

Type	Organophosphate insecticide - contact and ingestion systemic action.
Controls	Broad-spectrum insecticide
Mode of Action	Acetylcholinesterase (AChE) inhibitor.

Thurston County Review Summary:

Insecticide products containing acephate are rated high in hazard and fail Thurston County's IPM review criteria. Acephate is listed in EPA's chemical group "C" as a possible human carcinogen - which is considered an unacceptable hazard. Risk to residential applicators using low pressure handwands for the control of fire ants is rated high in hazard. The risk of toxicity to non-target organisms following applications of acephate insecticides is rated high in hazard.

Acephate is rated high in hazard for chemical mobility but low in hazard for both persistence and bioaccumulation potential.

MOBILITY

Property	Value	Reference	Rating
Water Solubility (mg/L)	790,000	1	High
Soil Sorption (Kd=mL/g)	0.09	2	High
Organic Sorption (Koc=mL/g)	2	2	High

Mobility Summary:

Acephate is highly soluble in water and adheres very poorly to all soil types. The potential for acephate to move off the site of application with rain or irrigation water is rated high.

PERSISTENCE

Property	Value	Reference	Rating
Vapor Pressure (mm Hg)	0.0000017	1	
Biotic or Aerobic Half-life (days)	3	2	Low
Abiotic Half-life (days)	Not found		
Terrestrial Field Test Half-life (days)	<2	1	Low
Hydrolysis Half-life (days)	"stable" at pH <9	1	High
Anaerobic Half-life (days)	6.6	1	Low
Aquatic Field Test Half-life (days)	Not found		

Persistence Summary:

In terrestrial settings, acephate is expected to break down to half of the applied concentration in less than one week. If it gets into a water body, it is stable to hydrolysis but degrades within days in sunlight. The degradation chemical, methamidophos, also degrades quickly in soil (half-life less than one week) and is hydrolyzed within a week in water bodies. The hazard of persistence for acephate and methamidophos is rated low for both chemicals.

BIOACCUMULATION

Property	Value	Reference	Rating
Bioaccumulation Factor	Not found		
Bioconcentration Factor	0.03	2	Low
Octanol/Water Partition Coefficient	log Kow = -0.85	2	Low

Bioaccumulation Summary:

"Laboratory studies showed that bioaccumulation of acephate in bluegill sunfish was insignificant" (Reference 1). The potential for acephate to bioaccumulate is rated low in hazard.

ACUTE TOXICITY HAZARD - ECOTOXICITY

Test Subject	Value	Reference	Rating
Mammalian (LD50)	1,000 mg/kg	1	Moderate
Avian (LD50)	350 mg/kg	2	Moderate
Honey bee or insect (LD50)	1.2 ug/bee	2	High
Annelida -worms (LC50)	22,974 mg/kg	2	Low
Fish (LC50)	50 - 100 mg/L	1	Moderate
Crustacean (LC50)	67.2 mg/L	2	Moderate
Mollusk (LC50)	Not found		
Amphibian (LD50 or LC50)	Not found		

Acute Toxicity Testing and Ecotoxicity Summary:

The EPA evaluated expected environmental concentrations from uses of acephate to calculate levels of concern for endangered species exposures. Except for fish (estuarine and freshwater) and estuarine invertebrates, the level of concern was exceeded for all uses of acephate. In addition, levels of concern were exceeded for 36 endangered species of mammals, amphibians, birds, reptiles, insects, and freshwater invertebrates for the degradate methamidophos formed from all uses of acephate (Reference 1). There are a number of long-term exposure issues also associated with acephate and/or its degradate methamidophos to birds (embryo and chick survival, number of eggs laid, reduction of egg thickness, etc.). The EPA also stated that acephate and its degradate may adversely affect mammal reproductivity by reducing the viability of pups and their body weight. Acephate is highly toxic to honey bees an other beneficial insects and the EPA recommends not using products where they can come into contact with flowering plants.

The risk of toxicity to non-target organisms following applications of acephate insecticides is rated high in hazard.

ACUTE TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Rating
Mixing/applying 2 gallons with handwand for ants	Inhalation + dermal	0.0028mg/kg/day and 0.5mg/kg/day	Not provided for each route	1.7	1	High
Mixing/applying 2 gallons with backpack sprayer	Inhalation + dermal	0.0028mg/kg/day and 0.5mg/kg/day	Not provided for each route	>70	1	Low
Mixing/applying <0.3 gallons with hose sprayer	Inhalation + dermal	0.0028 mg/kg/day and 0.5mg/kg/day	Not provided for each route	>10	1	Low
Child golfer playing on treated turf	Dermal	0.5 mg/kg/day	0.0139 mg/kg/day	36	1	Low

Acute Toxicity Risk Assessment Summary:

Short-term exposures to acephate from insecticidal use was evaluated by the EPA for numerous mixing and applying situations. Many of the application methods were shown to exceed the EPA's level of concern. The EPA removed several of the residential uses and applicaton methods to protect people from the worst potential exposures. After these changes, it appears that the only potential exposure to residential applicators that is still rated high in hazard by Thurston County, is from spraying for fire ants with a low pressure handwand (assuming 2 gallons of spray).

Potential exposures to residential applicators using the following techniques are considered low in hazard; mixing and spraying 2 gallons with backpack sprayer (0.023 pounds of active ingredient per gallon), mixing and spraying <0.3 gallons with hose sprayer (at 1 pound of active ingredient per gallon), applying up to 2 aerosol cans to ornamental plants, and mixing and applying up to 5 gallons with a sprinkling can (0.023 pounds of active ingredient per gallon).

Since the product manufacturers removed all indoor and residential turf grass use, the potential post-application exposures of concern to children were also eliminated. Post-application exposures to people playing golf on treated turf is rated low in hazard.

CHRONIC TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Group C	Possible human carcinogen	3	High
Mutagenicity	Not provided	See summary	4	High
Neurotoxicity - (NOAEL)	(Acute) 0.5 mg/kg/day	Brain cholinesterase inhibition	1	Check risk
Endocrine Disruption	Not found			
Developmental Toxicity (NOAEL)	28 mg/kg/day	Decreased number of live fetuses, +	5	Check risk
Reproductive Toxicity (NOAEL)	14 mg/kg/day	Decreased sperm motility and count	5	High
Chronic Toxicity (NOAEL)	0.12 mg/kg/day	Brain cholinesterase inhibition	1	Check risk

Chronic Toxicity Hazard Summary:

Acephate is listed in EPA's chemical group "C" as a possible human carcinogen - which is an unacceptable hazard according to Thurston County's pesticide review criteria. Acephate tested positive in reverse mutation and mitotic recombination assays, mouse lymphoma cell assays, sister chromatid exchange, mitotic recombination, unscheduled DNA synthesis in human fibroblasts, bone marrow chromosome aberrations, and cell transformation. These tests indicate that acephate is a chemical mutagen which is considered an unacceptable hazard by Thurston County. Reproductive testing induced impaired male fertility without other toxic effects to the male mouse which Thurston County rates as high in hazard. Developmental toxicity was only observed at doses higher than those that caused maternal toxicity.

CHRONIC TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Rating
Long-term contact exposures are not expected						
Occupational exposures could not be evaluated						
Drinking water exposures were not evaluated						
Dietary exposures were not evaluated						

Chronic Toxicity Risk Assessment Summary:

There were over 20 different occupational handler/applicator exposure assessments evaluated by the EPA. Many of the exposures exceeded the level of concern. Due to the concern over these potential exposures, the EPA eliminated several of the application methods and required specific personal protective equipment to be worn (chemical resistant gloves, coveralls, and respirators). These label requirements should significantly lessen the potential exposures, but Thurston County does not have the recalculated exposure data to rate them. Generally, mixing/handling/applying acephate insecticides that are granular or that are applied with a low pressure handwand have the highest potential exposures.

There are no long-term post-application exposures expected except from food or water sources. Thurston County does not evaluate exposures from food uses, and small-scale spot spray uses would not be expected to contribute significantly to drinking water exposures. Drinking water exposures from contaminated surface water (streams, rivers, reservoirs) may be possible from large-scale use in agricultural settings or from commercial turf grass use.

Metabolites and Degradation Products:

Acephate degrades to methamidophos which is further degraded by soil organisms to carbon dioxide and "microbial biomass" (Reference 1). In anaerobic conditions acephate is expected to degrade to carbon dioxide and methane (Reference 1).

Comments:

Acephate is not considered an eye or skin irritant (EPA Toxicity Category IV) and is not considered a skin sensitizer (Reference 1).

References

1. USEPA. Prevention, and Toxic Substances. Pesticides Reregistration Eligibility Decision for Acephate. September 2001. EPA 738-R-01-013.
2. International Union of Pure & Applied Chemistry. Pesticide Properties Database. Acephate. Accessed 3/28/2011 <http://sitem.herts.ac.uk/aeru/iupac/>
3. USEPA. Science Information Management Branch, Health Effects Division, Office of Pesticide Programs. Chemicals Evaluated for Carcinogenic Potential. July 19, 2004.
4. California EPA. Office of Environmental Health Hazard Assessment. Health Hazard Assessment. Acephate. July 2010.
5. Farag AT, Eweidah MH, El-Okazy AM. Department of Pesticide Chemistry, Faculty of Agriculture (El-Shatby), University of Alexandria, Alexandria, Egypt. Reproductive Toxicology. "Reproductive toxicology of acephate in male mice." 2000 Sep-Oct;14(5):457-62.