

# dichlorvos (ddvp)

Review Date: 09/16/2013

CAS #: 62-73-7

Type	Chlorinated organophosphate pesticide
Controls	Controls flies, gnats, mosquitoes, chiggers, ticks, cockroaches, armyworms, chinch bugs, clover mites, crickets, cutworms, grasshoppers, and sod webworms (Reference 1).
Mode of Action	Cholinesterase inhibitor.

## Thurston County Review Summary:

There are several organophosphate pesticides that may share a common mode of toxicity (cholinesterase inhibition) with dichlorvos, but the organophosphate chemicals naled and trichlorfon degrade or are metabolized to dichlorvos (Reference 1). This means that the use of one organophosphate product may contribute to the environmental concentration of another, and increase the risk to birds and animals. This review is specific to dichlorvos and is not rated on any other organophosphate chemical or combination of the chemicals.

Dichlorvos is a known chemical mutagen and is classified as a possible human carcinogen by the International Agency for Research on Cancer, which is rated high in hazard by Thurston County's pesticide review criteria. These toxicities are considered unacceptable hazards in Thurston County's IPM policy and pesticides that contain dichlorvos fail the County's pesticide review.

## MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	18,000	4	High
Soil Sorption (Kd=mL/g)	0.3 to 1.2	1	High
Organic Sorption (Koc=mL/g)	50	4	High

### Mobility Summary:

Dichlorvos is soluble in water and is expected to bind poorly to all soil types. The hazard for dichlorvos 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)	0.012 mmHg	3	Low
Biotic or Aerobic Half-life (days)	<1	1	Low
Abiotic Half-life (days)	<1 (soil photolysis)	3	Low
Terrestrial Field Test Half-life (days)	Value not found		
Hydrolysis Half-life (days)	5 (pH = 7)	1	Low
Anaerobic Half-life (days)	6	3	Low
Aquatic Field Test Half-life (days)	<1 (water/sediment)	4	Low

### Persistence Summary:

Dichlorvos has a high vapor pressure (0.012 mmHg) which will cause it to dissipate into the air after application. Dichlorvos is also degraded quickly by soil microbes and interaction with water (hydrolysis). Dichlorvos is likely to degrade to half of the applied application within one day. The hazard for chemical persistence is rated low.

## BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	Value not found		
Octanol/Water Partition Coefficient	log Kow = 1.58	1	Low

### Bioaccumulation Summary:

Dichlorvos has a low octanol/water partition coefficient (logKow = 1.58) which indicates that it is not likely to bind strongly with fat or animal tissue and accumulate. In metabolism testing, rats rapidly absorbed dichlorvos and eliminated about 50% of it within one day and up to 77% in one week. Due to the low octanol/water partition coefficient and fairly rapid chemical elimination in animals, the hazard for bioaccumulation is rated low.

# ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Value Rating
Mammalian (LD50)	56 mg/kg	3	Moderate - high
Avian (LD50)	7.78 mg/kg	3	High
Honey bee or insect (LD50)	0.5 ug/bee	3	High
Annelida -worms (LC50)	Value not found		
Fish (LC50)	0.183 ppm	3	High
Crustacean (LC50)	0.00007 ppm	3	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 dichlorvos is highly toxic to animals, birds, honeybees, fish and other aquatic organisms.

# ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Adult applicator of aerosol spray	Inhalation and dermal	0.008 mg/kg/day	0.00023 mg/kg/day	35	1	Low
After spraying 2oz aerosol indoors	Dermal, oral & inhalation	mg/kg/day	0.015 mg/kg/day	11.6	1	Low
Adult exposed to 16 gram pest strip for <2 hours	Inhalation	Value not reported	Value not reported	>10	1	Low
Adult exposed to 16 gram pest strip for >8 hours	Inhalation	Value not reported	Value not reported	<2	1	High

## Acute Toxicity Risk Assessment Summary:

The EPA evaluated the risk from potential short-term exposures from residential applications of dichlorvos products. Residential applicators may be exposed to dichlorvos while spraying products from pressurized aerosol spray cans. Residential post application exposure may occur after use of pressurized aerosol spray cans, resin pest strips, and pet flea collars.

Acute (one-time) exposures were evaluated using a dose of concern of 0.8 mg/kg/day and a safety factor of 100 for oral, inhalation and dermal exposures. The dose of concern for short-term (0 to 30 days) incidental ingestion of dichlorvos was derived from studies using human volunteers and so the safety factor was set at 30. The resulting dose of concern for short-term oral exposures (0 to 30 days) was set at 0.003 mg/kg/day. The same dose of concern was also utilized for short-term inhalation and dermal exposures.

Potential residential applicator risk was evaluated only for an adult spraying 2 ounces of product with an aerosol can. The calculated exposure is rated low in hazard. Potential post-application exposures combining inhalation, dermal and ingestion, following the aerosol spray, is also rated low in hazard.

Post-application exposures to pest strips was evaluated for occupying the space where the strip was used for consecutive hours. These pest strips are not intended for use in rooms that are expected to be occupied for more than 4 hours (like closets, attics, etc.). Exposures to 16 gram pest strips (or smaller) for less than 2 hours is rated low in hazard. Occupying the space for more than 8 hours is rated high in hazard.

# CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	IARC 2B / EPA "suggestive"	Possibly carcinogenic to humans	2 and 1	High
Mutagenicity	Value not found	"Direct acting mutagen"	1	High
Neurotoxicity - (NOAEL)	0.1 mg/kg/day (LOAEL)	Brain ChEI (infant)	3	Check risk
Endocrine Disruption	Not a known endocrine disruptor	- -	1	Low
Developmental Toxicity (NOAEL)	21 mg/kg/day	No developmental toxicity	1	Low
Reproductive Toxicity (NOAEL)	2.3 mg/kg/day	Decreased fertility & dams with litters	1	Check risk
Chronic Toxicity (NOAEL)	0.1 mg/kg/day (LOAEL)	Brain ChEI (infant), blood ChEI (adult)	3	Check risk

## Chronic Toxicity Hazard Summary:

"Dichlorvos has been shown to be a direct acting mutagen by common in vitro bacterial genetic toxicity assays and in in vitro mammalian test systems" (Reference 1). Dichlorvos was restricted for use in Sweden due to its mutagenic properties (Reference 3). Dichlorvos is classified as a possible human carcinogen by the International Agency for Research on Cancer (Reference 2). Reproductive toxicity in the form of decreased number of dams bearing litters, decreased fertility and pregnancies was observed at the same dose that caused maternal toxicity (Reference 1). The maternal toxicity observed (reduced estrous cycling and abnormal cycling, etc.) may be related to the observed reproductive toxicity, therefore the reproductive toxicity hazard is not rated high. There was no observed developmental toxicity in animal testing (Reference 1). The EPA reviewed toxicity studies for potential endocrine disruption and there was no estrogen, androgen or thyroid related toxicity (Reference 1).

# CHRONIC HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
1-hour exposure in warehouse after 24-hours	Dermal + inhalation	0.008 mg/kg/day	0.0012 mg/kg/day	6.5	1	Moderate
Child contacting pet with treated collar	Inhalation, dermal and	0.03 mg/kg/day	0.027 mg/kg/day	<2	1	High
Other long-term exposures are not expected						
Other long-term exposures are not expected						

## Chronic Toxicity Risk Assessment Summary:

Potential exposures to dichlorvos from home or recreational turf grass applications were evaluated for the combination from skin contact and ingestion from hand to mouth activities. The combined exposures were calculated for children and were less than 10% of the dose of concern which rates low in hazard. Inhalation exposures could not be evaluated by the EPA due to lack of data. The registrant of dichlorvos products is AMVAC and in the EPA's Reregistration Eligibility Decision for Dichlorvos (DDVP) dated July 31, 2006 states; AMVAC has requested voluntary cancellation of registration for use in mushroom houses, greenhouses, and warehouse hand held foggers, lawn, turf, and ornamental uses, total release foggers, as well as crack and crevice uses (Reference 1).

A child's potential long-term exposure was calculated for use of treated pet collars. A child in close contact with a pet with a treated collar for 8 hours daily may get a combined exposure from inhalation, skin contact and ingestion from hand to mouth activities. The calculated exposure is more than half of the calculated dose of concern and is rated high in hazard.

Occupational exposures evaluated by the EPA included applying and post-application work in mushroom houses, greenhouses, food manufacturing plants, trucks and railcars, and warehouses. Of these potential exposures only the warehouse application scenario could be applicable to an application by Thurston County. Post application exposures to people entering the warehouse 24-hours after a fogger application and working for one hour is rated moderate in hazard. There is no associated applicator exposure evaluation for an automatic fogger applicator.

## Metabolites and Degradation Products:

Dichloroacetic acid is the major degradation chemical of dichlorvos in soil. In animals it is metabolised to desmethyl dichlorvos, and in plants it hydrolyzes to dimethyl phosphate and dichloroacetaldehyde (Reference 1).

## Comments:

Dichlorvos is an eye irritant (EPA Toxicity Category III) but not a skin irritant (EPA Toxicity Category IV).

## References

- USEPA. Office of Pesticide Programs. Reregistration Eligibility Decision for Dichlorvos (DDVP). July 31, 2006.
- International Agency for Research on Cancer. Agents Classified by the IARC Monographs, Volumes 1-102. (Accessed 10/7/2013). [Http://monographs.iarc.fr](http://monographs.iarc.fr)
- USEPA. Environmental Fate and Effects Division. Revised EFED Risk Assessment for the Dichlorvos Reregistration Eligibility Document. June 20, 2005.
- International Union of Pure & Applied Chemistry. Pesticide Properties Database. Dichlorvos (Ref: OMS 14). Date accessed 10/11/2013.