

United States
Environmental Protection
Agency

Office of Pesticides and Toxic Substances
Office of Pesticide Programs (TS-766C)
Washington, DC 20460



Pesticide Fact Sheet

Name of Chemical: DICHLORVOS

Reason for Issuance: REGISTRATION STANDARD

Date Issued: 10/87

Fact Sheet Number: 134

1. DESCRIPTION OF CHEMICAL

Generic Name: 2,2-dichlorovinyl dimethyl phosphate
(Chemical) hexahydro-4,7-methanoindene

Common Name: Dichlorvos

Trade and

Other Names: 2,2-dichloroethenyl dimethyl phosphate;
DDVP (USA); DDVF (USSR), Nogos; Vapona;
Dedevap; Mafu; Oko; Atgard; No-pest;
Herkol; Ciovap; Ravap; Vaponite; Canogard;
Equigard; Task and Riton.

EPA Shaughnessy Code: 084001

Chemical Abstracts Service (CAS) Number: 62-73-7

Year of Initial Registration: 1948

Pesticide Type: Insecticide

Chemical Family: Organophosphate

U.S. and Foreign Producers: Amvac Chemical Corp.; SDS Biotech Corp.; Prentiss Drug and Chemical Co.; Dow Chemical Corp; Kaw Valley; MGK Co.; Denka Chemia B.V.; Kenco Chemical and Mfg. Corp.; Wesley Industries. Inc; Fermenta Animal Health; and E.I. du Pont de Nemours and Company

2. USE PATTERNS AND FORMULATIONS

Application Sites: Dichlorvos is used in areas where flies, mosquitoes, gnats, cockroaches and other nuisance insect pests occur. Use sites include the following:

in and around domestic dwellings (contract, crack and crevice, bait, resin strip, and space spray); direct application to domestic food animals (spray, pour-on, dip, back rubber, face oiler, and paint and impregnated material); direct application to domestic animals (spray, flea collar, and tag); in and around premises housing animals (food and nonfood) (space spray, bait, resin strip, and contact); ornamental and food crop greenhouse use (contact and space spray); mushroom houses (contact and space spray); tobacco warehouses (contact and space spray); postharvest tomato treatment (dust applied to fruit in containers); sewage plants/sewage systems (resin strips and direct application to sewage); aircraft, buses and other commercial transportation vehicles (space spray); nonperishable bulk-stored raw agricultural commodities (RACs) (including animal feed, beans [dried type], cocoa beans, coffee beans, grain crops such as corn, nut crops, peanuts, peas [field], soybeans, and tobacco) (resin strip and space spray); nonperishable packaged or bagged RACs (including beans [dried type], cocoa beans, coffee beans, grain crops such as corn, nut crops, peanuts, peas, and soybeans) (space spray); nonperishable packaged or bagged processed agricultural commodities (including cereals, crackers, flour, packaged cookies, and sugar); lawns (foliar application); ornamental turf (foliar application); ornamental plants (foliar and bark application); noncrop aquatic areas (ground or air equipment and resin strip);

eating establishments, and food processing and storage areas (space spray, contact, bait, and resin strip); other commercial, institutional and industrial areas (space spray, contact bait, and resin strip); enclosed outdoor utility equipment (space treatment); gypsy moth traps and malaise (tent) traps (resin strip); figs (EPA SLN No. CA-830045) (ground and air equipment); urban and rural outdoor areas (food and nonfood); including screwworm adult suppression (EPA SLN Nos. TX-780056, AZ-8003100, NM-790003, CA-810040) and recreational areas (spray, bait, and resin strip); and miscellaneous sites including epcot display crops (EPA SLN Nos. FL-820051, FL-820054, FL-820055), rat receptacle bags, refuse and solid waste containers and sites (spray, bait, and resin strip).

Formulation Types: Emulsifiable concentrates, soluble concentrate liquids, granulars, pressurized liquids and dusts, impregnated materials, pellets/tablets, liquids (ready to use), wettable powders and dusts.

3. SCIENCE FINDINGS

Summary Science Statement

Dichlorvos is an organophosphate insecticide with moderate to high acute toxicity. Dichlorvos is classified as a B₂ "Probable Human Carcinogen", is a potent cholinesterase inhibitor, and may cause liver effects from subchronic and chronic exposure. Dichlorvos is potentially highly to very highly toxic to fish and other wildlife. It may have the capacity under various use patterns, i.e., fig and mosquito larvicide use, to cause adverse effects to aquatic invertebrates, fish, and birds. Dichlorvos degrades fairly rapidly in soil and water and is therefore not expected to reach groundwater. However, the environmental fate is largely uncharacterized, and additional data are needed before definitive conclusions are reached. A tolerance reassessment of dichlorvos is not possible because of gaps in the toxicology data base and because many of the tolerances are not adequately supported.

Chemical/Physical Characteristics of the Technical Material

Physical State: Liquid
 Color: Colorless to light amber
 Molecular Weight and Formula: 221.0 - $C_4H_7Cl_2O_4P$
 Boiling Point: 117° C at 10 mm Hg
 Specific Gravity: 1.42 at 25° C
 Density: 1.65-1.67 g/ml
 Vapor Pressure: 0.032 mm Hg at 32 °C
 Solubility in Various Solvents: Slightly soluble in water and kerosene; readily soluble in most organic solvents
 Stability: Stable in the presence of hydrocarbon solvents; undergoes hydrolysis in the presence of water and is readily decomposed by strong acids and bases
 Miscibility: Miscible with most organic solvents and aerosol propellants
 Corrosion Characteristics: Corrosive to steel; noncorrosive to stainless steel, aluminum, nickel, Hostelloz 13, Teflon
 Chemical Relationships: Trichlorfon and naled are chemically related to dichlorvos. Naled degrades to dichlorvos in plants, animals, and soil. In cattle and poultry, naled is debrominated to dichlorvos which further degrades to dichlorodesmethyl-dichlorvos (major pathway) or desmethyl-dichlorvos (minor pathway). Trichlorfon degrades to dichlorvos in soil and alkaline pond water, and possibly in plants and animals.

Toxicology Characteristics

Acute Oral: Toxicity Category II (56 and 80 mg/kg in female and male Sherman rats, respectively).
 Acute Dermal: Toxicity Category I (75 and 107 mg/kg in female and male Sherman rats, respectively).
 Primary Dermal Irritation: Toxicity Category IV based on mild dermal irritation reported in a rabbit study.
 Primary Eye Irritation: Toxicity Category III based on a lack of corneal injury and only mild redness and chemosis at 24 hours postapplication of 1.67 mg/kg technical dichlorvos in rabbits' eyes.
 Skin Sensitization: Data Gap

Acute Inhalation: Toxicity Category I based on a toxicity value of $>193 \text{ mg/m}^3$ in rats.

Delayed Neurotoxicity: Data Gap

Subchronic Oral (rodent) Testing: Data Gap

Oncogenicity: Classified as a B₂ "probable human carcinogen" This determination for oncogenicity is based on a draft report of a review of two rodent studies sponsored by the National Toxicology Program in which there were significantly increased incidences of forestomach squamous cell carcinoma/papillomas in female mice and pancreatic acinar adenomas, mononuclear cell leukemia and lung adenomas in male rats and mammary gland fibroadenomas in female rats. The potency or Q_1 is $2.9 \times 10^{-1} \text{ (mg/kg/day)}^{-1}$.

Chronic Feeding: Based on a dog chronic feeding study with increased relative liver weights in males at 32 ppm and above, and enlargement of liver cells in both sexes at 32 ppm and above, the no-observable-effect level (NOEL) is 0.08 mg/kg/day (3.2 ppm). A rodent feeding study is required.

Metabolism: Data Gap

Teratogenicity: Rodent teratology study is a data gap; based on an acceptable rabbit teratology study by inhalation, the NOEL for embryo/fetotoxicity is 2 ug/L based on decreased fetal weights.

Reproduction: Data Gap

Mutagenicity: Dichlorvos is a direct-acting (gene) mutagen, in bacteria, fungi, and mammalian cells in vitro. Dichlorvos was shown to be negative in micronucleus and sister-chromatid exchange assays conducted in mice, and was also negative in repeated dominant lethal assays.

Major Routes of Exposure: Dermal and respiratory exposure to mixers, loaders, applicators, reentry workers and occupants of treated buildings.

Environmental Characteristics

Numerous data gaps exist for environmental fate. Data reviewed by the Agency indicate that dichlorvos degrades fairly rapidly with half-lives of 2 to 8 hours in soils ranging in texture from sand to silt. The mobility of dichlorvos is inversely correlated with soil organic matter content. Preliminary data also suggest that dichlorvos is intermediately to very mobile in a variety of soils ranging in texture from sandy loam to clay. Groundwater contamination may not be a problem because of dichlorvos's rapid degradation. However, acceptable data are lacking, and are needed before the Agency can assess the potential for dichlorvos to contaminate groundwater.

Ecological Characteristics (technical grade)

Avian oral toxicity: Data Gap

Avian dietary toxicity: Acute toxicity values greater than 1317 and 5000 ppm for mallard ducks at 5 and 16 days of age, respectively; for pheasants the acute toxicity value is 568 ppm.

Freshwater fish acute toxicity: 0.1 ppm for rainbow trout;
(96-hr. LC₅₀) 0.23 ppm for striped mullet.

Estuarine/marine fish acute toxicity: 0.23 for striped mullet

Freshwater invertebrate toxicity: 0.00007 ppm for Daphnia pulex; 0.004 ppm for sand shrimp.
(48-hr. or 96 hr. EC₅₀)

Estuarine/marine invertebrate toxicity: 0.0004 ppm for sand shrimp

Tolerance Reassessment

Analytical methodology for determining the levels of residues of dichlorvos in plants and animals is adequate for data collection of residues in plant commodities and in animal tissues and milk. Storage stability data demonstrate that residues of dichlorvos in or on frozen plant samples are stable up to 90 days after application. Residues in or on frozen animal tissues are stable up to 8 weeks after application. Additional storage data (length of time and conditions under which samples were stored) are required

in order to evaluate the adequacy of the dichlorvos tolerances. If previously submitted samples or newly generated samples were/are stored frozen for greater than 90 days (plants) or 8 weeks (animals), additional storage stability data will also be needed. Data on the magnitude and levels of residues of dichlorvos in radishes, lettuce, tomatoes, cucumbers, milk, eggs, and the meat, fat, and meat byproducts of cattle, goats, hogs, horses, sheep, and poultry are insufficient to determine the adequacy of the established tolerances. Tolerances for residues of dichlorvos in or on figs, dried figs, and mushrooms are adequately supported. Data are required to support use of dichlorvos products in food areas of food handling establishments. Processing and cooking studies are required. Data reflecting the use of dichlorvos on stored, unfinished tobacco are required. The established tolerances for residues of dichlorvos in or on bulk-stored nonperishable RACs are not adequately supported, and data are required. The established tolerances are adequate to cover residues of dichlorvos in or on packaged or bagged nonperishable RACs and processed food resulting from the application of dichlorvos vapors. However, the data indicate that residues following use of aerosol treatments will result in toleranceexceeding residues. Therefore, residue data and an accompanying tolerance revision must be submitted. Also, insufficient data are available regarding residues of dichlorvos in the meat, fat, and meat byproducts of cattle, goats, horses, sheep, and poultry and milk and eggs. This constitutes a data gap.

Based on a 2-year dog feeding study with a NOEL of 0.08 mg/kg/day (3.2 ppm) for changes in liver weight and enlarged liver cells, a provisional acceptable daily intake (PADI) of 0.0008 mg/kg/day has been calculated using a one hundred-fold uncertainty factor. The calculated estimate is provisional because the existing data base for dichlorvos is lacking a chronic rat feeding study, a reproduction study and a rat teratology study. The Anticipated Residue Contribution (ARC) for dichlorvos for the U.S. population average is 0.000416 mg/kg/day based on current tolerance levels, cooking data for small grains, and an estimate of percent crop treated. The ARC occupies 52% of the PADI. For children 1 to 6 years of age, the ARC occupies 122% of the PADI.

4. SUMMARY OF REGULATORY POSITIONS AND RATIONALES

* The Agency is considering further regulatory action for all registered uses of dichlorvos because of concerns about the risks of oncogenicity, cholinesterase inhibition, and liver effects. The risks of concern are for the public from consumption

risks of oncogenicity, cholinesterase inhibition, and liver effects. The risks of concern are for the public from consumption of foods containing residues of dichlorvos, for those involved in the application of dichlorvos, for workers reentering treated areas, for residents/occupants of treated areas (including areas treated with resin pest strips or other dichlorvos products), for people exposed to pets treated with dichlorvos, and for pets treated with dichlorvos.

- ° In order to meet the statutory standard for continued registration, the Agency has determined that all dichlorvos products (excluding domestic uses [household sprays containing 0.5% or less active ingredient], resin strips and pet uses) must be restricted for retail sale to and use by Certified Applicators or persons under their direct supervision. In view of the potential health hazards associated with exposure to dichlorvos, the Agency is concerned about exposure to dichlorvos which may result from improper application or use of dichlorvos products, and so is restricting use of the pesticide.
- ° In order to meet the statutory standard for continued registration, the Agency has determined that all products must contain a cancer hazard warning. The Agency believes that incorporation of this statement affords the product user with important information about the potential oncogenic hazard associated with the use of the product.
- ° The Agency has determined that in order to meet the statutory standard for continued registration, all dichlorvos product labels must bear protective clothing statements.
- ° An interim 48-hour reentry interval is imposed for the agricultural and commercial uses of dichlorvos until such time as appropriate reentry data have been submitted and evaluated. Exposure data are required to support registration of total release foggers and aerosol products intended for use in domestic dwellings.
- ° Pesticide spray drift data requirements are imposed for the fig use and outdoor aerosol and fogging mosquito use. Data required include droplet size spectrum studies and field evaluation of pesticide spray drift.
- ° The Agency is requiring a special environmental monitoring study in order to evaluate whether or not the fig and mosquito control uses of dichlorvos may result in exposure of certain terrestrial and aquatic organisms to potentially hazardous levels of the pesticide.
- ° The Agency has determined that endangered species label

- o In order to remain in compliance with FIFRA, the Agency has determined that endangered species label restrictions are necessary to protect endangered threatened species in aquatic areas. Labeling which prohibits the mosquito larvicide use of dichlorvos in the range of endangered and threatened species is required through PR Notice 87-4, which was issued in May, 1987. Additional endangered species labeling requirements are reserved pending the results of a consultation with the Office of Endangered Species regarding use of dichlorvos on figs.
- The Agency is deferring decisions concerning dichlorvos and groundwater contamination until such time as the information required by the Standard have been submitted and reviewed.
- No new tolerances for raw agricultural commodities or new food uses will be granted until data gaps for residue chemistry and chronic toxicology have been filled.
- All products must bear appropriate labeling as specified in 40 CFR 162.10, PR Notices 83-2, 83-3, and 87-4, precautions and warnings listed in the Dichlorvos Use Index, and as indicated in the Registration Standard.

6. SUMMARY OF OUTSTANDING DATA REQUIREMENTS

	<u>Time Frame</u>
<u>Toxicology</u>	
Dermal sensitization	9 Months
Dermal absorption	6 "
21-day dermal toxicity	9 "
Neurotoxicity	9 "
Subchronic oral toxicity - rodent species	12 "
Chronic feeding - rodent species	50 "
Teratogenicity - species other than the rabbit	15 "
Reproductive effects - rats (2-generation)	39 "
Metabolism	24 "
<u>Environmental Fate/Exposure</u>	
Hydrolysis study	9 Months
Aerobic soil metabolism study	27 "
Aerobic and anaerobic aquatic metabolism study	27 "
Leaching and adsorption/desorption study	12 "
Terrestrial field dissipation study	27 "

Aquatic (sediment) - field study	27	"
Photodegradation in water, soil and air	9	"
Volatility (lab) studies	12	"
Accumulation - irrigated crops	39	"
Reentry data	18	"
Dermal and inhalation Exposure	18	"
Spray drift data	18	"

Residue Chemistry

Livestock metabolism (direct animal treatment)	18	Months
Storage stability data	18	"
Residue analytical Method	15	"
Residue data (except	18	" -
for figs, dried figs, and mushrooms)	18	
Processing and cooking studies	18	"
Residue data on stored, unfinished tobacco	18	"
Residue data -food handling establishments	12	"

Product Chemistry

9-15 Months

Fish and Wildlife

Acute avian toxicity	9	Months
Acute toxicity to fish	9	"
Acute toxicity to freshwater invertebrates	9	"
Acute toxicity to estuarine and marine organisms	9	
Fish early life stage and aquatic invertebrate life-cycle	15	"
Special environmental residue monitoring study	24	"
Avian reproduction	24	"
Fish life cycle study	27	"
Honeybee - toxicity of residues on foliage	15	"

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