the level of concern is not exceeded with the use of liquid products on turf grass (Reference 2). Because of the low toxicity to honeybees, the EPA does not believe that use of trichlorfon poses a concern for beneficial insects (Reference 2). The risk mitigation that the EPA and the registrant agreed upon was to require "watering in" of all turf grass applications after application. Risk to wildlife from other applications were not included in the 1997 re-registration of trichlorfon, so they are not summarized here. Potential exposures to birds and animals from the use of trichlorfon insecticide products on turf grass is rated high in hazard (watering them in after application will reduce the risk significantly, although the risk was not calculated by EPA).

The EPA calculated risk to fish and other aquatic organisms from runoff following an application to 10 hectares of turf grass at the highest application rate. The potential exposures calculated exceeded the level of concern for short-term and long-term exposures (Reference 2).

ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Push spreader applicator to 0.5 acres	Dermal	0.1 mg/kg/day	0.04 mg/kg/day	2.5	1	Moderate
Child playing in treated lawn	Dermal	0.1 mg/kg/day	0.0096 mg/kg/day	10	1	Low
Push spreader applicator to 0.5 acres	Inhalation	0.0035 mg/kg/day	0.00005 mg/kg/day	65	1	Low
Golfer playin on treated turf	Dermal	0.1 mg/kg/day	0.0004 mg/kg/day	250	1	Low

Acute Toxicity Risk Assessment Summary:

Residential applicator exposure risk was calculated assuming a treatment area of 0.5 acres at the maximum application rate of 8.2 pounds of active ingredient per acre. The potential exposure from skin contact and inhalation combined is less than half of the EPA's dose of concern. Thurston County rates potential exposures that are less than half of the dose of concern but more than 10% of the dose of concern, as a moderate hazard. All other potential residential applicator and post-application exposures are rated low in hazard.

CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Not likely at low doses and likely at high doses	Dose related	1	High
Mutagenicity	1 to 145 ug/mL	Increases in mutation frequencies + others	2	High
Neurotoxicity - (NOAEL)	0.2 mg/kg/day	Brain cholinesterase inhibition	1	Check risk
Endocrine Disruption	Not listed	- -	4	Low
Developmental Toxicity (NOAEL)	<45 mg/kg/day	Reduced skull ossification	2	Data gap
Reproductive Toxicity (NOAEL)	15 mg/kg/day	Decreased brain weights in fetuses	2	Low
Chronic Toxicity (NOAEL)	0.2 mg/kg/day	Brain cholinesterase inhibition	1	Check risk

Chronic Toxicity Hazard Summary:

In the EPA's 1997 re-registration document trichlorfon is classified as a Group E chemical for "no evidence of carcinogenicity for humans." In the EPA's 2006 re-registration document for trichlorfon, the EPA determined that trichlorfon is not likely to be carcinogenic in humans at low doses but likely to be carcinogenic at high doses, although the dose levels were not provided (Reference 1). Trichlorfon degrades to the chemical dichlorvos, which is classified by the EPA as a Group C chemical "possible human carcinogen" (Reference 2). Mutagenicity testing indicated that trichlorfon increased mutation frequency in mammalian cells with and without S9 activation (Reference 2). Developmental toxicity was observed in the pups at the same dose that caused maternal toxicity, but the toxicity was observed at the lowest dose tested, so it is not known if developmental toxicity occurs without maternal toxicity. Without a clear understanding of which toxicity is illicited first (or together at the same concentration), there is a data gap and the hazard for developmental toxicity is rated high. Reproductive toxicity was observed at doses higher that those causing maternal toxicity.

CHRONIC HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Occupational applicator to 5 acres	Dermal + inhalation	1 mg/kg/day and 0.035 mg/kg/day	0.18 mg/kg/day and 0.0042 mg/kg/day	3.3	1	Moderate
Mix/apply 40 gallons using low pressure hand wand	Inhalation	0.035 mg/kg/day	0.0094 mg/kg/day	3.7	1	Moderate
Mix/apply 40 gallons to ornamentals with backpack	Dermal (with gloves)	1 mg/kg/day and 0.035 mg/kg/day	0.021 mg/kg/day	47	1	Low
Occupational applicator with sprinkling can	Dermal (no gloves)	1 mg/kg/day and 0.035 mg/kg/day	0.0083 mg/kg/day and 0.035 mg/kg/day	120	1	Low

Chronic Toxicity Risk Assessment Summary:

Occupational applicator exposure risk was calculated assuming a turf grass treatment area of 5 acres and the maximum application rate of 8.2 pounds of active ingredient per acre. The potential exposure from skin contact and inhalation combined is less than half of the EPA's dose of concern. Thurston County rates potential exposures that are less than half of the dose of concern but more than 10% of the dose of concern as a moderate hazard.

Potential inhalation exposures to occupational applicators spraying 40-gallons on ornamental plants with a low-pressure handwand is calculated as being moderate in hazard. Spot applications of 40-gallons to turf grass using a low-pressure handwand has a calculated inhalation exposure that is rated low in hazard. Other registered occupational handwand applications that had exposures calculated were for livestock and ornamental ponds, which are not applicable to residential or Thurson County uses and are not included in this review (but they were all calculated to be high in hazard).

Occupational exposure from sprinkling can applications to a 100 square foot area is low in hazard.

The EPA determined that they do not expect long-term dermal exposures to trichlorfon from residential pesticide use (Reference 1).

Metabolites and Degradation Products:

The major degradates in both soil and water is dichlorvos (DDVP) and desmethyl DDVP (Reference 2). Metabolites of trichlorfon found in animals were dimethyl trichlorfon, dimethyl dichlorvos, dimethyl hydrogen phosphate, methyl hydrogen phosphate and phosphoric acid (Reference 2).

Comments:

Trichlorfon is a moderate eye irritant (EPA Toxicity Category II) but is not irritating to the skin (EPA Toxicity Category IV), although it is considered a moderate contact allergen (Reference 1).

References

1. USEPA. Office of Pesticide Programs. Reregistration Eligibility Decision for Trichlorfon. July 31, 2006.
2. USEPA. Prevention, Pesticides and Toxic Substances. Reregistration Eligibility Decision (RED) Trichlorfon. EPA-738-R-96-017. January 1997.
3. International Union of Pure & Applied Chemistry. Pesticide Properties Database. Trichlorfon (Ref: OMS 800). Data accessed 6/21/2013.
4. Illinois EPA. "Endocrine Disruptors Strategy" February 1997.