MEVINPHOS

(Phosdrin)

RISK CHARACTERIZATION DOCUMENT

MEDICAL TOXICOLOGY AND WORKER HEALTH AND SAFETY BRANCHES

DEPARTMENT OF PESTICIDE REGULATION

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

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EXECUTIVE SUMMARY

Mevinphos (Phosdrin) is a restricted organophosphate insecticide. Mevinphos is used to control aphids, mites, grasshoppers, cutworms, leafhoppers caterpillars, and many other insects on a broad range of field, forage, vegetable, and fruit crops. Eleven products containing mevinphos are registered in California. Mevinphos can be applied by aerial spraying, but the majority of mevinphos used in California is applied to vegetables by boom spraying. Mevinphos can produce significant human toxicity by the inhalation, dermal, and oral routes of exposure. Mevinphos entered the risk assessment process because of its high acute toxicity. This document addresses the risk of both dietary and occupational exposure to mevinphos.

RISK ASSESSMENT

The risk assessment process consists of four aspects: hazard identification, dose response assessment, exposure evaluation, and risk characterization.

Hazard identification entails review and evaluation of the toxicological properties of each pesticide. The dose-response assessment then considers the toxicological properties and estimates the amount which could potentially cause an adverse effect. The amount which will not result in an observable or measurable non-oncogenic effect is called the No-Observed-Effect Level, NOEL. In general, it is assumed that oncogenic effects of a chemical may occur at all dosages. The ability of a chemical to cause tumors is indicated by its potency.

A basic premise of toxicology is that at a high enough dose, virtually all substances will cause some toxic manifestation. Chemicals are often referred to as "dangerous" or "safe", as though these concepts were absolutes. In reality, these terms describe chemicals which require low or high dosages, respectively, to cause toxic effects. Toxicological activity is determined in a battery of experimental studies which define the kinds of toxic effects which can be caused, and the exposure levels (doses) at which effects may be seen. State and federal testing requirements mandate that substances be tested at doses high enough to produce toxic effects, even if such testing involves chemical levels many times higher than those to which people might be exposed.

In addition to the intrinsic toxicological activity of the pesticide, the other parameters critical to determining risk are the exposure level, frequency and duration. The purpose of the exposure evaluation is to determine the potential exposure pathways and the amount of pesticide likely to be delivered through those routes.

The risk characterization then integrates the observed toxic effects (from laboratory studies conducted with high dosages of pesticide) with potential human exposures at low dosages. The likelihood of potential, non-oncogenic adverse health effects in people is generally expressed as a margin of safety. The margin of safety is a ratio of the dosage which produced no effects in laboratory studies to the dosage humans might potentially receive. For oncogenic effects, an additional lifetime risk of cancer may be calculated by multiplying the cancer potency of the pesticide times the estimated exposure dosage.

TOXICOLOGY

Based on the currently available toxicity information, the Department of Pesticide Regulation (DPR) has concluded that principal toxicological effects (headaches, nausea, diarrhea, and tremors) of mevinphos are the result of inhibition of acetyl cholinesterase. Mevinphos did not produce any developmental toxicity in rats or rabbits, nor was it carcinogenic in mice. There was no indication, either behaviorally or histopathologically, that mevinphos caused delayed neuropathy.

WORKER EXPOSURE

Estimates of occupational exposures were based on both monitoring data, and calculations from monitoring data for surrogate active ingredients with similar chemical properties and application rates. Mixer/loader/applicators and some harvesters had the greatest work-related exposures.

DIETARY EXPOSURE

Analyses of potential dietary exposure to mevinphos residues have been conducted by DPR. The acute and chronic dietary exposure to primary residues on raw agricultural commodities (RAC) and secondary residues, which result from residues on animal feeds, have been assessed under the provisions of 1989 legislation, AB2161 (Bronzan). The potential exposure to residues in RAC as consumed by members of specific population subgroups, including infants and small children, and the attendant risks have been assessed. Non-nursing infants, less than 1 year of age, had the highest potential acute dietary exposure to mevinphos when all food uses were considered. Non-nursing infants, less than 1 year of age, and children, 1 to 6 years of age, had the highest potential chronic exposures.

CONCLUSIONS

Using current acute exposure and toxicity data, the calculated margins of safety (MOSs), based on a no observed effect level in humans for cholinergic signs, for agricultural workers are less than the value conventionally recommended to protect people from the toxic effects of mevinphos.

Based on the available toxicity and residue data, DPR concludes that the margins of safety for potential acute dietary exposure to mevinphos residues on labeled use foodstuffs is less than the value conventionally recommended to protect non-nursing infants, less than the age of 1, from the toxic effects of mevinphos. Margins of safety for potential chronic dietary exposure for all population subgroups are greater than the value conventionally recommended to protect people from the toxic effects of mevinphos. Many of the USEPA tolerances for mevinphos on agricultural commodities do not provide margins of safety for theoretical acute exposure which would be greater than the value conventionally recommended to protect people from the toxic effects of mevinphos.

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I SUMMARY

Mevinphos {Trade name- Phosdrin ; (2-carbomethoxy-1-methyl-vinyl dimethyl phosphate)} is a restricted, organophosphate insecticide used as a "clean-up" prior to harvest. The principal uses in California in 1990 were for lettuce, cauliflower and broccoli. The technical formulation (Phosdrin 10.3) consists of 60% alpha isomer (E- mevinphos) and 40% beta isomer (Z- mevinphos).

Illness Reports- The USEPA recorded 356 illness reports involving mevinphos between 1966 and 1980. Within the State of California there were 563 reported mevinphos poisonings involving workers from 1982 to 1991.

Environmental Fate- Mevinphos E- and Z- isomers are readily soluble in water and hydrolyze at pH 7, with half lives of 15 and 39 days, respectively. Although neither isomer is photolabile, both are readily metabolized, with half-lives under 25 hours in soil under aerobic conditions and 36 hours under anaerobic conditions. Mevinphos is also a volatile compound. Thus, mevinphos is unlikely to persist where it has been applied. Because mevinphos is rapidly hydrolyzed in water, and rapidly metabolized in soil, it is unlikely to become a groundwater contaminant.

Pharmacokinetics- Dermal absorption of mevinphos in the rat was approximately 47% of the applied dose. It was assumed that oral absorption was 100%, as 94% of an orally administered dose to rats was excreted through the urine, or as carbon dioxide, in the first 24 hours.

Acute Toxicity- The oral LD_{50} for technical mevinphos in rats was less than 10 mg/kg. The dermal LD_{50} in rabbits ranged from 5.7 to 60 mg/kg, and the one hour inhalation LC_{50} for rats was 8.2 to 10 ppm. Mevinphos caused mild eye and skin irritation, but exhibited no potential for causing dermal sensitization in guinea pigs.

The principal adverse effects noted at 7 days or less in studies on humans or laboratory animals were cholinergic signs as a result of inhibition of acetylcholinesterase activity. Both humans and laboratory animals exhibited approximately the same level of sensitivity to acute exposures of mevinphos. The No Observed Effect Level (NOEL) for cholinergic signs in humans was 0.025 mg/kg. The Lowest Observed Effect Level (LOEL) for pin-point pupils in rats was 0.005 mg/kg. The NOEL for nasal and oral discharges from rats was 0.05 mg/kg, and the NOEL for tremors in rats was 0.1 mg/kg. The NOEL for emesis in dogs was 0.025 mg/kg. The NOEL for diarrhea and ano-genital staining in rabbits was 0.05 mg/kg.

Chronic Toxicity/Oncogenicity- Mevinphos was not oncogenic in mice or rats, and there were no discernible histopathological effects. An apparent NOEL for inhibition of both plasma and red blood cell cholinesterase activity in a dog study (unacceptable under FIFRA guidelines; USEPA, 1990c) was 0.025 mg/kg-day. The 1-year NOEL for inhibition of plasma and brain cholinesterase activities from an interim report on the chronic toxicity of mevinphos in rats was 0.025 mg/kg-day. The 2-year NOEL for clinical signs (tremors and exopthalmus) was also 0.025 mg/kg-day.

Genotoxicity- Mevinphos was mutagenic in a dose-dependent manner, with and without metabolic activation, in both an assay with *Salmonella typhimurium* (strains TA98, TA100, TA1535, TA1537, and TA1538), and in an assay with CHO/HGPRT. Mevinphos, with and without metabolic activation, also caused chromosomal aberrations in Chinese Hamster Ovary cells *in vitro*, but no unscheduled DNA synthesis. These results indicate a strong probability that mevinphos is genotoxic.

Reproductive Toxicity- Mevinphos did not cause any reproductive toxicity in rats. The maternal NOEL was 0.1 mg/kg-day for tremors and pin-point pupils.

Developmental Toxicity- No developmental toxicity was noted in either rats or rabbits. The maternal NOEL for cholinergic signs (fine and coarse tremors) in rats was 0.2 mg/kg. The NOEL for plasma cholinesterase activity depression in rabbits was 0.05 mg/kg-day, and the LOEL for red blood cell cholinesterase activity depression was 0.05 mg/kg-day.

Neurotoxicity- There was no indication, either behaviorally or histopathologically, that mevinphos caused acute delayed neuropathy. The NOEL for acute neurotoxicity (clinical signs, sensorimotor alterations, reduced neuromuscular performance, and inhibition of brain cholinesterase activity) in the rat was 0.1 mg/kg.

Hazard Identification- The NOEL for cholinergic signs in humans (0.025 mg/kg) was used to evaluate the risk of potential acute dietary and occupational exposures. The NOEL for brain cholinesterase inhibition in rats (0.025 mg/kg-day) was used for the assessment of potential chronic dietary and occupational exposure to mevinphos.

Dietary Exposure- Potential acute dietary ingestion of mevinphos for all labeled uses, based on the 95th percentile of user-day exposure for all population subgroups, ranged from 1.5 to 3.2 *u*g/kg-day. Non-nursing infants, less than 1 year of age had the highest potential acute dietary exposure to mevinphos when all food uses were considered. The mean potential daily dietary exposure for all population subgroups ranged from 0.02 to 0.07 *u*g/kg-day. Non-nursing infants, less than the age of 1, and children, 1 to 6 years of age, had the highest potential chronic exposures.

Occupational Exposure- Monitoring data, and calculations from monitoring data for surrogate active ingredients with similar application rates and chemical properties, indicated mean work-related absorbed daily dosages (ADDs) ranged from negligible for some vegetable harvesters, to 11.0 *u*g/kg-day for apple harvesters. The 95th percentile of ADDs ranged from 1.1 *u*g/kg-day for helicopter pilots, to 33.8 *u*g/kg-day for mixer/loaders in helicopter operations. When the potential acute dietary exposure (1.3 *u*g/kg-day) was combined with the mean acute occupational exposure, the absorbed daily dosages ranged from 1.3 *u*g/kg-day for flaggers to 12 *u*g/kg-day for apple harvesters.

Potential chronic occupational exposure (average annual daily dosage- AADD) ranged from negligible for some vegetable harvesters to 0.63 *u*g/kg-day for apple harvesters. When the potential chronic dietary exposure (0.03 *u*g/kg-day) was combined with the mean chronic exposure, the AADDs ranged from 0.03 *u*g/kg-day for flaggers to 0.66 *u*g/kg-day for apple harvesters.

Risk Characterization- The margins of safety (MOSs) for mean acute occupational exposures, based on the NOEL of 0.025 mg/kg for human cholinergic signs, ranged from 2 (apple harvesters) to 625 (flaggers in enclosed vehicles). When the 95th percentile of the short-term exposures were considered for each of the job categories, the MOSs ranged from less than 1 (mixer/loaders involved in helicopter applications) to 23 (helicopter pilots). The MOSs for combined potential acute dietary exposure and mean occupational exposure ranged from 2 (apple harvesters) to 19 (flaggers in closed cabs). MOSs for chronic occupational exposure, based on a NOEL of 0.025 mg/kg-day for inhibition of brain cholinesterase activity in rats, ranged from 40 (apple harvesters) to 8,333 (flaggers in enclosed vehicles).

MOSs for potential acute dietary exposure to mevinphos residues ranged from 8 to 24. Non-nursing infants, less than 1 year of age, had the lowest MOS for potential acute dietary exposure. MOSs ranged from 338 to 1,250 for potential chronic dietary exposure to mevinphos residues on labeled use foodstuffs. Non-nursing infants, less than the age of 1, and children, 1 to 6 years of age, had the lowest MOS for potential chronic dietary exposure to mevinphos.

Tolerance Assessment- The margins of safety for theoretical acute dietary exposure to mevinphos at tolerance levels were inadequate for twenty-five of the forty-five commodities with USEPA tolerances.

Conclusions- Margins of safety (MOSs), based on current toxicity data, for mean acute occupational exposure of mixer/loader/applicators associated with ground application and of harvesters working in fruit trees are less than the value conventionally recommended to protect people from the toxic effects of mevinphos. When the mean short term occupational exposures were combined with potential acute dietary exposure, the MOSs for mixer/loaders engaged in aerial applications also become less than the value conventionally recommended to protect people from the toxic effects of mevinphos. MOSs for the 95th percentile of short term worker exposure for all mixer/loader work categories associated with mevinphos application are less than the value conventionally recommended to protect people from the toxic effects of mevinphos.

No practical mitigation measures to reduce occupational exposure appear to be available at this time. Consequently, margins of safety for short term occupational exposure remain less than the value conventionally recommended to protect people from the toxic effects of mevinphos.

Margins of safety for chronic occupational exposure, or combined occupational and potential chronic dietary exposure, are greater than the value conventionally recommended to protect people from the toxic effects of mevinphos.

The margin of safety for potential acute dietary exposure of non-nursing infants, less than the age of 1, to residues on approximately 45 label-approved commodities was less than the value conventionally recommended to protect people from the toxic effects of mevinphos. All other population subgroups have margins of safety for potential acute dietary exposure which are greater than the value conventionally recommended to protect people from the toxic effects of mevinphos. Margins of safety for potential chronic dietary exposure to mevinphos for all population subgroups are greater than the value conventionally recommended to protect people from the toxic effects of mevinphos.

Twenty-five of the USEPA tolerances for mevinphos on agricultural commodities do not provide margins of safety greater than the value conventionally recommended to protect people from the toxic effects of mevinphos for theoretical acute dietary exposure to one or more population subgroups if commodities are consumed with residues at the tolerance level.

II INTRODUCTION

A. CHEMICAL IDENTIFICATION

Mevinphos is an organophosphate insecticide produced by AMVAC. Mevinphos entered the risk assessment process in the Department of Pesticide Regulation (DPR) because of its high short-term toxicity. Pesticidal activity of mevinphos is due to inhibition of acetylcholinesterase (AChE) activity. Cholinesterases are a family of enzymes found throughout the body that hydrolyze choline esters. In the nervous system, acetylcholinesterase is involved in the termination of impulses across nerve synapses including neuromuscular junctions by rapidly hydrolyzing the neural transmitter, acetylcholine. Inhibition of AChE leads to accumulation of acetylcholine in the synaptic cleft which results in over stimulation of the nerves followed by depression or paralysis of the cholinergic nerves throughout the central and peripheral nervous system. AChE is highly selective, although not exclusively, for acetyl esters as substrates (Brimijoin, 1992). Another form of cholinesterase, butyrylcholinesterase (BuChE), preferentially hydrolyzes butyryl and proprionyl esters, depending on the species; however, it will hydrolyze a wider range of esters, including acetylcholine (Brimijoin, 1992). Unlike AChE, the physiological function of BuChE is not known. Although AChE and BuChE are found in most tissues, their ratio varies from one tissue to another and from one species to another. In rats, AChE is the predominant form of ChE in the central nervous system and in the neuromuscular junctions of peripheral tissues such as the diaphragm, skeletal muscle, heart, and spleen (Gupta *et al.*, 1991; Mendoza, 1976). AChE and BuChE are present in roughly equal proportions in the liver and kidney. Non-synaptic AChE is also present to a lesser extent in peripheral tissues, however, its function is not known (Brimijoin, 1992). Non-synaptic AChE is essentially the only ChE present in erythrocytes of higher animals. BuChE is the predominant form of ChE in the plasma of humans, however, the ratio of AChE to BuChE varies greatly from species to species and between sexes. For example, the AChE:BuChE ratio in human plasma is approximately 1:1000, but closer to 1:2 in female rats and 3:1 in male rats (Brimijoin, 1992).

In acutely toxic episodes, muscarinic, and nicotinic receptors are stimulated by acetylcholine with characteristic signs and symptoms occurring throughout the peripheral and central nervous systems (Ellenhorn and Barceloux, 1988; Murphy, 1986). Peripheral muscarinic effects can include increased intestinal motility, bronchial constriction and increased bronchial secretions, bladder contraction, miosis, secretory gland stimulation and bradycardia. Peripheral nicotinic effects include muscle weakness, twitching, cramps and general fasciculations. Stimulation of muscarinic and nicotinic receptors in the central nervous system can cause headache, restlessness, insomnia, anxiety, slurred speech, tremors, ataxia, convulsions, depression of respiratory and circulatory centers, and coma. Death, which occurs in the worst circumstances, is usually due to respiratory failure from a combination of peripheral and central effects.

B. REGULATORY HISTORY

The United States Environmental Protection Agency (USEPA) Office of Pesticide Programs has established a Reference Dose (RfD) of 0.00025 mg/kg-day for mevinphos, based on a NOEL of 0.025 mg/kg-day for plasma and red blood cell cholinesterase activity inhibition noted in a two-year dog dietary study (USEPA, 1993). The World Health Organization set an RfD of 0.0015 mg/kg-day in 1972 (USEPA, 1993).

C. TECHNICAL AND PRODUCT FORMULATIONS

Mevinphos [Trade name- Phosdrin ; (2-carbomethoxy-1-methyl-vinyl dimethyl phosphate)] was originally developed by Shell in 1954. AMVAC Chemical Corporation has 4 products containing mevinphos registered in California- Durham Duraphos EM 4, Phosdrin IPA 4, Phosdrin 10.3 WS, and Phosdrin 4 EC. The technical formulation (Phosdrin 10.3) consists of 60% alpha isomer (E-mevinphos) and 40% beta isomer (Z- mevinphos). Product formulations consist of two different aqueous dilutions of the technical material.

D. USAGE

Mevinphos is an organophosphate insecticide used to control aphids, mites, grasshoppers, cutworms, leafhoppers caterpillars, and many other insects on a broad range of field, forage, vegetable, and fruit crops. Over 409,723 lbs of mevinphos were sold in California in 1989 (CDFA, 1990a). Reported applications involved a wide variety of crops for pest control as a "clean-up" prior to harvest. The principal uses in California in 1991 were for lettuce, cauliflower and broccoli (DPR, 1992).

E. ILLNESS REPORTS

Pesticide incidents in the United States involving mevinphos have been numerous over the years (Table 1). Incidents of this type, often represent exposures to multiple individuals (Warren *et al*., 1963; Coye *et al*., 1986; Whorton and Obrinsky, 1983; BNA, 1989). Preliminary data from the Worker Health and Safety Branch of DPR indicates a significant number of illness reports in California involving mevinphos (Table 2).

Table 1 - Mevinphos poisoning incidents in the United States involving humans, listed by site of occurrence, from 1966 to 1980 (USEPA, 1980).

Site	Mevinphos alone	Mevinphos in Combination	Total
Agricultural	107	155	262
Industrial	43	14	57
Commercial	1	4	5
Dump Site	1	1	2
Roadside	1	0	1
Transportation	2	3	5
Warehouse	2	3	5
Nursery	0	3	3
Unspecified	12	4	16

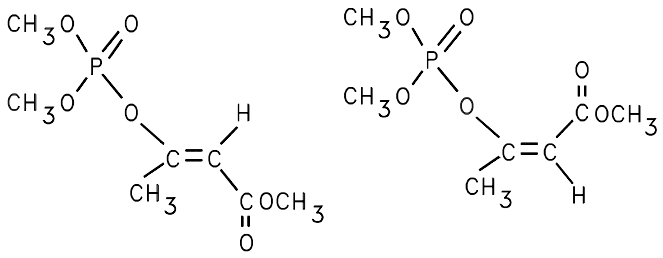
Table 2 - Definite, probable and possible mevinphos poisonings involving humans in the State of California, listed by type of exposure, from 1982 to 1989 (Worker Health and Safety Branch, DPR).

	Exposure Type					
Site	Drift	Application	Field Residue	Direct	Misc.	Total
Agricultural	267	70	52	37	12	438

F. PHYSICAL/CHEMICAL PROPERTIES[a]

Chemical Name:	alpha isomer of 2-carbomethoxy-1-methylvinyl dimethyl phosphate
Common Name:	mevinphos
Trade Name:	Phosdrin , Duraphos
CAS #	7786-34-7
Empirical Formula:	$C_7H_{13}O_6P$

Chemical Structure:



E– mevinphos (alpha isomer)

Z– mevinphos (beta isomer)

Molecular Weight:	224 g/mole
Physical State	Pale, yellow liquid
Boiling Point:	99-103°C
Vapor Pressure:	2.9E-3 mm Hg @ 21°C
Henry's Law Constant:	2.9E-3 atm m^3g.mol^{-1} @ 25°C
Solubility (25°C):	miscible in water
Partition Coefficient Octanol:Water	1.34

a/ Reference - Shell, 1986

G. ENVIRONMENTAL FATE

Summary- Mevinphos E- and Z- isomers are readily soluble in water and hydrolyze at pH 7, with half lives of 15 and 39 days, respectively. Although neither isomer is photolabile, both are readily metabolized, with half-lives under 25 hours in soil under aerobic conditions and 36 hours under anaerobic conditions. Mevinphos is also a volatile compound. Thus, mevinphos is unlikely to persist where it has been applied. Because mevinphos is rapidly hydrolyzed in water, and rapidly metabolized in soil, it is unlikely to become a groundwater contaminant.

Hydrolysis

The hydrolytic stability of mevinphos (E- and Z- isomers) at 10 *u*g/ml was studied in buffers at pH 5, 7, or 9 (Bosio, 1982). The half-life of E- mevinphos (alpha mevinphos) at pH 5, 7, or 9 was 41, 15.2, or 3.9 days, respectively. The half-life of the Z- mevinphos isomer at pH 5, 7, or 9 was 54, 39, or 9.6 days, respectively. However, the study was considered unacceptable to DPR because 1) the purity of the test compound was not indicated, 2) there was no indication the study was conducted in darkness, 3) no indication of sterilization to prevent microbial action, 4) buffer concentrations were not given, and 5) the products of hydrolysis were not identified.

Photolysis

^{14}[C]-mevinphos (96.6% pure with 72.3% E- isomer and 24.3% Z- isomer) was placed in a pH 7 buffer solution and exposed to artificial sunlight (Xenon Arc) to determine the half-life and rate constant for any photolytic degradation (Carpenter, 1987). Both photosensitized and non-photosensitized systems were evaluated. The rate constant for the sensitized system was determined to -0.0339 days^{-1}. This gives a half-life of 20.4 days. The rate constant for the non-sensitized system was -0.0435 days^{-1}. This gives a half-life of 15.9 days. In aqueous solutions, the E- isomer of mevinphos undergoes photoisomerization to form Z-mevinphos (Halls, 1989). The study was acceptable to DPR.

^{14}[C]-mevinphos (96.6% pure with 72.3% E- isomer and 24.3% Z- isomer) was applied to the surface of soil (loam) and exposed to artificial sunlight (Xenon Arc) to determine the half-life and rate constant for any photolytic degradation (Carpenter and Fennessey, 1987). Photolysis did not occur. Dark control samples had a significantly higher rate of loss than the samples exposed to light, but no explanation of this rate difference was given. The study was acceptable to DPR.

Aerobic Soil Metabolism

An aerobic soil metabolism study was conducted under dark conditions at a temperature of 25^{o}C with an isotopic dilution of 3-^{14}C-mevinphos on sandy loam soil under microbially active conditions (Cranor and Halls, 1989). The calculated half-life of mevinphos (E- and Z- isomers) was 18.5 hours. The cumulative volatiles at one month were 54% of the initial dose, most of which was CO_2. However, the study was adjudged unacceptable to DPR because none of the metabolites were identified.

A 29 day aerobic soil metabolism study was conducted with ^{14}C-mevinphos, E- isomer, under dark conditions at a temperature of 25^{o}C on sandy loam soil under microbially active conditions (Cranor, 1989a). The calculated half-life of the isomer was 24.8 hours when the natural log of the percent of the initial dose measure was plotted versus time. The correlation coefficient was 0.96. The cumulative volatiles by the day-29 sample point were 49% of the initial dose measured. However, the study was adjudged unacceptable to DPR because none of the metabolites were identified.

Anaerobic Soil Metabolism

A 62 day anaerobic soil metabolism study was conducted with an isomeric mixture of ^{12}C-isotopically diluted ^{14}C-mevinphos on sandy loam soil at 25^{o}C (Cranor, 1989b). Study samples were incubated under static conditions, in flame sealed glass ampules under dark conditions. At study termination only 4.2 % of the dose had evolved as volatile ^{14}C-products. Half-lives for mevinphos under aerobic and anaerobic conditions were calculated assuming first order degradation. These were 36.1 hours and 12.2 days, respectively. However, the study was adjudged unacceptable to DPR because none of the metabolites were identified.

Soil Mobility

Aqueous solutions of $^{14}[C]$-mevinphos were equilibrated with four soil types and the adsorption and desorption coefficients and constants were determined (Warren, 1987). Based on the desorption constants obtained, the estimated leaching potential of mevinphos is as follows: sandy loam (medium to high mobility), silt loam (high mobility), loam (high to very high), and clay loam (high mobility). The study was acceptable to DPR.

III TOXICOLOGICAL PROFILE

A. PHARMACOKINETICS

Summary- Dermal absorption of mevinphos in the rat was approximately 47% of the applied dose. It was assumed that oral absorption was 100%, as 94% of an orally administered dose to rats was excreted through the urine or as carbon dioxide in the first 24 hours.

Oral- rat

[^{14}C]-Mevinphos (12 mCi/mmol, 98-99% pure) was given as a single oral dose (0.15 or 1.5 mg/kg) to 5 rats/sex/dose; or intravenously (0.15 mg/kg) to 5 rats/sex/dose; or as multiple oral doses of 0.15 mg/kg of unlabeled mevinphos to 5 rats/sex for 15 days followed by a 16th oral dose of 0.15 mg/kg [^{14}C]-mevinphos (Reddy *et al.*, 1991b). Approximately 76% of the administered doses were eliminated as $^{14}CO_2$ within 24 hours after oral or intravenous administration. Elimination in urine accounted for approximately 18% of the administered dose. Cumulative excretion through both CO_2 and urine (0 to 24 hr) accounted for 94% of the total administered dose in both sexes. Four major radioactive peaks were observed in the urine: 1) the E- isomer of mevinphos acid, 2) the E-isomer of desmethyl mevinphos, and 3) unmetabolized E- mevinphos. The fourth component could not be identified.

Dermal- rat

Male CD rats (16/group) were dosed with [^{14}C]-mevinphos (96.5% purity) at 12.5, 2.5 or 0.4 *u*g/cm^2 applied over 12 cm^2 on the backs where fur had been clipped (Jeffcoat, 1993). Protective devices were attached to the rats to isolate the dose area. The devices were non-occluding, but each contained a charcoal impregnated covering to absorb any mevinphos that evaporated from the skin surface. Groups of four animals were killed at 6, 10, 24 and 48 hours. Just prior to termination, or at 10 hours after dose application, whichever occurred first, the remaining unabsorbed dose was washed from the skin. The remaining animals were fitted with new protective devices. The dose site of each animal terminated at 24 and 48 hours was washed again immediately prior to termination. Excreta, carcass, blood, traps for expired $^{14}CO_2$, and the area of the skin where the dose was applied were assayed for absorbed radioactivity. The recovery of the administered radioactivity from all sources averaged 91%, 92%, and 93% of the dose, respectively for the 12.5, 2.5 or 0.4 ug/cm^2 dose levels. The average absorbed dose ranged from 46.7 to 47.6% of the applied dose. A large percentage of the applied dose remained in the skin, with only 13.3 to 16.8% of the applied dose found in the urine, feces, expired CO_2, carcass and blood.

Supplemental Data

A rapid conversion of mevinphos to dimethyl phosphate has been reported in the cow (Casida *et al.*, 1958). Seventy-seven percent of a single oral dosage of 2 mg/kg given to one cow was excreted within 72 hours. In the first 12 hours after this single dose, 36% of the label was found in the urine. Only metabolites were found in the urine or feces. Neither mevinphos nor its metabolites accumulated in the tissues. Milk from the cow, which was given a single dose of 2 mg/kg [^{32}P]-mevinphos, contained 0.06 ppm after 6 hours, and 0.007 ppm after 96 hours. In another cow, approximately 50% of a daily administered dosage of 1 mg/kg was excreted in the urine, and 12-15% in the feces. The amount of excreted radiolabel was determined each day for 7 days.

B. ACUTE TOXICITY

The acute toxicity of technical mevinphos and its isomers are summarized in Table 3. The oral LD_{50} for mevinphos in rats was generally less than 10 mg/kg, and, therefore, the compound is considered a Category I pesticide. Mevinphos caused mild eye and skin irritation (Deenihan, 1985). Mevinphos exhibited no potential for causing dermal sensitization in guinea pigs (Auletta, 1988a).

Table 3 - The Acute Toxicity of Technical Mevinphos and Isomers

Species	Sex	Dosage	Reference[a]
		TECHNICAL GRADE (approximately 60% E- isomer)	
Oral LD_{50}			
Rat	M	4.2 mg/kg	1
	F	2.2 mg/kg	1
Rat	M	4.2 mg/kg	2,3
	F	6.3 mg/kg	2,3
Rat	M	12 mg/kg	2,3
	F	5.5 mg/kg	2,3
Rat	M	6.3 mg/kg	2,3
	F	5.5 mg/kg	2,3
Rat	M	3.5 mg/kg	4
	F	2.3 mg/kg	4
Mouse	M	6-18 mg/kg	2,3
Inhalation $L.C._{50}$			
Rat		8.2-10 ppm/1hr	5
Dermal LD_{50}			
Rabbit	M/F	5.7-54.8 mg/kg	5
Rabbit	M	51 mg/kg	6
	F	60 mg/kg	6
		ISOMERS AND ANALOGS	
E- Isomer Oral LD_{50}			
Mouse	M/F	4.1 mg/kg	2,3
Rat	M/F	2.9 mg/kg	2,3
Z- Isomer Oral LD_{50}			
Mouse	M/F	59 mg/kg	2,3
Rat	M/F	46 mg/kg	2,3
Chloro-Analog Oral LD_{50}			
Mouse	M/F	57 mg/kg	2,3
Rat	M/F	82 mg/kg	2,3

a/ References: 1. Deenihan, 1985; 2. Newell, 1956a; 3. Newell, 1956b; 4. Auletta *et al*., 1988; 5. Jorgenson, 1970; 6. Auletta, 1988b.

C. SUBCHRONIC TOXICITY

Summary- The principal adverse effects reported at 7 days or less in studies on humans or laboratory animals were cholinergic signs as a result of inhibition of acetylcholinesterase activity. The Lowest Observed Effect Level (LOEL) for pin-point pupils in rats was 0.005 mg/kg-day. The No Observed Effect Level (NOEL) for nasal and oral discharges from rats was 0.05 mg/kg-day, and the NOEL for tremors in rats was 0.1 mg/kg-day. The NOEL for emesis in dogs was 0.025 mg/kg-day. The NOEL for diarrhea in rabbits was 0.05 mg/kg-day. The NOEL for cholinergic signs and/or symptoms in humans was 0.025 mg/kg-day.

Oral- human

In one study, four groups of male volunteers (5 persons/group) were given daily doses of mevinphos (purity not stated) in capsular form at 1.0, 1.5, 2.0, or 2.5 mg for 30 days (Rider *et al*., 1975). Two individuals served as controls. Mevinphos had no significant effect on plasma cholinesterase activity. Depression of red blood cell cholinesterase activity in individuals ranged from 17% at 1.0 mg/day to 34% at 2.5 mg/day after 30 days. Some of the individuals ingesting capsules with up to 2.5 mg/day of mevinphos (approximately 0.036 mg/kg-day, assuming a weight of 70 kg) produced "occasional" loose stools, and developed other, minor, undescribed "side effects". It was not clear from the text, which was in summary form, at which dosage(s) or exactly when the cholinergic signs occurred. Unfortunately, individual data from the study were unavailable, and a NOEL could not be established.

In a study based on the earlier study (Rider *et al*., 1975), eight males received technical grade mevinphos (69% E- isomer, 31% Z- isomer) dissolved in corn oil at a dosage of 0.025 mg/kg-day in a gelatin capsule ingested during dinner each day for a period of 28 days (Verberk and Salle, 1977). Eight males, serving as controls, received gelatin capsules containing only corn oil during the same period. "No subject demonstrated signs or symptoms that could be ascribed to mevinphos." In addition, "there was no change in SGOT, SGPT, or alkaline phosphatase activity" (Verberk, 1977). Red blood cell cholinesterase activity decreased at a rate of 3.4% per week to a maximum of 19% inhibition. As daily observation did not reveal any clinical signs or symptoms, the 1-day NOEL for cholinergic effects was equal to or greater than 0.025 mg/kg-day. Because the study went 28 days, the NOEL was applicable to 28 days as well as 1 day. The actual 1-day NOEL is probably higher.

Oral- rat

Carsworth rats (30/sex/treatment) were fed diets containing mevinphos (97% pure, of which 67% was the E- isomer, 33% Z- isomer) at 0, 0.32, 0.8, 2 or 5 ppm (approximately 0, 0.03, 0.08, 0.2, or 0.5 mg/kg-day using a default conversion factor- Zielhuis and van der Kreek, 1979) for up to 14 weeks (Treon *et al.*, 1957a,b). Only female rats exhibited a significant ($P<0.05$) decrease in plasma cholinesterase activity (37% of control) at the high dose (5 ppm). The subchronic NOEL for inhibition of plasma cholinesterase activity was 0.2 mg/kg-day. Red blood cell cholinesterase activity in both sexes was significantly ($P<0.05$) reduced 40 and 25% at the two highest doses (0.5 and 0.2 mg/kg-day, respectively). The subchronic NOEL for inhibition of red blood cell cholinesterase activity was 0.08 mg/kg-day. Brain cholinesterase activity was slightly depressed (5-10%) at the high dose. No cholinergic signs, or changes in organ weights were noted at any dosages. The study was unacceptable as a subchronic study under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) guidelines series 82-1 because the histopathological examinations of designated tissues were not performed, and there was a lack of clinical chemistry and hematology (USEPA, 1984). The data were considered supplemental in helping to establish the pattern of inhibition of cholinesterase activity, and providing a basis for comparing the dose response for cholinergic signs in laboratory animals with that in humans.

In a range finding study for reproductive toxicity, Sprague-Dawley rats (10/sex/group) were dosed daily by oral intubation with 0, 0.005, 0.05, 0.1, 0.5 or 1.0 mg/kg-day mevinphos (89.57% pure, 74.48% E-isomer, 15.09% Z-isomer) for 3 weeks prior to mating and during the mating period (Beyer, 1991a). Dosing of dams continued during gestation and lactation up to the time of weaning on postnatal day 21. The acute NOEL for tremors was 0.1 mg/kg-day. The acute NOEL for nasal and oral discharges was 0.05 mg/kg-day. Pin-point pupils were seen at all dosages by day 3. The study was unacceptable as a subchronic study under FIFRA guidelines series 82-1 because of the limited duration of dosing, histopathological examinations of designated tissues were not performed, and a lack of clinical chemistry and hematology. The data were considered supplemental, providing a basis for comparing the dose response for cholinergic signs in laboratory animals with that in humans.

Sprague-Dawley Crl:CDBR rats (10/sex/group) were given mevinphos (89.57% purity, 74.48% E-isomer, 15.09% Z-isomer) by gavage 7 days a week for 13 weeks at 0 (water), 0.056, 0.56, 1.12 or 1.67 mg/kg-day (males) or 0, 0.011, 0.056, 0.56 or 0.84 mg/kg-day (females)(Keefe, 1992). On day 36 the high dose for males was reduced to 1.12 mg/kg-day. The acute NOEL (7 days or less) for cholinergic signs in males (fine tremors, pin-point pupils) was 0.56 mg/kg-day. The acute NOEL (7 days or less) for cholinergic signs in females (ocular opacity, red ocular discharge, pin-point pupils) was 0.056 mg/kg-day. Plasma and brain cholinesterase activities were significantly affected by mevinphos, but not red blood cell cholinesterase activity (Table 4). The study was unacceptable as a subchronic study under FIFRA guidelines series 82-1 because histopathological examinations of designated tissues were not performed, and a lack of clinical chemistry and hematology. The data were considered supplemental, providing a basis for comparing the dose response for cholinergic signs in laboratory animals with that in humans and helping to establish the pattern of inhibition of cholinesterase activity.

Table 4 - Mean Cholinesterase Inhibition in Sprague-Dawley Rats Exposed to Mevinphos by Gavage for 13 Weeks (Keefe, 1992)

	Dosage (mg/kg-day)			
Male, N = 10	0.056	0.56	1.12	
Plasma Cholinesterase Activity[a]	3	46**	57**	
Red Blood Cell Cholinesterase Activity[a]	9	12	12	
Brain Cholinesterase Activity[a]	0	41**	56**	
	Dosage (mg/kg-day)			
Female, N = 10	0.011	0.056	0.56	0.84
Plasma Cholinesterase Activity[a]	10	23	69**	79**
Red Blood Cell Cholinesterase Activity[a]	3	0	14	13
Brain Cholinesterase Activity[a]	0	0	53**	58**

a/ Expressed as average percent inhibition of concurrent control
** Significantly different from control by Fisher's Exact Test, $p<0.01$

Oral- dog

Dogs (2/sex/group) were dosed with mevinphos (89.57% pure, 74.48% E- isomer, 15.09% Z-isomer) at 0, 0.025, 0.05, 0.25 or 0.5 mg/kg-day by gelatin capsule (corn oil vehicle) for 3 weeks (Reddy *et al*., 1991a). The acute NOEL (7 days or less) for emesis was 0.025 mg/kg-day. No other adverse effects were noted. The study was unacceptable under FIFRA guidelines series 82-1 because too few animals were used, the duration of dosing was limited, histopathological examinations of designated tissues were not performed, and a lack of clinical chemistry and hematology. The data were considered supplemental, providing a basis for comparing the dose response for cholinergic signs in laboratory animals with that in humans.

Oral- rabbit

In a range-finding study for developmental toxicity, technical grade mevinphos (89.57% pure, 74.48% E- isomer, 15.09% Z-isomer) was administered by gavage in distilled water to groups of 8 mated New Zealand white rabbits at levels of 0, 0.05, 0.5, 1.5, 2.0 or 4 mg/kg-day on days 7-19 of gestation (Beyer, 1991b). A dose related effect on maternal mortality was noted (1 at 1.5 mg/kg-day; 3 at 2 mg/kg-day; and 6 at 4 mg/kg-day). A decrement in body weight gain (14 and 25%, respectively) was noted at the two highest doses. The maternal NOEL for cholinergic signs (diarrhea and ano-genital staining) was 0.05 mg/kg-day. The study was unacceptable under FIFRA guidelines series 82-1 because too few animals were used, the duration of dosing was limited, histopathological examinations of designated tissues were not performed, and a lack of clinical chemistry and hematology. The data were considered supplemental, providing a basis for comparing the dose response for cholinergic signs in laboratory animals with that in humans.

D. CHRONIC TOXICITY/ONCOGENICITY

Summary- Mevinphos was not oncogenic in mice or rats, and there were no discernible histopathological effects. An apparent NOEL for inhibition of both plasma and red blood cell cholinesterase activity in a dog study (unacceptable under FIFRA guidelines; USEPA, 1990c) was 0.025 mg/kg-day. The 1-year NOEL for inhibition of plasma and brain cholinesterase activities from an interim report on the chronic toxicity of mevinphos in rats was 0.025 mg/kg-day. The 2-year NOEL for clinical signs (tremors and exopthalmus) was also 0.025 mg/kg-day.

Dietary- dog

In a two-year chronic dog study, beagles (4 dogs/sex/group) were dosed with the E- isomer of technical grade mevinphos (60.2%) at 0, 0.025, 0.075, 0.25, or 0.75 mg/kg-day in olive oil in gelatin capsules (Wilson and Thorpe, 1971). The study was judged unacceptable under FIFRA guidelines because of deficiencies in dose level justification, hematology, urinalysis, ophthalmology, individual animal data, and histopathology (USEPA, 1984; Appendix A). The apparent NOEL for both plasma and red blood cell cholinesterase inhibition was 0.025 mg/kg-day. No other indications of toxicity were reported. The USEPA's RfD (0.00025 mg/kg) was based on the statistically significant inhibition of red blood cell and plasma cholinesterase activity (USEPA, 1993).

Dietary- rat

The initial study on the chronic effects of mevinphos in rats did not indicate any adverse effects, but it was deemed unacceptable under FIFRA guidelines because of inadequacies in individual animal data, dose justification, ophthalmology, hematology, urinalysis and histopathology (Simpson *et al.*, 1971). Cholinesterase activities were not reported.

In a combined oncogenicity/chronic toxicity study, Sprague-Dawley rats (80/sex/dose) were dosed orally by gavage with mevinphos (86% pure; 75% E- isomer, 11% Z- isomer) at 0, 0.025, 0.35 or 0.7 mg/kg-day for up to 2 years. On day 83, the high dosage for females was lowered to 0.6 mg/kg-day due to decreased survival. At 12 months, 10 rats/sex/group were killed for analysis (Clay, 1991). Statistically significant ($P<0.05$) decreases in plasma cholinesterase activities (47 to 66% of control) were noted in both sexes at 12 months. No statistically significant changes in red blood cell cholinesterase activity were noted. However, statistically significant ($P<0.05$) decreases (27 to 55% of control) in brain cholinesterase activity were also observed in both sexes. The 1-year NOEL for inhibition of plasma and brain cholinesterase activities was 0.025 mg/kg-day. At the end of the study there were no significant non-neoplastic findings during gross necropsy or histopathological examinations (Plutnick, 1994). There were no statistically significant increases in specific tumors using pairwise comparison tests. However, Peto's Trend Test indicated a significant ($P<0.05$) trend in hepatocellular adenomas in female rats (Table 5). Malignant fibrous histiocytomas (histiocytic sarcomas) were identified in the liver of only the high dose males. The incidence of occurrence (4.5%) was well within the historical range (0 to 5.7%, with a cumulative average of 2.6%) (McMartin *et al*., 1992), and it was not accompanied by increased neoplastic development in related cell types. Consequently, the incidence does not appear to be compound related.

With regard to the apparent increased incidence of hepatocellular adenomas and carcinomas in females, there were no increases in relevant preneoplastic lesions. Nor was there any evidence of progression from benign to malignant tumors. The first female hepatocellular adenoma was in a control female, so there was a lack of a dose effect on latency and severity of oncogenic development in females. Males exhibited a reverse trend for carcinomas, which was unrelated to survival differences. Nor were there any apparent sex differences which might predispose females to hepatocellular tumors. The intermediate dose (0.35 mg/kg-day) was sufficiently close to the high dose (0.6 mg/kg-day) that one would expect confirmation of the oncogenicity of mevinphos. Yet, no tumors were reported at 0.35 mg/kg-day in the female. On balance, the lesions appear to be incidental.

Cholinesterase activity (plasma and brain) appeared to be depressed at the end of two years, but because of the death of all female controls for cholinesterase activity, statistical comparisons were not possible (Plutnick, 1994). The 2-year NOEL for cholinergic signs (tremors and exopthalmus) was 0.025 mg/kg-day. The study was acceptable to DPR under FIFRA guidelines.

Table 5 - Incidence of tumors in Sprague-Dawley rats exposed to mevinphos by gavage for two years (Plutnick, 1994).

	Male Dose (mg/kg-day)				Female Dose (mg/kg-day)			
Lesion	0	0.025	0.35	0.7	0	0.025	0.35	0.6
Hepatocellular adenoma	0/67 (0%)	1/67 (2%)	1/69 (1%)	2/68 (3%)	1/70+ (1%)	0/66 (0%)	0/67 (0%)	3/67 (5%)
carcinoma	4/67 (6%)	4/67 (6%)	2/69 (3%)	0/68 (0%)	0/70+ (0%)	0/66 (0%)	0/67 (0%)	1/67 (2%)
combined[a]	4/67 (6%)	5/67 (8%)	3/69 (4%)	2/68 (3%)	1/70 (1%)	0/66 (0%)	0/67 (0%)	4/67 (6%)
Hystiocytoma	0/67 (0%)	0/67 (0%)	0/69 (0%)	3/68 (4%)	0/70 (0%)	0/66 (0%)	0/67 (0%)	0/67 (0%)

a/ Total, combined hepatocellular carcinomas and adenomas.
+ Statistically significant (P<0.05) by Peto's trend test

Dietary- mouse

In a mouse oncogenicity study acceptable under FIFRA guidelines, CD-1 mice (50/sex/group) were fed on a diet containing 0, 1, 10, or 25 ppm mevinphos (100%) for 18 months (Atkinson, 1989). No carcinogenicity or other adverse effects were noted, although a transient decrement in body weight gain for both sexes did occur at 25 ppm. Cholinesterase activity was not measured.

E. GENOTOXICITY

Summary- Mevinphos was mutagenic in a dose-dependent manner, with and without metabolic activation, in both an assay with *Salmonella typhimurium* (strain TA100), and in an assay with CHO/HGPRT. Mevinphos, with and without metabolic activation, also caused chromosomal aberrations in Chinese Hamster Ovary cells *in vitro*, but no unscheduled DNA synthesis. These results indicate a strong probability that mevinphos is genotoxic.

Gene Mutation

Salmonella typhimurium strains TA98, TA100, TA1535, TA1537, and TA1538 with and without metabolic activation were exposed to mevinphos (purity = 74.48 % E- isomer, 15.09% Z- isomer) at concentrations of 0, 100, 1000, 3333, 6667 or 10000 *u*g/plate for 48 hours (San and Schadly, 1989). An increase in TA100 revertant colonies was observed at $\geq$ 3333 *u*g/plate both with and without S-9 metabolic activation. This study was acceptable to DPR. The acceptability of the genotoxicity studies is based on the Toxic Substances Control Act guidelines (Federal Register, 1985).

Mevinphos (purity = 74.48% E- isomer, 15.09% Z- isomer) was tested with Chinese Hamster ovary cells (CHO-K_1-BH_4) at concentrations of 0.1, 0.4, 0.6, 0.8 or 1.0 *u*l/ml without S-9 metabolic activation and at 0.1, 0.6, 1.2, 1.8 or 2.4 *u*l/ml with S-9 metabolic activation (5 hr exposure) in an initial study (Harbe, 1989). In another study, the cells were tested at 0.5, 0.6, 0.7, 0.8, 0.9 or 1.1 *u*l/ml without S-9, and 0.6, 0.9, 1.2, 1.4, 1.6 or 1.8 *u*l/ml with S-9 in a repeat assay. The number of mutant/10^6 clonable cells without S-9 increased at 1 *u*l/ml in the initial test, and at 0.9 *u*l/ml in the repeat test. The relative cloning efficiency averaged 16-20% and 42% for the 1.0 and 0.9 *u*l/ml doses, respectively. This study was acceptable to DPR.

Structural Chromosomal Aberration

In a chromosome aberration assay, Chinese Hamster ovary cells were incubated with technical mevinphos (purity = 76% E- isomer, 13.5% Z- isomer) at 0, 0.04, 0.08, 0.15, 0.3 or 0.6 *u*l/ml (without S-9 metabolic activation, 18 hr), and 0.13, 0.5, 1.0 or 2.0 *u*l/ml (with S-9, 2 hr)(Putman, 1990). A repeat assay was performed without S-9 at 0.15, 0.21, 0.3 or 0.42 *u*l/ml. The percentage of mevinphos treated cells with aberrations was significantly increased over controls at $\geq$ 0.15 *u*l/ml without activation. This study was acceptable to DPR.

Other Genotoxic Effects

Technical mevinphos (purity = 76% E- isomer, 13.5% Z- isomer) was tested in an unscheduled DNA synthesis assay on primary rat (Fischer 344 or Sprague-Dawley) hepatocytes at 0, 0.0003, 0.001, 0.003, 0.01, 0.03, 0.06, 0.1 or 0.3 *u*l/ml for 18-20 hrs (3 plates/dose + [^{3}H]Thymidine at 10 *u*Ci/ml/plate)(Curren, 1990). No increase in unscheduled DNA synthesis was observed at any dose. This study was acceptable to DPR.

Mice (8/sex/dose) were dosed twice orally on two consecutive days with mevinphos (70% E-isomer) at 0, 1.5 or 3 mg/kg (Dean and Senner, 1974). Cyclophosphamide, 100 mg/kg, was used as a positive control. The animals were given colcemid 90 minutes prior to termination, which occurred at 8 and 24 hours after dosing. No bone marrow aberrations were reported. However, the study was unacceptable to DPR (not upgradeable) for deficiencies including no maximum tolerated dose.

F. REPRODUCTIVE TOXICITY

Summary. Mevinphos did not cause any reproductive toxicity in rats. The maternal NOEL was 0.1 mg/kg-day for tremors and pin-point pupils.

Dietary- Rat

The initially submitted 3-generation rat study was considered unacceptable under FIFRA guidelines because it had incomplete histopathology, a lack of toxicity at the high dose, no dose justification or analysis of diet, and poor pup survival in the F_{2b} treated groups (Hill Top Research, 1967). A NOEL could not be established.

Mevinphos (89.6% pure; 75% E- isomer, 15% Z- isomer) at dosages of 0, 0.05, 0.1 or 0.5 mg/kg was administered by gavage to Sprague-Dawley rats (35/sex/group) daily for 10 weeks prior to mating and throughout the mating period (P_1) (Beyer, 1991c). The dams were dosed during gestation and lactation up to the time of weaning on postnatal day 21. Dosing of the F_1(P_2) generation was initiated on postnatal day 28 and continued for 11 weeks through the mating period. P_2 females were dosed during the gestation and lactation period until postnatal day 21. No reproductive effects were noted in the course of the study. Pinpoint pupils were observed in 11/35 P_1 females in the high dose group (0.5 mg/kg) in the first week of treatment. Fine and coarse tremors were also observed in this group after the first week. The maternal NOEL was 0.1 mg/kg-day for tremors and pin-point pupils. The NOEL for reproductive toxicity was equal to, or greater than, 0.5 mg/kg-day. This study was acceptable under FIFRA guidelines.

G. DEVELOPMENTAL TOXICITY

Summary. No developmental toxicity was noted in either rats or rabbits. The maternal NOEL for cholinergic signs (fine and coarse tremors) in rats was 0.2 mg/kg. In a rabbit study, the NOEL for maternal cholinergic signs (tremors, salivation) was 0.3 mg/kg. The NOEL for plasma cholinesterase activity depression in another rabbit study was 0.05 mg/kg-day, and the NOEL for red blood cell cholinesterase activity depression was less than 0.05 mg/kg-day.

Oral- rat

In a rat teratology study, technical grade mevinphos was administered by gavage in distilled water to groups of 24 mated Sprague-Dawley rats at levels of 0, 0.2, 0.75 or 1 mg/kg on days 6-15 of gestation (Schroeder and Daly, 1987). No developmental toxicity was observed at any dose level. Thus, the developmental NOEL was equal to or greater than 1 mg/kg-day. Maternal toxicity (tremors and salivation) was observed at 0.75 and 1 mg/kg-day. Therefore, the maternal NOEL for cholinergic signs was 0.2 mg/kg-day. Cholinesterase activities were not measured. The NOEL for developmental toxicity was equal to, or greater than, 1 mg/kg-day. The study was acceptable under FIFRA guidelines.

Oral- rabbit

Inseminated female rabbits (20/dose) were dosed with mevinphos (89.6% pure; 75% E- isomer, 15% Z- isomer) at 0, 0.05, 0.5 or 1.5 mg/kg by oral gavage once a day from day 7 through 19 of gestation (Beyer, 1991d). Although no cholinergic signs were reported, maternal toxicity was indicated by a treatment-related death in the high dose group. Red blood cell cholinesterase activity was significantly ($P<0.05$) depressed at all dosages in a dose-dependent manner (6, 13, 18%). Consequently, there was no maternal NOEL for depression of red blood cell cholinesterase. Plasma cholinesterase activity was significantly depressed ($P<0.01$) at the two highest dosages (33 and 47%, respectively). Levels of brain cholinesterase activity were not measured. No other signs of maternal toxicity were noted. Mevinphos was not fetotoxic or teratogenic under the conditions of this study. The maternal NOEL for depression of plasma cholinesterase activity was 0.05 mg/kg-day. The NOEL for developmental toxicity was equal to, or greater than, 1.5 mg/kg-day. The study was considered acceptable to DPR under FIFRA guidelines.

Inseminated female rabbits (20/group) were given technical mevinphos (0, 0.3 or 1.0 mg/kg, purity unspecified) in corn oil in gelatin capsules on days 6 through 18 of gestation (Dix and McCarthy, 1974). No developmental toxicity was observed. Seven rabbits at the high dosage (1 mg/kg) exhibited mild tremors, salivation, and other undescribed cholinergic signs. One rabbit aborted at the high dosage. The NOEL for maternal toxicity (tremors, salivation, abortion) was 0.3 mg/kg. The NOEL for developmental toxicity was equal to, or greater than, 1 mg/kg-day. The study was considered unacceptable under FIFRA guidelines because there was no analysis of the dosing material, no justification of dosage levels and selection, and incomplete litter data.

H. NEUROTOXICITY

Summary. Mevinphos did not cause delayed neuropathy in the hen. The NOEL for acute neurotoxicity (clinical signs, sensorimotor alterations, reduced neuromuscular performance, and inhibition of brain cholinesterase activity) in the rat was 0.1 mg/kg.

Gavage - Hen

Hens were dosed with mevinphos at 7.5 mg/kg by gavage on days 1 and 23, and sacrificed on day 43 (Samuels *et al*., 1972). Despite atropine and protopam protection, 3/6 mevinphos treated hens died after the second dose. There was no indication, either behaviorally or histopathologically, that mevinphos caused acute delayed neuropathy. The report was acceptable to DPR under FIFRA guidelines.

Mevinphos (no purity stated) was administered by gastric intubation to White Leghorn pullet hens at 0 (6 hens) or 12.5 mg/kg (10 hens) on days 0 and 21 (Barrett, 1988). Positive controls (4 hens) were given 750 mg/kg of TOCP on days 0 and 21. Hens receiving mevinphos were given sub-cutaneous injections of atropine (0.625 mg/kg) during the 48 hours after dosing. An injection of 2-PAM (10 mg/kg) was given 5 and 11 hours after the second dose of mevinphos. No significant neurotoxic effects occurred at the given dose. There was no indication of delayed neuropathy. The study was acceptable to DPR under FIFRA guidelines.

Gavage - rat

Mevinphos (86.55% purity; 75.86% E-isomer, 10.69% Z-isomer) was administered by gavage in a single dose to Sprague-Dawley rats (2/sex/dose) at 0.025, 0.05, 0.1, 0.5, 1.0, 1.75, 2.5, 3.5, or 4.0 mg/kg and (1/sex/dose) 5.0 and 10 mg/kg (Lamb, 1992). Rats dosed at 1.75 mg/kg and above exhibited some clinical signs (gait alterations, tremors, hypoactivity, salivation, lacrimation, constricted pupils, exophthalmus), with males more sensitive than females. All males and females dosed at 5 and 10 mg/kg died within 15 minutes, one female dosed with 4 mg/kg died after 45 minutes. The time to maximum effect in the rat was 45 minutes. The study was unacceptable under FIFRA guidelines series 82-1 because too few animals were used, the duration of dosing was limited, histopathological examinations of designated tissues were not performed, and there was a lack of clinical chemistry and hematology. The data were considered supplemental.

Sprague-Dawley rats were given a single dose of mevinphos (86.55% purity; 75.86% E-isomer, 10.69% Z-isomer) by oral gavage at 0 (27/sex), 0.025 (17/sex), 0.1 (27/sex), 2.0 (27/sex), or 3.5 mg/kg (27/sex) and a functional observation battery was administered 45 minutes post dosing and on days 7 and 14 for the seven rats per sex per group in the neuropathology evaluation and for the five rats per sex per group in the cholinesterase evaluation (Lamb, 1993). Six rats died (1 male, 5 females) after receiving 3.5 mg/kg. Treatment-related clinical signs (gait alterations, tremors, salivation, lacrimation, exophthalmus) were observed at 2.0 and 3.5 mg/kg (Table 6) at 45 minutes post-dosing. Clinical signs (lacrimation, salivation, impaired mobility, tremors) continued to be observable at 2.0 and 3.5 mg/kg during the first day. No treatment-related clinical signs were observed on day 7 or day 14 at any dose level. Sensorimotor alterations (approach, touch, startle, tail pinch, pupil and eyeblink responses, and air righting reflex) were noted at 2.0 and 3.5 mg/kg in both male and female rats. These alterations had disappeared by day 7. Neuromuscular performance (reduced hind limb resistance, forelimb grip strength, rotarod performance) was significantly affected at 2.0 and 3.5 mg/kg on the first day, but not at any dose on days 7 or 14. Plasma cholinesterase was significantly affected on day 0 in both males and females at 2.0 and 3.5 mg/kg (Table 6). Mevinphos had no effect on red blood cell cholinesterase activity at any dosage. Brain cholinesterase activity in males was significantly inhibited in the brain stem (at doses of 2.0 and 3.5 mg/kg) and cerebral cortex (3.5 mg/kg) on day 0. In females, brain cholinesterase activity was significantly inhibited in the brain stem (at doses of 2.0 and 3.5 mg/kg), hippocampus (3.5 mg/kg), and olfactory region (3.5 mg/kg) on day 0. No brain cholinesterase inhibition was observed in either males or females on days 7 and 14 post-dosing. The NOEL for acute neurotoxicity (clinical signs, sensorimotor alterations, reduced neuromuscular performance, and inhibition of brain cholinesterase activity) was 0.1 mg/kg. The report was acceptable to DPR under FIFRA guidelines.

Table 6 - Neurotoxic Effects in Sprague-Dawley Rats Exposed to a Single Dose of Mevinphos by Gavage (Lamb, 1993)[a]

	Dosage (mg/kg)				
Parameter	0	0.025	0.1	2.0	3.5
Males					
Clinical Signs- cage	-	-	-	+	+
Clinical Signs- handling	-	-	-	+	+
Sensorimotor Alterations	-	-	-	+	+
Functional Observational Battery	-	-	-	+	+
Plasma Cholinesterase Activity[a]	-	96%	87%	64%**	59%**
RBC Cholinesterase Activity[a]	-	92%	91%	91%	96%
Brain Cholinesterase Activity[a]					
Olfactory Region	-	107%	87%	78%	82%
Cerebellum	-	95%	90%	89%	87%
Cerebral Cortex	-	104%	95%	89%	81%*
Brain Stem	-	102%	97%	80%*	67%**
Midbrain	-	109%	104%	102%	81%
Hippocampus	-	105%	84%	88%	82%
Females					
Clinical Signs- cage	-	-	-	+	+
Clinical Signs- handling	-	-	-	+	+
Sensorimotor Alterations	-	-	-	+	+
Functional Observational Battery	-	-	-	+	+
Plasma Cholinesterase Activity[a]	-	91%	94%	61%**	53%**
RBC Cholinesterase Activity[a]	-	98%	91%	99%	94%
Brain Cholinesterase Activity[a]					
Olfactory Region	-	98%	98%	84%	72%*
Cerebellum	-	98%	107%	94%	86%
Cerebral Cortex	-	101%	105%	85%	87%
Brain Stem	-	101%	110%	75%**	69%**
Midbrain	-	102%	99%	80%	80%
Hippocampus	-	86%	99%	83%	64%*

a/ Mean activity expressed as percent of control value.
* Significantly different (P<0.05) from control by Dunnett's test.
** Significantly different (P<0.01) from control by Dunnett's test.
+ Significantly greater (P<0.05) incidence than in controls.

IV RISK ASSESSMENT

A. HAZARD IDENTIFICATION

Table 7 provides a summary of the toxic effects of mevinphos. Mevinphos was genotoxic in several of the *in vitro* studies. However, there was no indication of oncogenicity in rats or mice. Mevinphos did not exhibit any teratogenic/developmental toxicity or reproductive effects, nor did it cause delayed neuropathy. The principal toxic effect of mevinphos was inhibition of cholinesterase activity.

Table 7 - Summary of Selected Mevinphos Toxicology Studies

STUDY[b]	SPECIES	EFFECT	LOEL (mg/kg-day)	NOEL (mg/kg-day)	GENOTOXIC	REF[a]
acute neurotox. (1d)	rat	clin. signs, brain ChE	2.0	0.1		1
subchronic (14wk)	rat	plasma ChE	0.5	0.2		2
subchronic (14wk)	rat	rbc ChE	0.2	0.08		2
subchronic (1d)	human	cholinergic signs	-	0.025		3-4
subchronic (3d)	rat	pinpoint pupils	0.005	-		5
subchronic (7d)	rat	pinpoint pupils, tremors	0.56	0.056		6
subchronic (7d)	dog	emesis	0.050	0.025		7
subchronic (3d)	rabbit	mat. diarrhea,AG stain	0.5	0.05		8
developmental	rat	mat. tremors	0.75	0.2		9*
developmental	rabbit	mat. plasma ChE	0.5	0.05		10*
developmental	rabbit	mat. tremors,diarrhea	1.0	0.3		11
chronic	dog	plasma,rbc ChE	0.075	0.025		12
combined (interim)	rat	plasma,brain ChE	0.35	0.025		13
onco	mouse	weight gain decrement	3.8	1.5	-	14*
reproduction	rat	mat. tremors	0.5	0.1		15*
mutagenicity	bacteria	*in vitro*			+	16*
mutagenicity	CHO	*in vitro*			+	17*
chrom. abber.	CHO	*in vitro*			+	18*
unsched. DNA syn.	rat	*in vitro*			-	19*

a/ References - 1. Lamb, 1993; 2. Treon *et al*., 1957a,b; 3. Verberk and Salle, 1977; 4. Verberk, 1977; 5. Beyer, 1991a; 6. Keefe, 1992; 7. Reddy *et al*., 1991a; 8. Beyer, 1991b; 9. Schroeder and Daly, 1987; 10. Beyer, 1991d; 11. Dix and McCarthy, 1974; 12. Wilson and Thorpe, 1971; 13. Clay, 1991; 14. Atkinson, 1989; 15. Beyer, 1991c; 16. San and Schadly, 1989; 17. Harbe, 1989; 18. Putman, 1990; 19. Curren, 1990.

b/ The number in parenthesis is the day when the listed effect was first reported.

* Study acceptable to DPR.

Acute Toxicity

Both plasma and red blood cell cholinesterase activities were significantly reduced compared to controls in several acute studies (Keefe, 1992; Lamb, 1993; Treon *et al*., 1957a,b; Verberk and Salle, 1977; Verberk, 1977). Although the depression of plasma or red blood cell cholinesterase activities is generally used as an indication of exposure to a neurotoxic substance, the toxicological significance is controversial (USEPA, 1988, 1990b). Consequently, these parameters were not used to characterize the potential risk to humans. Cholinergic signs (loose stool and undescribed other effects) were noted in humans following oral ingestion of capsules with mevinphos up to an estimated dosage of 0.036 mg/kg (Rider *et al*., 1975). Unfortunately, individual data from that study were unavailable, and a NOEL could not be established. In a subsequent study, a different group of investigators (Verberk and Salle, 1977;

Verberk, 1977) built upon the earlier study. A NOEL for cholinergic signs in humans was established as 0.025 mg/kg or greater (only one dose level, and no cholinergic effects)(Verberk and Salle, 1977; Verberk, 1977). Although the study ran for 28 days, no cholinergic signs were reported at any time. Thus, the NOEL for cholinergic signs and symptoms (0.025 mg/kg) in humans applies to both acute (single dose) and subchronic (28 days) time periods. The actual 1-day NOEL is probably higher. For the short-term time frame, this human 1-day NOEL is approximately the same as the NOELs for cholinergic signs from studies on dogs, rats, or rabbits (see Table 7- Treon *et al*., 1957a,b; Beyer, 1991a,b,c; Reddy *et al*., 1991a; Schroeder and Daly, 1987; Dix and McCarthy, 1974; Keefe, 1992; Lamb, 1993). The human NOEL (0.025 mg/kg) for cholinergic signs was used to evaluate the risk of potential short-term occupational exposure.

Chronic Toxicity

A lifetime of exposure to mevinphos in the diet did not cause any histopathological changes in mice (Atkinson, 1989). No acceptable (under FIFRA guidelines) chronic exposure study in dogs has been submitted to DPR by the registrant. In an interim (12 month) report for the combined chronic toxicity/oncogenicity study in rats, a NOEL of 0.025 mg/kg-day (LOEL = 0.35 mg/kg-day; 27-55% inhibition) was established for depression of brain cholinesterase activity following chronic dietary exposure to mevinphos (Clay, 1991). A statistically significant depression of brain cholinesterase activity may be considered an adverse effect (USEPA, 1988). However, this view is not unanimous (USEPA, 1988, 1990b). A single dose of mevinphos did not result in any lingering inhibition of plasma, red blood cell, or brain cholinesterase activity in the rat (Lamb, 1993). However, in a time course study, inhibition of red blood cell cholinesterase activity was increased with repeated dosing in humans (Verberk, 1977). Therefore, inhibition of brain cholinesterase activity after repeated dosing probably represents an accumulated effect. The NOEL, 0.025 mg/kg-day for brain cholinesterase inhibition in rats, was used for the assessment of potential chronic exposure to mevinphos. If better data on the chronic effects of mevinphos become available, the basis for the chronic NOEL can be reconsidered.

B. EXPOSURE ASSESSMENT

1. Formulations, Application Rates, and Use Restrictions (from Labels and Appendix B)

Mevinphos is a restricted pesticide in California, meaning it can be sold to and used by only certified applicators or persons under their supervision. It is contained in four products registered in California. Each of the products are liquid concentrate/emulsifiable concentrate formulations. One product (Phosdrin 10.3) is approximately 100% mevinphos. The other 4 products range from 47 to 50% mevinphos by weight, approximately 4 lbs of active ingredient (a.i.) per gallon.

Mevinphos can be applied by air or ground power equipment. Use of hand-held application equipment is prohibited except with Phosdrin 4EC. In California, mevinphos must be used through a closed mixing/loading system (Calif., 1989). The application rates range from 0.5 lb a.i./acre for forage and grain crops, from 0.25 to 1.0 lbs a.i./acre for vegetable crops, 1.0 to 3.25 lbs a.i./acre for fruits.

Even with a closed system, according to the California label mixer/loaders must wear long-sleeved shirts, long-legged pants, chemical resistant gloves, chemical resistant apron, shoes and socks. Goggles or a face shield must be worn when the system is under pressure. The following personal protective equipment must be available nearby: protective suit of one or two pieces that covers all parts of the body except head, hands and feet; chemical resistant gloves; chemical resistant shoes (or chemical resistant shoe coverings or chemical resistant boots); goggles or face shield; hood or wide-brimmed hat; NIOSH or MSHA approved respiratory protection breathing device. Personal protective equipment must be worn during application, repair and cleaning of equipment, and disposal of mevinphos.

If application is performed using an enclosed cab (ground application), or cockpit (aerial application), the following alternative equipment and clothing may be used: long-sleeved shirt and long-legged pants, shoes and socks. Chemical resistant gloves must be available in the cab or cockpit, and must be worn during entry to and exit from the application vehicle. For ground application all other protective clothing and equipment required for use during application must be available in the cab, and must be worn when exiting the cab into treated areas. Contaminated clothing may not be brought back into the cab unless in an enclosure such as a plastic bag. According to the California label, reentry intervals vary from 2 to 4 days, depending upon the crop treated and the amount of mevinphos which has been applied. Workers are not required to wear the protective clothing described above unless reentering areas prior to the specified reentry interval.

2. Occupational Exposure

The studies and data which form the basis for estimating worker exposure are described in Appendix B. These estimates are based on both monitoring data, and calculations from foliar residue data. The mean exposure values used for the risk assessment are shown in Table 8.

However, the use of geometric mean values underestimates potential short term exposures of populations of workers (USEPA, 1992). Consequently, the 95% upper-bound confidence limit on short term worker exposure was also examined (Table 8). These values represent the maximum acute occupational exposures which workers might be expected to encounter. Chronic occupational exposures to mevinphos were estimated assuming 21 spraying days per year (Appendix B).

As there were no acceptable exposure studies for ground application of mevinphos, surrogate data were used as an alternative to estimate the exposures of mixer/loader/applicators. A study which examined the exposure of workers to oxydemeton-methyl was selected as an appropriate surrogate study (Appendix B).

The exposure estimates for pilots of fixed-wing aircraft and helicopters, loaders for helicopters, and flaggers were obtained from studies conducted in Monterey and Imperial counties (Maddy *et al.*, 1981, 1982). In those studies, the mean absorbed dosage was calculated from the amount of mevinphos collected by cotton gauze and cloth patches placed on the bodies of workers. As the amount of material on the patches was averaged by body location (*ie*., all chest patches averaged), the individual variability in exposure dosage could not be estimated.

Exposure estimates for field workers and harvesters relied on measured dislodgeable foliar residues of mevinphos and transfer factors generated from studies of other active ingredients on the same type of vegetable of fruit crops (Appendix B). Although airblast application of mevinphos is not prohibited on the product label, "it is not customary in California to use mevinphos by air blast" (Appendix B).

Table 8. Estimates of Occupational Exposure to Mevinphos (from Appendix B).

Work Task	No.	ADD[a] (*u*g/kg-day)	95th Percentile[b] of ADD (*u*g/kg-day)	AADD[c] (*u*g/kg-day)
Helicopters				
Mixer/Loader[d]	3	2.4	33.8	0.14
Pilot[d]	3	0.5	1.1	0.03
Fixed-wing Aircraft				
Mixer/Loader[d]	4	1.6	5.9	0.09
Pilot[d]	4	0.5	1.8	0.03
Flagger[d]	7	0.04	2.2	0.002
Ground Application				
Mixer/Loader/Applicator[e] (open cab)	17	3.8	13.9	0.21
Mixer/Loader/Applicator[e] (closed cab)	4	3.2	9.2	0.20
Harvester[f]				
Field workers (vegetables)		neg. - 1.5		neg.-0.09
Field workers (fruit trees)		0.8 - 11		0.05-0.63
Field workers (grapes)		0.4 - 1.0		0.02-0.06

a/ The geometric mean of the estimated Absorbed Daily Dosage for helicopter, fixed-wing aircraft, and ground application. For harvesters- the range of exposures for workers harvesting different commodities. The dermal absorption was 16.8%. Inhalation retention, and inhalation absorption were 50% and 100%, respectively. Assumes a 75.9 kg body weight for workers (Appendix B).
b/ The 95th percentile of the absorbed daily dosage = (geometric mean) x (geometric S.D)$^{1.645}$
c/ The Average Annual Daily Dosage assumes 21 working days per year (Appendix B).
d/ From Table 5, Appendix B.
e/ From Table 4, Appendix B.
f/ Calculated from surrogate data for folpet, propargite, methomyl, azinphos-methyl and captan assuming an 8 hour work day, from Table 7, Appendix B.

3. Dietary Exposure Assessment

DPR evaluates the risk from potential exposure to an active ingredient in the diet using separate processes: (1) risk is determined for total exposure based on measured residue levels, and (2) risk is determined for exposure to individual commodities at the tolerance level (see Tolerance Assessment Section). For the evaluation of risk to measured residue levels, the potential total exposure to the pesticide in the diet is determined for all label-approved crops (raw agricultural commodities) and their processed forms as well as any secondary residues in animal tissues. The degradation products and/or metabolites of the active ingredient which have established tolerances or whose toxicity is of concern are also considered in the assessment.

The sources of residue data include surveillance programs conducted by the DPR and Federal agencies, field trials, and survey studies by registrants. Residue data obtained from the monitoring programs are preferred for human dietary assessments as they are a more realistic estimate of potential exposure. In the absence of any measured residues, the DPR dietary exposure assessments utilize surrogate data from the same crop group as defined by USEPA, or theoretical residues equal to USEPA tolerances. When residues are at levels higher than established tolerances, they are not utilized in the dietary exposure assessments because they are illegal. At the time over-tolerance situations occur, they

are investigated by the DPR Pesticide Enforcement Branch, and DPR's Medical Toxicology Branch conducts an expedited acute dietary risk assessment as part of the process.

Two elements of the DPR monitoring programs are currently used for dietary exposure assessment: 1) priority pesticide, and 2) marketplace surveillance. The priority pesticide program focuses on pesticides of health concern, as determined by DPR Enforcement and Medical Toxicology Branches. Samples are collected from fields known to have been treated with the specific pesticides. For the marketplace surveillance program, samples are collected at the wholesale and retail outlets, and at the point of entry for imported foods. Sampling in this program is weighted toward such factors as patterns of pesticide use; relative number and volume of pesticides typically used to produce a commodity; relative dietary importance of the commodity; past monitoring results; and extent of local pesticide use.

The U. S. Food and Drug Administration (FDA) has three monitoring programs for determining residues in food: 1) regulatory monitoring, 2) a total diet study, and 3) incidence/level monitoring. Depending on the program, raw agricultural commodities and/or processed foods are collected for analysis. For regulatory monitoring, surveillance samples are collected from individual lots of domestic and imported foods at the source of production or at the wholesale level. In contrast to the regulatory monitoring program, the total diet study monitors residue levels in the form that the commodity is commonly eaten, or in prepared meals. The incidence/level monitoring program is designed to address specific concerns about pesticide residues in particular foods.

The U. S. Department of Agriculture (USDA) is responsible for the Pesticide Data Program, which is designed to collect objective, comprehensive pesticide residue data from fresh produce. The bases used for selecting the pesticides and produce to be sampled are 1) pesticide toxicity, and 2) the need for residue data to determine potential exposure for risk assessments. The samples are collected at produce markets and chain store distribution centers close to the consumer level in several states, including California. The National Residue Program of USDA provides data for potential pesticide residues in meat and poultry. These residues in farm animals can result from direct application to livestock, or from consumption of contaminated commodities or by-products in the feed.

Dietary exposure to mevinphos has been estimated using DPR focused monitoring data, marketplace surveillance data, and produce destined for processing data from 1987 to 1991 for mevinphos residues (Appendix C). Additional survey data from the FDA were also utilized. The gas chromatographic analytical techniques did not always differentiate between the two isomers of mevinphos. When differentiation did occur, the isomers were summed. It was assumed that mevinphos was used to treat 100% of the more than 45 crops for which there are USEPA approved labeled uses (Appendix E).

Acute Exposure

Estimates of potential acute dietary exposure used the highest measured residue values at or below the tolerance for each commodity. The following assumptions were used to estimate potential acute dietary exposure from measured residues: a) the residue level does not change over time, b) the concentration of residue does not decrease when the raw agricultural commodity (RAC) is washed, c) processing changes the residues to a level equivalent to the RAC residue level multiplied by a concentration factor, and d) all foods that are consumed will contain the highest reported residue.

If the surveillance data did not indicate any detectable residues, then the minimum detection level (MDL) of 0.01 ppm was used. If measured residues were not available for specific commodities, then surrogate residue information or tolerances were used as a default procedure.

Acute dietary exposure analyses were conducted using the Exposure-4 software program developed by Technical Assessment Systems, Inc (TAS). The Exposure-4 software program estimates the distribution of user-day exposures for the overall U.S. population and specific subgroups (TAS, 1992a). A user-day is any day in which food from the list of commodities potentially containing residues is consumed. The consumption analysis uses individual food consumption data as reported in the 1987-88 USDA Nationwide Food Consumption Survey (USDA, 1987-88). Potential acute ingestion of mevinphos for all labeled uses, based on the 95th percentile of user-day exposure for all population subgroups, ranged from 1.0 to 3.3 *u*g/kg-day (Table 7). Non-nursing infants, less than 1 year of age had the highest potential acute dietary exposure to mevinphos when all food uses were considered. The complete acute dietary exposure analysis is presented in Appendix C.

Chronic Exposure

Estimates of potential chronic dietary exposure used the average of measured and "below the detection limit" residue values for each commodity. The default procedure assumed that "below detection limit" residues were equal to one half (50%) of the detection limit for each RAC. The following assumptions were used to estimate potential chromic dietary exposures from measured residues: a) the residue level on an RAC does not change over time, b) residues are not reduced by washing the RAC, d) processing changes the residues to a level equivalent to the RAC residue level multiplied by a concentration factor, and d) exposures to a commodity at all reported residue levels do occur, i.e. a commodity with the average calculated residue is consumed every day at an annual average level (dosage).

The potential chronic dietary exposure was calculated using the Exposure-1 software (TAS, 1992b). The food consumption data for the chronic analysis were also based on the 1987-88 USDA Nationwide Food Consumption Survey. The program estimates the annual average exposure for all members of a designated population subgroup.

The mean potential chronic dietary exposure for all population subgroups ranged from 0.02 to 0.07 *u*g/kg-day (Table 9). Non-nursing infants, less than 1 year of age, and children, 1 to 6 years of age, had the highest potential exposures. The complete chronic dietary exposure analysis is presented in Appendix C.

The crops and food groups contributing more than 10% to the dietary exposure to mevinphos for the various population subgroups were: oranges, potatoes, tomatoes, carrots, apples, peaches, and fruiting vegetables excluding cucurbits.

Table 9 - Potential Acute and Chronic Dietary Exposures to Mevinphos Residues.

Population Subgroup	Exposure Dosage (*u*g/kg-day)	
	Acute[a]	Chronic[b]
US Pop. (All Seasons)	1.5	0.04
Western Region	1.6	0.04
Nursing Infants (<1 yr)	2.0	0.02
Non-Nursing Infants (<1 yr)	3.3	0.07
Children (1-6 yrs)	2.2	0.07
Children (7-12 yrs)	1.6	0.05
Female (13+ yrs/pregnant/not nursing)	1.0	0.03
Female (13+ yrs/nursing)	1.3	0.03
Females (13-19 yrs/not pregnant/not nursing)	1.2	0.04
Female (20+ yrs/not pregnant/not nursing)	1.6	0.03
Males (13-19 yrs)	1.2	0.04
Male (20+ yrs)	1.3	0.03
Seniors (55+ yrs)	2.1	-

a/ Calculated from highest measured residues, less than tolerance, and using the MDL to represent commodities with non-detectable levels of residues. Based on the upper 95th percentile for user-day exposures in all population subgroups. See Appendix B for other percentiles.

b/ Calculated using the arithmetic mean of measured residues and 1/2 the MDL for residues below the limit of detection for each commodity. See Appendix C for other population subgroups.

Combined Occupational and Dietary Exposure

Occupational exposures do not constitute the sole source of an absorbed dose of mevinphos. Dietary exposure may also contribute to the overall body burden of mevinphos in workers. The potential dietary exposure was added to the mean occupational exposure to obtain an estimate of the total exposure to mevinphos.

The potential dietary exposure of the population subgroup of males, aged 20 and over, was chosen for the purposes of estimating combined occupational and potential dietary exposures. The choice was based on two factors: 1) Occupational exposures were derived from actual measurements or surrogate data involving agricultural workers from this population subgroup. 2) The dietary exposure values are approximately the same as those of any other population subgroup which might contribute to the agricultural workforce. The potential acute dietary exposure of this population subgroup was 1.3 *u*g/kg-day, and the potential chronic dietary exposure was 0.03 *u*g/kg-day. These values were added to the mean estimated occupational exposures (Table 10).

Table 10 - Estimates of Combined Occupational and Dietary Exposure to Mevinphos.

Work Task	Combined ADD[a] (*u*g/kg-day)	Combined AADD[b] (*u*g/kg-day)
Helicopters		
Mixer/Loader	3.7	0.17
Pilot	1.8	0.06
Fixed-wing Aircraft		
Mixer/Loader	2.9	0.12
Pilot	1.8	0.06
Flagger	1.3	0.03
Ground Application		
Mixer/Loader/Applicator (open cab)	5.1	0.24
Mixer/Loader/Applicator (closed cab)	4.7	0.23
Harvester		
Field workers (vegetables)	1.8 - 2.8	0.03 - 0.12
Field workers (fruit trees)	2.1 - 12	0.08 - 0.66
Field workers (grapes)	1.7 - 2.3	0.05 - 0.09

a/ A dietary exposure of 1.3 *u*g/kg-day for males over the age of 20 has been added to the mean acute occupational exposures from Table 8.

b/ A dietary exposure of 0.03 *u*g/kg-day for males over the age of 20 has been added to the mean chronic occupational exposures from Table 8.

C. RISK CHARACTERIZATION

Occupational

The margins of safety (MOSs) corresponding to various occupational exposure scenarios are presented in Table 11 below. A margin of safety is defined as the ratio of the dosage of mevinphos which produced no effect (NOEL) in a human or laboratory animal study, to the dosage of mevinphos to which a specific population subgroup is theoretically exposed. MOSs for mean acute occupational exposures, based on the NOEL of 25 *u*g/kg for human cholinergic signs, ranged from 2 (apple harvesters) to 625 (flaggers in enclosed vehicles) (Table 11). The MOSs for each work task are based on the geometric mean of measured exposures for individuals in that category. However, the use of geometric mean values underestimates potential short term exposures of populations of workers (USEPA, 1992). Consequently, the 95th percentile of short term worker exposure was also examined. If the 95th percentile of short term exposures were considered for each of the job categories, the MOSs would range from less

than 1 (mixer/loaders involved in helicopter applications) to 23 (helicopter pilots) (Table 11). MOSs for potential chronic occupational exposure ranged from 40 (apple harvesters) to 8,333 (flaggers in enclosed vehicles) (Table 11).

Table 11 - Margins of Safety for Potential Acute and Chronic Exposure of Workers to Mevinphos

Work Task	Acute Margins of Safety[a]	95th Percentile MOS[a]	Chronic Margins of Safety[b]
Helicopters			
Mixer/Loader	10	<1	179
Pilot	50	23	833
Fixed-wing Aircraft			
Mixer/Loader	16	4	278
Pilot	50	14	833
Flagger	625	11	8,333
Ground Application			
Mixer/Loader/Applicator (open cab)	7	2	119
Mixer/Loader/Applicator (closed cab)	8	3	125
Harvester			
Field Workers (vegetables)	17 - 50		278 - >833
Field workers (fruit trees)	2 - 31		40 - 500
Field workers (grapes)	25 - 63		417 - 1,250

a/ MOS based on a NOEL of 25 *u*g/kg for cholinergic signs in human studies (Verberk and Salle, 1977; Verberk, 1977) and exposure values from Table 8.
b/ MOS based on a NOEL of 25 *u*g/kg for inhibition of brain cholinesterase in the rat (Clay, 1991) and exposure values from Table 8.

Dietary

The margins of safety for potential acute dietary exposure to mevinphos ranged from 8 to 24 (Table 12). The population subgroup, non-nursing pregnant women greater than 13 years of age had the highest MOS. The lowest MOS in any group was 8 for non-nursing infants, less than 1 year of age.

The MOSs (based on the NOEL of 25 *u*g/kg-day for inhibition of brain cholinesterase activity in rats) for potential chronic dietary risk from the annualized daily dosage of mevinphos ranged from 338 to 1,250 (Table 12). Nursing infants, less than 1 year of age, had the highest MOS. The population subgroup of non-nursing infants, less than 1 year of age, had the lowest MOS from potential chronic exposure to mevinphos.

Table 12 - Margins of Safety for Potential Acute and Chronic Dietary Exposure to Mevinphos.

Population Subgroup	Margin of Safety	
	Acute[a]	Chronic[b]
US Pop. (All Seasons)	16	658
Western Region	16	676
Nursing Infants (<1 yr)	12	1250
Non-Nursing Infants (<1 yr)	8	373
Children (1-6 yrs)	12	338
Children (7-12 yrs)	16	481
Female (13+ yrs/pregnant/not nursing)	24	862
Female (13+ yrs/nursing)	19	735
Females (13-19 yrs/not pregnant/not nursing)	22	714
Female (20+ yrs/not pregnant/not nursing)	16	806
Males (13-19 yrs)	21	658
Male (20+ yrs)	20	833
Seniors (55+ yrs)	12	-

a/ Based on NOEL = 0.025 mg/kg-day for cholinergic signs from human studies (Verberk and Salle, 1977; Verberk, 1977).

b/ Based on a NOEL = 0.025 mg/kg-day for depression of brain cholinesterase activity from a chronic dietary study in rats (Clay, 1991).

Combined Occupational and Dietary

Potential acute (1.3 *u*g/kg-day) and chronic (0.03 *u*g/kg-day) dietary exposures for the population subgroup of males, aged 20 and over, were combined with the respective acute and chronic mean occupational exposures in Table 10. These values represent the estimated total exposure of agricultural workers. The margins of safety for the combined occupational and dietary exposure are presented in Table 13.

Table 13 - Margins of Safety for Combined Acute and Chronic Mean Occupational Exposure and Potential Dietary Exposure to Mevinphos

Work Task	Combined Acute Margins of Safety[a]	Combined Chronic Margins of Safety[b]
Helicopters		
Mixer/Loader	7	147
Pilot	14	417
Fixed-wing Aircraft		
Mixer/Loader	9	208
Pilot	14	417
Flagger	19	833
Ground Application		
Mixer/Loader/Applicator (open cab)	5	104
Mixer/Loader/Applicator (closed cab)	5	109
Harvester[d]		
Field workers (vegetables)	9 - 14	208 - >500
Field workers (fruit trees)	2 - 12	38 - 313
Field workers (grapes)	11 - 15	278 - 500

a/ MOS based on a NOEL of 25 *u*g/kg for cholinergic signs in human studies (Verberk and Salle, 1977; Verberk, 1977). Combines potential acute dietary exposure of 1.3 *u*g/kg for the population subgroup, males 20 years of age and older and mean acute occupational exposure.

b/ MOS based on a NOEL of 25 *u*g/kg for inhibition of brain cholinesterase activity in the rat (Clay, 1991). Combines potential chronic dietary exposure of 0.03 *u*g/kg for the population subgroup, males 20 years of age and older and mean chronic occupational exposure.

Combining potential acute dietary exposure with mean occupational exposures caused a substantial drop in the MOS for all job categories. The MOSs ranged from 2 (apple harvesters) to 19 (flaggers in closed cabs). Combining the potential chronic dietary exposure with the mean chronic occupations exposure did not substantially alter the margins of safety. MOSs ranged from 38 (apple harvesters) to 833 (flaggers in closed cabs). If the potential acute dietary exposure were combined with the upper confidence limit of occupational exposure the MOSs would range from 1 (flaggers in closed cabs) to 7 (pilots of helicopters).

V RISK APPRAISAL

Risk assessment is a process used to evaluate the potential for exposure and the likelihood that the toxic effects of a substance may occur in humans under the specific exposure conditions. Every risk assessment has inherent limitations on the application of existing data to estimate the potential risk to human health. Therefore, certain assumptions and extrapolations are incorporated into the hazard identification, dose-response assessment, and exposure assessment processes. This, in turn, results in uncertainty in the risk characterization, which integrates all the information from the previous three processes. Qualitatively, risk assessment for all chemicals has similar types of uncertainty. However, the degree or magnitude of the uncertainty varies depending on the availability of the data and the exposure scenarios being assessed. Risk, the probability of a compound causing an adverse health effect, is a product of the potential exposure and the toxicity of a compound. Estimation of both of these aspects involves varying degrees of uncertainty, which can affect the accuracy of the risk characterization. Overestimates of potential exposure or toxicity will lead to excessive projections of risk, while under valuation of these aspects would result in underestimates of risk. Specific areas of uncertainty associated with this risk assessment for mevinphos are delineated in the following discussion.

Occupational

Exposure. Occupational exposure data for flaggers and individuals associated with helicopter applications were derived from measurements of dermal and ambient air concentrations of mevinphos during the operations (Appendix B). However, the small number of individuals sampled, assumptions regarding application rates and duration of time on the job, and the assumption that exposures of workers in each job category follows a log-normal distribution all contribute to possible under- or over-estimation of the mean acute occupational exposures. Because exposures for work tasks associated with ground applications or harvesting came from surrogate data, these data carry a greater degree of uncertainty than measurements made during mevinphos usage. Greatest uncertainty is associated with exposure estimates for harvesters and field workers. Although the foliar residues of mevinphos they would encounter were measured, the transfer factors used to estimate dermal exposure were derived from surrogate studies. These studies used the same crop types, but with different pesticides.

The data on the absorption of a single dose of mevinphos through the dermal route indicated that only about 16% of the administered radiolabel was excreted in the urine, or as CO_2, while 32% of the radiolabel remained in the skin (Jeffcoat, 1993). It was assumed that this material was unavailable systemically, either via dermal metabolism of mevinphos or through binding to the skin. Whether subsequent dermal doses would dislodge dermally bound mevinphos, or overwhelm the metabolic activity of the skin, is unknown. If dermal abosorption were greater, then the MOS would be less than estimated.

Acute Toxicity. MOSs greater than 10, based on a NOEL determined in humans, would generally be considered adequate for protection against the potential acute toxicity of mevinphos. This benchmark number (MOS=10) assumes some individuals will be ten times more sensitive to mevinphos than those individuals used in the study. This level of uncertainty is warranted by the small number of individuals used in the studies on the effects of mevinphos in humans (Rider *et al.*, 1975; Verberk, 1977; Verberk and Salle, 1977). Although no cholinergic signs were noted at 0.025 mg/kg, this was the only dosage used in the study (Verberk, 1977; Verberk and Salle, 1977). Because the study went 28 days, the NOEL was applicable to 28 days as well as 1 day. The actual 1-day NOEL is probably higher.

If the human NOEL had not been used as the basis for calculating the MOSs for acute exposure, the next best NOEL was 0.1 mg/kg-day for neurotoxicity (clinical signs, sensorimotor alterations, reduced neuromuscular performance, and inhibition of brain cholinesterase activity) in the rat (Lamb, 1993). However, when an animal study is used as the basis for calculating MOSs, a margin of safety of 100 is generally considered necessary for adequate protection of workers from the toxic effects of mevinphos. This benchmark of 100 includes an uncertainty factor of 10 for intraspecies variability, as well as an uncertainty factor of 10 for interspecies variability, which assumes that humans are 10 times more sensitive to mevinphos than are laboratory animals (Davidson *et al.*, 1986; Dourson and Stara, 1983,1985; USEPA, 1986). Although humans do not appear to be 10 times more sensitive to mevinphos exposure on

an acute basis (Table 4), in the absence of better data on the human dose response, the assumption is made to be health protective.

Using the 1-day rat NOEL (0.1 mg/kg-day) for neurotoxicity, MOSs for mean acute occupational exposures would range from 6 to 2500 for agricultural workers engaged in aerial or ground use of mevinphos. If the 95th percentile of short-term exposure were considered for these workers, the MOSs would range from 3 to 91. MOSs for potential acute dietary exposure combined with mean occupational exposures for these workers would range from 20 to 77. Consequently, the conclusions do not change. Margins of safety remain less than the value conventionally recommended to protect people from the toxic effects of mevinphos.

Chronic Toxicity. The NOEL for chronic exposure to mevinphos (25 *u*g/kg-day), based on depression of brain cholinesterase activity, comes from a study on rats (Clay, 1991). In the absence of scientific evidence to the contrary, this effect is expected to occur in humans at similar dosages. As the NOEL is from a laboratory animal study, a MOS of 100 would generally be considered adequate for protection against the potential chronic toxicity of mevinphos.

Dietary

Exposure. Some practices, such as the sampling of RACs as composites, could lead to underestimates of potential acute dietary exposure. In general, though, sampling procedures, default assumptions for non-detectable residue levels, assumptions on the fate of residues on commodities, and assumptions regarding the percentage of crops treated with mevinphos are likely to contribute to an overestimation of the potential dietary exposure. The consumption data contained in the 1987-1988 USDA survey may not be an accurate representation of actual dietary consumption by each of the population subgroups. Coding and reporting errors, response and sampling bias, and variation in culinary habits over the sampling period resulted in uncertainties in consumption data which can lead to either over- or underestimates of exposure (Bingham, 1991). The accuracy with which the low number of respondents from the 1987-1988 survey represents the culinary habits of the general population has also been called into question (GAO, 1991). The probability of the dietary contribution to the exposure of an individual in a given population subgroup is a product of the probabilities that 1) an individual would consume a sufficient amount of the commodities to be in the 95th percentile of daily dietary exposure dosages and 2) the commodities would all contain the maximum residue levels. Clearly, this is an overestimate of dietary exposure.

The potential combined dietary and occupational exposures indicated in Table 10 are probably over-estimations of the actual exposures, as it is improbable that all of the assumptions made in the calculation of combined exposure dosage would be met. It is unlikely that the agricultural workers engaged in mevinphos application would also be in the 95th percentile of consumption of commodities with maximum mevinphos residues.

Toxicity. The acute and chronic toxicological considerations for estimating dietary risks to agricultural workers or the general population are the same as discussed above under the section on occupational risk.

Conclusions

Margins of safety, based on current toxicity data, for mean acute occupational exposure of mixer/loader/applicators associated with ground application and of harvesters working in fruit trees are less than the value conventionally recommended to protect people from the toxic effects of mevinphos. When the mean short term occupational exposures were combined with potential acute dietary exposure, the MOSs for mixer/loaders engaged in aerial applications also become inadequate. MOSs for the 95th percentile of short term worker exposure were inadequate for all mixer/loader work categories associated with mevinphos application. Mitigation measures need to be considered.

Margins of safety for chronic occupational exposure, or combined occupational and potential chronic dietary exposure, are greater than the value conventionally recommended to protect people from the toxic effects of mevinphos.

The margin of safety for potential acute dietary exposure of non-nursing infants, less than the age of 1, to residues on approximately 45 label-approved commodities was less than the value conventionally recommended to protect people from the toxic effects of mevinphos. All other population subgroups had margins of safety for potential acute dietary exposure that were greater than the value conventionally recommended to protect people from the toxic effects of mevinphos. Margins of safety for potential chronic dietary exposure to mevinphos for all population subgroups were greater than the value conventionally recommended to protect people from the toxic effects of mevinphos.

VI RISK MANAGEMENT

The Worker Health and Safety Branch has concluded that "a single excessive exposure event (e.g. splash or spill) can result in illness. Additional protective equipment or protective clothing does not seem possible at this time. It is theoretically possible to mitigate reentry and drift exposures through administrative controls (reentry intervals and buffer zones), however, this was not considered further because of excessive mixer/loader/applicator exposures. The current PPE [personal protective equipment] required for mevinphos handlers is close to the maximum level under California's climate. Additional mitigation measures that are practical and reasonable will not reduce the estimated upper bound (95th percentile) exposure to an acceptable level for ground mixer/loader/applicators and mixer/loaders of helicopter applications." Consequently, it does not appear possible to mitigate the estimated excessive exposures at this time.

VII TOLERANCE ASSESSMENT

BACKGROUND

A tolerance is the maximum amount of a pesticide residue that may remain in or on a food, or animal feed (USEPA, 1991). The USEPA tolerance program was developed as an enforcement mechanism to identify illegal residue concentrations resulting from potential non-compliance with the product label requirements (e.g. improper application rates or methods, inadequate pre-harvest intervals, direct or indirect application to unapproved commodities). Tolerances are enforced by the FDA, USDA, and state enforcement agencies (e.g. Pesticide Enforcement Branch of DPR)

The data requirements established by USEPA for tolerances include: 1) residue chemistry which includes measured residue levels from field studies, 2) environmental fate studies, 3) toxicology studies which evaluate the hazards to humans, domestic animals, and non-target organisms, 4) product performance such as efficacy, and 5) product chemistry which includes physical-chemical characteristics and analytical methods (Code of Federal Regulations, 1992). The field studies must reflect the proposed use with respect to the rate and mode of application, number and timing of applications, and formulations proposed (USEPA, 1982).

Currently, the tolerances set by USEPA are at levels necessary for the maximum application rate and frequency, and not expected to produce deleterious health effects in humans from chronic dietary exposure (USEPA, 1991). USEPA uses the Reference Dose for non-cancer risks, and negligible level (generally defined as a lifetime probability of tumor occurrence at one in a million) for cancer risks as guides to determine the appropriate levels for dietary exposure.

Assembly Bill 2161 (Bronzan and Jones, 1989) requires the DPR to "conduct an assessment of dietary risks associated with the consumption of produce and processed food treated with pesticides". In the situation where "any pesticide use represents a dietary risk that is deleterious to the health of humans, the DPR shall prohibit or take action to modify that use or modify the tolerance....". As part of the tolerance assessment, a theoretical dietary exposure for a specific commodity and specific population subgroups can be calculated from the product of the tolerance and the daily consumption rate.

Acute Exposure: An acute exposure assessment using the residue level equal to the tolerance is conducted for each individual label-approved commodity. The TAS Exposure-4 software program and the 1987-1988 USDA consumption data base are used in this assessment. The acute tolerance assessment does not routinely address multiple commodities at the tolerance levels as the probability of consuming multiple commodities all at the tolerance significantly decreases as the number of commodities included in the assessment increases. Residue levels were set equal to the tolerance, and the MOS, based on the upper 95^{th} percentile for user-day exposures for each population subgroup was examined. As the acute MOS is based on a human NOEL for clinical signs of acetylcholinesterase inhibition, a MOS of at least 10 is generally considered adequate. Ranges of MOS for the most highly consumed commodities (FDA, 1991) for potential acute dietary exposure for all population subgroups are presented in Table 14.

The MOSs were over 10 for all population subgroups theoretically exposed to tolerance levels of residue on: celery, popping corn, cucumbers, lettuce, okra, green onions, parsley, peas, peppers, potatoes, summer squash, tomatoes, turnips, walnuts, and watercress. MOSs were 9 or less for at least one population subgroup for theoretical exposure to tolerance levels of residues on beans, strawberries, and carrots. MOSs were 9 or less for at least two, but not all population subgroups (with sufficient consumption data) for theoretical exposure to tolerance levels of residues on: apples, artichokes, beets, broccoli, Brussels sprouts, cabbage cauliflower, citrus, collards, sweet corn, eggplant, grapes, kale, melons, mustard greens, peaches, pears, plums, raspberries, spinach, turnip tops, and watermelon.

Chronic Exposure: A chronic exposure assessment using residues equal to the established tolerances for individual or combinations of commodities has not been conducted because it is highly improbable, if not impossible, that an individual would chronically consume single or multiple commodities with pesticide residues at the tolerance levels. Support for this conclusion comes from FDA and DPR (formerly California Department of Food and Agriculture) pesticide monitoring programs which indicate that less than one percent of all sampled commodities have residue levels at or above the established tolerance (CDFA, 1990b).

Table 14 - MOS for potential acute dietary exposure to tolerance levels of mevinphos residues for the most highly consumed commodities[1]

Agricultural Commodity	Tolerance (ppm)	Margin of Safety (Range)
apples	0.5	1 - 11
beans	0.25	6 - 45
broccoli	1.0	3 - 9
carrots	0.25	7 - 106
cauliflower	1.0	3 - 27
celery	1.0	12 - 60
cherries	1.0	6 - 163
citrus	0.2	5 - 30
cucumbers	0.2	32 - 219
grapes	0.5	6 - 30
green onions	0.25	48 - 319
lettuce	0.5	16 - 35
melons	0.5	3 - 40
peaches	1.0	1 - 17
peppers	0.25	70 - 403
plums	1.0	2 - 10
potatoes	0.25	10 - 33
strawberries	1.0	9 - 198
summer squash	0.25	20 - 81
sweet corn	0.25	11 - 45
tomatoes	0.2	15 - 50

1/ Based on the 95th percentile of user-days.

VIII CONCLUSION

Occupational

Margins of safety, based on current toxicity data, for mean acute occupational exposure of mixer/loader/applicators associated with ground application and of harvesters working in fruit trees are less than the value conventionally recommended to protect people from the toxic effects of mevinphos. When the mean short term occupational exposures were combined with potential acute dietary exposure, the MOSs for mixer/loaders engaged in aerial applications also become less than the value conventionally recommended to protect people from the toxic effects of mevinphos. MOSs for the 95th percentile of short term worker exposure for all mixer/loader work categories associated with mevinphos application are less than the value conventionally recommended to protect people from the toxic effects of mevinphos.

Margins of safety for chronic occupational exposure, or combined occupational and potential chronic dietary exposure, are greater than the value conventionally recommended to protect people from the toxic effects of mevinphos.

Dietary

The margin of safety for potential acute dietary exposure of non-nursing infants, less than the age of 1, to residues on approximately 45 label-approved commodities was less than the value conventionally recommended to protect people from the toxic effects of mevinphos. All other population subgroups had margins of safety for potential acute dietary exposure which are greater than the value conventionally recommended to protect people from the toxic effects of mevinphos. Margins of safety for potential chronic dietary exposure to mevinphos for all population subgroups were greater than the value conventionally recommended to protect people from the toxic effects of mevinphos.

Tolerances

Twenty-five of the USEPA tolerances for mevinphos on agricultural commodities do not provide margins of safety greater than the value conventionally recommended to protect people from the toxic effects of mevinphos for theoretical acute dietary exposure to one or more population subgroups if commodities are consumed with residues at the tolerance level.

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X APPENDICES

APPENDIX A

Summary of Toxicology Data

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
DEPARTMENT OF PESTICIDE REGULATION
MEDICAL TOXICOLOGY BRANCH

SUMMARY OF TOXICOLOGY DATA

MEVINPHOS

Chemical Code # 000480, Tolerance # 00157
SB 950 # 079

Revised: 5/28/87; 3/5/90; 5/25/90; 4/14/92; 6/26/92
Updated: 3/22/94

I. DATA GAP STATUS

Chronic rat :	No data gap, no adverse effect
Chronic dog :	Data gap, inadequate study, no adverse effect indicated
Onco rat :	No data gap, no adverse effect
Onco mouse :	No data gap, no adverse effect
Repro rat :	No data gap, no adverse effect
Terato rat :	No data gap, no adverse effect
Terato rabbit :	No data gap, no adverse effect
Gene mutation :	No data gap, possible adverse effect
Chromosome :	No data gap, possible adverse effect
DNA damage :	No data gap, possible adverse effect
Neurotox :	No data gap, no adverse effect

Note, Toxicology one-liners are attached

** indicates an acceptable study.
Bold face indicates a possible adverse effect.

File Name: T940322
Revised by M. Silva, 5/25/90; J. Kishiyama & M. Silva, 3/2/92; M. Silva, 6/26/92. Updated: Kellner, 3/22/94.

Rectified with library printout (3/4/94) through volume -070, record 128430.

These pages contain summaries only. Each individual worksheet may contain additional effects.

II. TOXICOLOGY SUMMARY

CHRONIC, RAT

009 034546, "Toxicity Studies on the Organophosphorous Insecticide Phosdrin: 2 Year Oral Experiment with Rats", (Tunstall Laboratory, Shell Research LTD, London, #TLRG.0043.71, October 1971). Phosdrin technical, 60.2% cis-isomer, 39/sex, fed in the diet at 0, 0.5, 1.5, 5.0, and 15.0 ppm; negative control had 78/sex; mean dietary concentrations were calculated to be 74.25% of nominal; interim sacrifices at 6, 12, and 18 months; males 42-58% mortality and females 54-71% - not dose related; no adverse effect noted; UNACCEPTABLE, incomplete, data presented in summary form only; inadequacies exist in individual animal data, dose justification, ophthalmology, hematology, urinalysis and histopathology, not upgradeable. (Shimer, Apostolou 9/23/85, Martz 11/30/86)

006 020019. Summary of 034546 in 009

010 and 013 048723, rebuttal/response to CDFA review of 034546 in 009, (no status change). (Martz 11/30/86)

COMBINED CHRONIC/ONCO, RAT

068 127978 Plutnick, R. "2-Year Chronic Toxicity/Oncogenicity Study in Rats with Mevinphos (MRD-88-331)" (Exxon Biomedical Sciences, Inc., Toxicology Laboratory, East Millstone, N.J., Study #233170C, 1/3/94). Mevinphos technical (purity 85.74%, lot #910072) was administered by oral gavage 5 days/week to 80 Sprague-Dawley Crl:CDBR rats (30/sex/dose 1-year chronic and 50/sex/dose 2-year oncogenicity) at levels of 0, 0.025, 0.35, 0.60/0.70 mg/kg/day (dose lowered in females on day 83 due to overt toxicity); compound-related increase in mortality in high-dose males, apparently due to acute toxicity (ChE inhibition effects), was seen by study termination. Clinical signs immediately after dosing included tremors and exophthalmus. **NOEL (for cholinergic signs) = 0.025 mg/kg/day. High-dose males (chronic; 1-year sampling) had cholinesterase (ChE) activity in plasma, RBC and brain that was 57%, 6% and 53% lower than control, respectively; corresponding females showed reductions of 71%, 8% and 55%, respectively (significant reductions also seen in 0.35 mg/kg/day rats). **ChE NOEL = 0.025 mg/kg/day.** No significant effects on body weight or organ weights; no significant non-neoplastic findings during gross necropsy or histopathologic examinations. **No Adverse Chronic Effects** (no non-ChE related findings at the highest dose tested). Although increased liver adenomas in high-dose males and increased in combined liver adenomas and carcinomas in females achieved statistical significance, the percentages of animals involved were small and the changes were not indicative of a compound-related effect. **No Adverse Oncogenic Effects.** ACCEPTABLE. Kellner, Aldous and Gee, 3/18/94.

051 112087 "Two Year Chronic Toxicity/Oncogenicity Study in Rats (MRD-88-331; Mevinphos," (Interim Report to -068:127978). No Worksheet. M. Silva, 4/14/92.

SUBCHRONIC, RAT

057 119598 "90-Day Subchronic Oral Toxicity Study in Rats with Mevinphos (MRD-88-331): 233170B", (R.T. Keefe, EXXON Biomedical Sciences, Inc., 11/4/92). Mevinphos, purity 89.57% (74.48% a isomer and 15.09% b isomer), was administered by oral gavage to 10 male Crl:CDBR Sprague-Dawley (SD) rats/group at 0, 0.05, 0.50, 1.0, or 1.5 mg/kg/day and 10 females/group at 0, 0.01, 0.05, 0.5 or 0.75 mg/kg for 90 days. Mortality: 5 males in each of the two high-dose groups resulted in reduction of dosage from 1.5 to 1.0 mg/kg at day 36; one female in 0.5 mg/kg group died. Clinical signs included pinpoint pupils in all but the low dose male group and also tremors, oral discharge and ocular discharge in the two highest dose groups. Cholinesterase (ChE) inhibition (plasma and brain) was observed at doses above 0.05 mg/kg. Liver toxicity was indicated with a trend toward increased liver weights (two highest dose male and female) and hepatocellular vacuolation of centrilobular and midzonal hepatocytes in 2 high-dose males. NOEL = 0.05 mg/kg/day (for ChE inhibition and systemic toxicity). These data support the dose levels administered in the 2-year chronic/onco study (-068:127978). No worksheet is needed, since the study did not identify unique toxicological concerns, nor did it show a lower NOEL than the 2-year study. Data were examined by Kishiyama and Kellner, 3/22/94.

CHRONIC, DOG

062 123702 Protocol for "A 52-Week Oral (Capsule) Toxicity Study of Mevinphos in the Beagle Dog" Amvac Chemical Corporation. This submission is the protocol for a 1-year dog chronic study that was scheduled to begin 7/6/93 (final report to be ready by 3/1/95). The sponsor was originally going to proceed with a 90-day dog study prior to the 1-year dog study because of problems with emesis and attaining an MTD. Instead, a preliminary study (single male dog) using a modified feeding/dosing regimen revealed that a dose level of 0.5 mg/kg could be tolerated for 6 consecutive days. Based on this result, Amvac decided to proceed directly to the 1-year study; this study is now in progress. Preliminary data from the first 3 months and during weeks 13 through 26 were submitted in -064:126501 and -070:128430, respectively. No Worksheet. Kellner, 3/21/94.

064 126501 Preliminary report (covering day 0 to 3rd month) for "A 52-Week Oral (Capsule) Toxicity Study of Mevinphos in the Beagle Dog" Amvac Chemical Corp. project #85746. Kangas, L. (9/30/93). The author reported compound-related effects on RBC and plasma cholinesterase (ChE) levels at 4 and 12 weeks. Males at 12 weeks had mean RBC ChE levels of 105%, 112%, 89% and 68% of pretreatment values in the 0, 0.025, 0.25 and 0.50 mg/kg/day groups, respectively. Corresponding female values were 78%, 109%, 55% and 34%, respectively. For male plasma ChE, these values were 103%, 86%, 50% and 36%, and for females they were 99%, 88%, 53% and 43% of the pretreatment levels, respectively. No other compound-related effects were reported; clinical signs consisting of soft feces and emesis were considered incidental. No Worksheet. Kellner, 3/21/94.

070 128430 Preliminary report (covering weeks 13 to 26) for "A 52-Week Oral (Capsule) Toxicity Study of Mevinphos in the Beagle Dog" Amvac Chemical Corp. project #85746. Kangas, L. (1/14/94). The author reported significant ChE inhibition in RBC and plasma in mid- and high-dose animals. Low-dose males also showed significant reductions in ChE activity. Clinical signs consisted of slightly higher incidence of emesis in the high-dose animals, therefore the apparent NOEL (excluding ChE enzyme inhibition) is 0.25 mg/kg/day. Soft feces were seen in all groups (i.e.,

this was considered an incidental finding). No other compound-related effects were reported. No Worksheet. Kellner, 3/21/94.

045 092717, "Range-Finding Study of Mevinphos Administered Orally to Beagle Dogs (Preliminary Study #1)," (V. Reddy, D.W. Arneson, B.W. Maidment, Midwest Research Institute, MRI Project No. 9497-F, 3/26/91). Mevinphos technical (purity = 89.57%) was administered orally in capsules at concentrations of 0 (corn oil), 0.025, 0.05, 0.25 (elevated to 1.0 mg/kg on day 14 of dosing), or 0.50 mg/kg to 2 Beagle dogs/sex/group for three weeks. NOEL = 0.025 (Decreased plasma cholinesterase values of $\geq$ 45% in both sexes at $\geq$ 0.25 mg/kg. Vomiting occurred in both sexes at $\geq$ 0.05 mg/kg. Motor activity decreased at $\geq$ 0.5 mg/kg). These data are supplemental. (Kishiyama & Silva, 1/31/92).

045 092716, "Range-Finding Study of Mevinphos Administered Orally to Beagle Dogs (Preliminary Study #2)," (V. Reddy, D.W. Arneson, B.W. Maidment, Midwest Research Institute, MRI Project No. 9497-F, 3/26/91). This study was initiated to test a split dosing system to reduce emesis and to test specific areas of the brain for cholinesterase activity. Mevinphos technical (89.57% pure) was administered orally in capsules at concentrations of 0 (corn oil) or 0.5 mg/kg/day to 1 Beagle dog/sex/group once daily and to another like set but dosed twice daily (0 and 1.0 mg/kg total/animal/day) for 5 days. Vomiting seemed to be somewhat related to the amount of treatments. Appetite (food consumption) and weight were affected in the twice treated group. Cholinesterase was not significantly affected by mevinphos. (Kishiyama & Silva, 2/5/92).

009 034547, "Toxicology Studies on the Organophosphorous Insecticide Phosdrin, Two Year Oral Dosing Experiment with Dogs", (Tunstall Laboratory, Shell Research LTD, London, #TLGR.0052.71, December 1971). Phosdrin technical, 60.2% cis-isomer, at 0, 0.025, 0.075, 0.25, and 0.75 mg/kg in gelatin capsules in olive oil, 4/sex/group, no consistent dose related effects observed; no adverse effect noted; apparent NOEL 0.025 mg/kg/day (CHE inhibition); UNACCEPTABLE, incomplete; deficiencies include dose level justification, hematology, urinalysis, ophthalmology, individual animal data, and histopathology; not upgradeable. (Shimer, Apostolou 9/23/85, Martz 11/30/86).

006 020018. Summary of 034547 in 009

010 and 013 048724, rebuttal/response to DPR review of 34547 in 009, (no status change). (Martz 11/30/86).

ONCOGENICITY, RAT

See Combined Chronic/Onco Rat (-068:127978)

ONCOGENICITY, MOUSE

** 028 073163, "An Eighteen Month Oncogenicity Feeding Study in Mice with Mevinphos", (Bio/dynamics Inc., Project no. 86-3006, 2/23/89). Mevinphos technical (purity = 100%) mixed in the feed at concentrations of 0 (diet only), 1, 10, or 25 ppm were fed to 50 CD-1 mice/sex/group for approximately 18 months. No adverse effect. NOEL = 10 ppm (transient decrease in body weights for both sexes). NOAEL $\geq$ 25 ppm. Cholinesterase inhibition was not measured.

Dose selection was based on a 3 month study. ACCEPTABLE. (Kishiyama & Silva, 3/1/90).

REPRODUCTION, RAT

** 050 111291 "Multi-Generation Rat Reproduction Study MRD-88-331: Mevinphos," (Beyer, B.K., Exxon Biomedical Sciences, Inc., ID#: 233135, 11/26/91). Mevinphos technical was administered via oral intubation (7 days/week) to Crl:CD BR VAF/Plus Sprague-Dawley rats (35/sex/group) at 0 (reverse osmosis water), 0.05, 0.1 and 0.5 mg/kg for 2 generations (1 litter/generation). Reproduction NOEL = 0.1 mg/kg (There were decreased numbers of corpora lutea in P2 dams at 0.5 mg/kg.) Chronic NOEL = 0.1 mg/kg (P1 females at 0.5 mg/kg showed ataxia, coarse and fine tremors, oral discharge and pinpoint pupils. There was a significant decrease in ovaries/body weight at 0.5 mg/kg.) Pup NOEL = 0.1 mg/kg (There was a significant decrease in mean pup weights on day 21, survival indices for days 1, 4 and 14 and the lactation index in the P1 generation. There was a significant decrease in male pup weights on day 21 and in day 4 survival index in the P2 generation.) Cholinesterase NOEL = 0.1 mg/kg (Plasma (44-60%) and brain (41-51%) cholinesterase were inhibited at 0.5 mg/kg in both sexes for both generations.)
No adverse effect. The study is acceptable. M. Silva, 2/20/92.

NOTE: A disclosure statement for possible adverse effects was submitted by the registrant (January 18, 1991) in reference to results observed in a range-finding study (no record #, ID # SBC-126884-E). In light of the results of the definitive rat reproduction study (no adverse effects), this document does not need to be further addressed (no worksheet). M. Silva, 2/20/92.

009 034549, "3-Generation Reproduction Study of Phosdrin Insecticide in Rats", (Hill Top Research, Inc., Miamiville, Ohio, #P-5, 10/24/67). Phosdrin Insecticide, 60% alpha isomer and 40% related compounds; at 0, 1.2, and 24 ppm in Purina Lab Chow to 10 males/group and 2 females/group for 3-generations, 2 litters/generation; no adverse reproductive effect reported; NOEL $\geq$ 24 ppm (nominal), UNACCEPTABLE, incomplete; lack of toxicity at high dose, poor pup survival in F2b control and treated groups; does not include analysis of diet, dose level justification, and complete histopathology data; not upgradeable. (Shimer, Parker 9/24/85, Martz 11/30/86).

006 955232. Summary of 034549 in 009.

010 and 013 048726, rebuttal/response to DPR review of 034549 in 009 (no status change). (Martz 11/30/86).

TERATOLOGY, RAT

**016 055833, "Mevinphos - A Teratology Study in Rats with Mevinphos", (Bio/dynamics Inc., 85-3009, March 2, 1987). Mevinphos technical, lot 50826, 12/18/85, administered by gavage in distilled water to groups of 24 mated Sprague-Dawley rats at levels of 0, 0.2, 0.75, and 1.00 mg/kg on days 6 - 15 of gestation. The initial high dose group, 1.25 mg/kg/day was terminated due to excessive maternal toxicity (tremors and salivation) was observed at 0.75 and 1.00 mg/kg/day, Maternal NOEL = 0.2 mg/kg/day. There was no evidence of developmental toxicity at any dose level, Developmental NOEL > 1.00 mg/kg/day. ACCEPTABLE, no adverse effect. (J. Parker, 4-28-87)

015 055832. Range finding study for 055833.

TERATOLOGY, RABBIT

** 042 096691, "Teratology Study in Rabbits (MRD-88-331: Mevinphos)", (B. K. Beyer, Exxon Biomedical Sciences Inc., Laboratory Project I.D. 233134RB, 2/22/91). Mevinphos (89.57% pure), administered by oral gavage at concentrations of 0, 0.05, 0.5 and 1.5 mg/kg/day to artificially inseminated New Zealand White rabbits (20/group) on days 7 through 19 of gestation. **Maternal NOEL =** 0.5 mg/kg (There was a significant decrease in body weight gain at 1.5 mg/kg.) **ChE NOEL =** 0.05 mg/kg (There was a significant decrease in plasma and RBC ChE at $\geq$ 0.5 mg/kg.) **Developmental NOEL =** 1.5 mg/kg (No significant effects were observed at any dose level.) Maternal body weight gains were decreased, but no other toxic effects were observed. Decreases in plasma and RBC cholinesterase were measured without cholinergic signs. Although there was little evidence of maternal toxicity, the dose selection for this study was justified, based upon the pilot. Originally reviewed as unacceptable (Silva, 2/6/92). Upon submission and review of stability data, recomputed data from Table 3, historical control data for fetal malformations and variations and information on pregnancy status of animal HEB054, the study has been upgraded to acceptable status, with no adverse effect indicated. In addition, the cholinesterase data were re-examined and the NOEL was adjusted to 0.05 mg/kg, based on plasma ChE inhibition. M. Silva, 6/17/92.

009 034548 "Toxicity Studies With Phosdrin: Teratological Studies in Rabbits Given Phosdrin Orally," (Dix, K.M. and McCarthy, W.V., Tunstall Laboratory and the Statistics Unit of Sittingbourne Research Centre, Shell Research LTD, London, #TLGR.0016.74, 4/74). Phosdrin (purity = 71.6%/17.1% 2-methoxycarbonyl-1-methylvinyl dimethyl phosphate in E/Z forms; batch #ADC/73/5) was administered in gelatin capsules to mated Dutch rabbits (30--control and 20/dose group) at 0 (corn oil), 0.3 and 1.0 mg/kg/day during days 6-18 of gestation. Maternal NOEL = 0.3 mg/kg (7/20 rabbits at 1.0 mg/kg exhibited occasional mild tremors, salivation and signs of organophosphate toxicity, shortly after dosing--no summary table, no individual data). **Developmental NOEL** $\geq$ 1.0 mg/kg (No significant teratogenic effects were reported at any dose.) This study is not acceptable and not upgradeable (deficiencies are too numerous to list in the one-liner). A. Apostolou (9/23/85), F. Martz (11/30/86) and M. Silva, (3/25/92).

006 020017. Summary of 034548 in 009.

010 and 013 048725, rebuttal/response to CDFA review of 034548 in 009; possible status change, study may be acceptable/upgradeable if more information is supplied. (Martz, 11/86).

MUTAGENICITY, GNMU

** **034 085454**, "CHO/HGPRT Mutation Assay with Confirmation with Mevinphos", (Microbiological Associates Inc., Laboratory Study No. T8858.332001, 11/9/89). Mevinphos (purity = 74.48% alpha isomer and 15.09% beta isomer) was tested with Chinese Hamster ovary cells (CHO-K$_1$-BH$_1$) at concentrations of 0.1, 0.4, 0.6, 0.8, 1.0 µl/ml without S-9 activation and at 0.1, 0.6, 1.2, 1.8, or 2.4 with Arochlor-induced rat liver S-9 (exposure = 5 hours) in an initial study. In another study the cells were tested with mevinphos at 0.5, 0.6, 0.7, 0.8, 0.9, or 1.1 without S-9 and 0.6, 0.9, 1.2, 1.4, 1.6, or 1.8 µl/ml with S-9 in a repeat assay. **Adverse effect** (the number of mutant/10^6 clonable cells, without

S-9 increased at 1.0 µl/ml in the initial test and at 0.9 µl/ml in the repeat test). Relative cloning efficiency averaged 16-20% and 42% for mevinphos doses at 1.0 and 0.9 µl/ml, respectively. ACCEPTABLE. (Kishiyama & Silva, 2/26/90).

** **030 087669**, "Salmonella/Mammalian-Microsome Plate Incorporation Mutagenicity Assay (Ames Test) with A Confirmatory Assay with Mevinphos", (Microbiological Associates, Inc., Laboratory study No. T8858.501014, 10/23/89). Mevinphos (purity = 74.48% alpha isomer, 15.09% beta isomer) was used at concentrations of 0 (deionized water), 100, 1000, 3333, 6667 or 10000 µg/plate exposures to *Salmonella typhimurium* strains TA98, TA100, TA1535, TA1537 and TA1538 with and without metabolic activation (S-9 Mix) for 48 hours. **Adverse effect.** An increase in TA100 revertant colonies was observed at ≥ 3333 ug/plate both with and without S-9. ACCEPTABLE. (Kishiyama & Silva, 2/28/90).

009 034551, "The Mutagenic Effect of Organophosphate Insecticides on Escherichia coli", (Tunstall Laboratory, Shell Research LTD, London, #TLGR.0034.71, August, 1971). Phosdrin, 67.3% W cis-isomer, plate incorporation assay with E. coli B/r WP2 in triplicate seeded at $9x10^8$/plate; no reverse mutation reported; UNACCEPTABLE, incomplete, summary information only; no data - results as "-" only, lacks dose level selection and justification and control information. (Green, Parker 5/13/87).

006 035764. Summary of 034551 in 009.

MUTAGENICITY, CHROMOSOME

**** 035, 036 090374, 086427** "Chromosome Aberrations in Chinese Hamster Ovary (CHO) Cells With Mevinphos," (Microbiological Associates, Inc., 1/18/90). Mevinphos technical (purity = 76% alpha isomer; 13.5% beta isomer) was used in a chromosome aberration assay using Chinese hamster ovary cells at 0 (vehicle = culture medium or water), 0.04, 0.08, 0.15, 0.3 and 0.6 ul/ml (without S-9; 18 hour treatment in duplicate) and 0.13, 0.5, 1.0 and 2.0 ul/ml (with S-9; 2 hour treatment in duplicate). A repeat assay was performed without S-9 at 0.15, 0.21, 0.30 and 0.42 ul/ml Mevinphos. **Possible adverse effect.** The percentage of Mevinphos treated cells (no S-9) with chromosome aberrations was significantly increased over the controls at ≥ 0.15 ul/ml. This worksheet was revised with the addition of CDFA volume/record #: 036/086427 which contains an analysis of technical Mevinphos (no separate worksheet). ACCEPTABLE. M. Silva, 5/18/90.

009 034550, "Toxicity Studies with Phosdrin: Dominant Lethal Assay in Male Mice after a Single Oral Dose of Phosdrin", (Tunstall Laboratory, Shell Research LTD, London #TLGR.0031.74, July, 1974). Phosdrin, methyl 3-(dimethoxy phosphinyloxy) crotonate, E-isomer 70.0%, batch no. ACD 73/69; single oral dose in water at 0, 1.5, 3.0, and 6.0 mg/kg to males 12/group, mated 1 male/3 females/week for 8 weeks; females sacrificed 13 days after mating; no dominant lethal effects reported; no adverse effect noted; UNACCEPTABLE, not upgradeable; deficiencies include no MTD, no concurrent historical or positive control, and no individual data. (Shimer, Remsen 9/25/85).

006 035763. Summary, insufficient information for evaluation.

006 955233. Summary of 034550 in 009.

010 and 013 048727, rebuttal/response to CDFA review of 034550 in 009, (no status change). (Martz 11/30/86).

009 034555, "Toxicity Studies with Phosdrin: Chromosome Studies on Bone Marrow Cells of Mice after Two Daily Oral Doses of Phosdrin", (Tunstall Laboratory, Shell Research LTD, London, #TLGR.0008.74, February 1974). Phosdrin E-isomer 70.0%, batch no. ACD 73/69 dosed twice orally on 2 consecutive days in water 8/sex/group at 0, 1.5, and 3.0 mg/kg, positive control of 100 mg/kg cyclophosphamide; colcemid 90 minutes prior to sacrifice, sacrificed at 8 and 24 hours after dosing 100 cells/animal; no bone marrow chromosomal aberration reported; UNACCEPTABLE, not upgradeable. (Shimer, Remsen 9/25/85).

010 and 013 048728, rebuttal/response to CDFA review of 034555 in 009, (no status change). (Martz 11/30/86).

MUTAGENICITY, DNA

** 035, 036 090373, 086427 "Unscheduled DNA Synthesis in Rat Primary Hepatocytes With Mevinphos," (Microbiological Associates, Inc., 1/25/90; Study #: T8858.380). Mevinphos technical (purity = 76.34% alpha isomer; 13.5% beta isomer) was used in a UDS assay on primary rat (Fischer 344 or Sprague-Dawley) hepatocytes at 0 (vehicle = William's Medium E), 0.0003, 0.001, 0.003, 0.01, 0.03, 0.06, 0.1, and 0.3 ul/ml for 18-20 hours (3 plates/dose + [3-H]Thymidine at 10 uCi/ml/plate). A parallel cytotoxicity test was also performed (3 plates/dose). After treatment, cells were placed on coverslips and slides were prepared (50 cells/slide were scored; 3 slides/dose). No adverse effect. No increase in UDS was observed at any dose. This worksheet was revised with the addition of CDFA volume/record #: 036/086427 which contains an analysis of technical Mevinphos (no separate worksheet). ACCEPTABLE. Volume 036/086427 contains an analysis of Mevinphos technical. M. Silva, 5/18/90.

009 034552, "Toxicity Studies with Phosdrin: Effect of Phosdrin on Micro-Organisms in the Host-Mediated Assay and in vitro", (Tunstall Laboratory, Shell Research LTD London, #TLGR.0067.74, November 1974). Technical Phosdrin, 81.9% E-isomer of methyl 3-(dimethoxyphosphinoxy) crotonate; spot test on plates with Serratia marcescens; NTG as positive control; no reversion reported; no data, summary only; UNACCEPTABLE, not upgradeable. (Shimer, Remsen 9/25/85).

009 034553, "Toxicity Studies with Phosdrin: Effect of Phosdrin on Micro-Organisms in the Host-Mediated Assay and in vitro", (Tunstall Laboratory, Shell Research LTD, London, #TLGR.0067.74, November 1974). Technical Phosdrin, 81.9% E-isomer of methyl 3-(dimethoxyphosphinoxy) crotonate, in vitro study in triplicate with Saccharomyces cerevisiae at 0, 0.2, 1, 2, and 4 mg/ml NTG positive control; at 1 mg/ml increase in conversion rate at adenine locus after 24 hour incubation; summary data only; **possible adverse effect** (genotoxicity); UNACCEPTABLE, not upgradeable. (Shimer, Remsen 9/25/85).

009 034554, "Toxicity Studies with Phosdrin: Effect of Phosdrin on Micro-Organisms in the Host-Mediated Assay and in vitro", (Tunstall Laboratory, Shell Research LTD, London, #TLGR0067.74, November 1974). Technical Phosdrin 81.9% E-isomer of methyl 3-(dimethoxyphosphinoxy) crotonate, host-mediated assay in triplicate, male CF-1 dosed orally at 0, 1.5, and 3.0 mg/kg, EMS positive control; Saccharomyces cerevisiae D4 injected; sacrificed at 5 hours; tryptophan and adenine plate assay, no positive effects reported; no adverse

effect noted; summary data only, UNACCEPTABLE, not upgradeable. (Shimer, Remsen 9/25/85).

006 035762. Summary of 034552, 034553, and 034554 in 009.

NEUROTOXICITY, HEN

010 048729. Rebuttal to 034556, in 009, status change: report acceptable with major deficiencies.

** 053 114192 "Acute Delayed Neurotoxicity Study in Mature Hens With Mevinphos," (Barrett, D.S., Bio/dynamics Inc., Department of Toxicology, East Millstone, NJ, 7/26/88). Mevinphos technical (no purity given, batch #50826) was administered by gastric intubation to White Leghorn pullet hens at 0 (distilled water, 6 hens), 12.5 mg/kg (10 hens) and positive control animals were given TOCP at 750 mg/kg (4 hens) on days 0 and 21 of the study. Mevinphos treated animals received 5-17 s.c. injections of Atropine (0.625 mg/kg) during the 48 hours after dosing. An injection of 2-PAM (10 mg/kg/injection) was administered s.c. at approximately 5 & 11 hours after the 2nd dose of mevinphos. The positive control was TOCP (750 mg/kg). NOEL Delayed Neurotoxicity > 12.5 mg/kg (No significant neurotoxic effects occurred at the given dose.) No adverse effect. Acceptable. M. Silva, 6/23/92.

**009 034556, "Toxicity Studies on the Organophosphorus Insecticide Phosdrin: An Investigation of the Potential Neurotoxicity of Technical Phosdrin", (Tunstall Laboratory, Shell Research LTD, London, #TLGR.0047.72, November, 1972). Technical Phosdrin (purity 60.2% cis-isomer), 0 or 7.5 mg/kg (~LD50) by oral gavage once on day 1 and 23 with sacrifice on day 43, TOCP positive control, atropine and protopam protection; no clinical signs of delayed neurotoxicity in phosdrin group; 3/6 phosdrin hens died after second dose; 1 dead and 3 survivors examined histologically no evidence of delayed neurotoxicity found. Previously reviewed (AA, 9/23/85) unacceptable and not upgradeable. Rebuttal accepted, repeat of study would not provide additional information. Report ACCEPTABLE with major deficiencies. (F. Martz, 12/2/86).

NEUROTOXICITY, RAT

066 126747 Lamb, I. "An Acute Neurotoxicity Study of Mevinphos in Rats" (WIL Research Laboratories, Inc., Ashland, Ohio; WIL Study # 188006, 10/13/93). Mevinphos technical (lot # 910072, 86.55% purity) was administered in a single oral dose to 27 Sprague-Dawley Crl:CD® BR rats/sex/dose (except for the 0.025 mg/kg group which had 17/sex) at levels of 0, 0.025, 0.1, 2.0 and 3.5 mg/kg. Compound related deaths included 1 male and 5 females (3.5 mg/kg); no body weight effects were noted. Clinical signs (45-min. after dosage) in the 2.0 and 3.5 mg/kg groups included gait alteration, tremors, salivation, exophthalmus and lacrimation. Plasma cholinesterase (ChE) reductions ranged from 36-39% of control in the 2.0 mg/kg group and 41-50% in the 3.5 mg/kg group. Brain ChE (brain stem and/or cerebral cortex, hippocampus and olfactory region) ranged from 20-25% of control in the 2.0 mg/kg group and from 19-36% in the 3.5 mg/kg group; no appreciable RBC ChE reductions were reported. **Possible Adverse Effects:** For Functional Observation Battery (FOB) during day 0, home cage observations included altered posture, clonic convulsions and tremors primarily in the high-dose rats. Handling observations (FOB): lacrimation, salivation, decreased respiratory rate (and/or gasping), red deposits (nose and mouth) and changes in eye prominence. Open field

observations: impaired mobility and gait, clonic and tonic convulsions, tremors, bizarre and/or stereotypic behavior, decreased arousal and decreased rearing counts. Sensory observations: air righting reflex (and approach), touch, startle, tail pinch, pupil and eyeblink reponses. Neuromuscular observations: reduced hindlimb resistance and forelimb grip strength rotarod performance. Physiological observations: increased catalepsy values and decreased body temperatures; no significant findings during subsequent FOB observations. Reductions in mean ambulatory and total motor activity were noted on Day 0 in the 2.0 and 3.5 mg/kg dosage groups. NOEL = 0.1 mg/kg for ChE inhibition and neurobehavioral effects. ACCEPTABLE. Kellner and Gee, 2/15/94.

065 126746 Lamb, I. "A Range-Finding Acute Study of Mevinphos in Rats" (WIL Research Laboratories, Inc., Ashland, Ohio; WIL Study # 188005, 10/12/93) was a range-finding study for the acute neurotoxicity study -066:126747. The data support the dose range used. No Worksheet. Kellner, 3/21/94.

SUPPLEMENTAL STUDIES

053 114188 "21-Day Repeated Dermal Study in the Rabbit," (Trimmer, G.W., Exxon Biomedical Sciences, Inc., NJ, 4/4/90, MRD-88-331). Mevinphos technical (89.57% pure, Batch #1) was administered to New Zealand White rabbits (5/sex/dose) on clipped unabraded skin (5 days/week for 3 weeks--6 hr exposure) at 0, 0.1, 1.0 and 10.0 mg/kg. Cholinesterase determinations were performed on all animals (RBC, plasma and brain). Dermal NOEL > 10.0 mg/kg (No effects at any dose.) ChE NOEL = 1.0 mg/kg (Plasma, RBC and brain cholinesterase levels were significantly inhibited at 10.0 mg/kg). Possible adverse effect: Significant inhibition of brain cholinesterase. M. Silva, 6/17/92.

APPENDIX B

Occupational Exposure Assessment

ESTIMATION OF EXPOSURE OF PERSONS IN CALIFORNIA TO PESTICIDE PRODUCTS THAT CONTAIN MEVINPHOS

By

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HS-1653, September 28, 1992
First Revision, May 17, 1993
Second Revision, March 7, 1994

California Environmental Protection Agency
Department of Pesticide Regulation
Worker Health and Safety Branch
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ABSTRACT

Mevinphos is a highly acutely toxic organophosphate insecticide that is used on a variety of crops, mainly vegetables. There were 438 cases of suspected systemic illness associated with exposure to mevinphos or tank mixes containing mevinphos in California during 1982 to 1989. Drift accounted for 61 percent of all the illnesses. Mevinphos residues dissipate rapidly from the foliage of crops following application. Mevinphos is rapidly absorbed, metabolized, and excreted after oral or intravenous administration in animals. Dimethyl phosphate (DMP) is a primary metabolite. A dermal absorption of 16.8 percent was estimated based on a mevinphos dermal absorption study in rats. The Absorbed Daily Dosage (ADD) of mixer/loader/applicators using ground rigs was estimated at 3.8 µg/kg/day. The ADDs for pilots, mixer/loaders and flaggers for aerial application were estimated at 0.5 µg/kg/day, 2.4 µg/kg/day and 0.04 µg/kg/day, respectively. Field workers' exposure estimates ranged from negligible to 11.0 µg/kg/day.

This exposure assessment was prepared to be included in the Department risk characterization document for mevinphos because of a low NOEL observed for cholinergic effects in laboratory animals and in humans.

Department of Pesticide Regulation
Worker Health and Safety Branch

Human Exposure Assessment

Mevinphos

September 28, 1992
First Revision, May 17, 1993
Second Revision, March 7, 1994

PHYSICALICHEMICAL PROPERTIES

Mevinphos, methyl 3-[(dimethoxyphosphinyl)oxyl-2-butenoate is a colorless liquid (molecular formula $C_7H_{13}O_6P$; CAS #7786-34-7). Phosdrin® and Duraphos® are its trade names. The technical material contains at least 60 percent of the alpha (cis) isomer. It is miscible in water and several organic solvents except hexane.

Boiling Point (0.03 mm Hg)	99 - 103 ^{o}C
Vapor Pressure (25 ^{o}C)	0.0029 mm Hg

Based on the vapor pressure cited above the primary physical form of inhalation exposure for handlers of mevinphos will be as a vapor.

U.S. EPA STATUS

In 1988, the US Environmental Protection Agency (U.S. EPA) issued guidance for the reregistration of mevinphos containing pesticide products. Numerous data gaps were identified. The U.S. EPA also expressed its concerns over the risk posed by the use of mevinphos to handlers and field workers. The Agency reserved consideration of a special review of mevinphos at that time until the data became available; however, mevinphos is currently under U.S. EPA's review.

FORMULATIONS

As of February 8, 1993, there were four mevinphos-containing products registered in California. These are all liquid concentrate/emulsifiable concentrate formulations. One product contains 100 percent mevinphos, which is equivalent to 10.3 pounds (lb.) of mevinphos/gallon. The other three products contain mevinphos in the range of 47 to 50 percent by weight, approximately four lb. of active ingredient (a.i.) per gallon of the product.

USAGE

Mevinphos is used as a broad-spectrum insecticide/acaricide on a variety of vegetable, fruit, and field crops. It is used primarily as a short residual foliar insecticide to "clean up" crops just prior to harvest. Mevinphos can be applied by air or ground power equipment. All product labels, except Phosdrin® 4 EC, prohibit the use of handheld application equipment. Mevinphos must be used through a closed mixing/loading system in California (Title 3, CAC).

A total of 333,790 lb. of mevinphos was used in California in 1990, primarily on vegetable crops (PUR, 1992). Approximately one-half of this amount was used on lettuce. Other mevinphos use crops are shown in Table 1.

Table I

Mevinphos Major Use Crops in California in 1990

Crop	Pounds a.i.	Percent
Lettuce	169,588	50.8
Cauliflower	34,378	10.3
Broccoli	29,325	8.8
Celery	18,650	5.6
Alfalfa	13,954	4.2
Grapes	10,491	3.1
Other	57,404	17.2
Total	333,790	100.0

Formoli, WH&S, 1992

The application rates are 0.25 to 1.0 lb. a.i./acre for vegetable crops, 1.0 to 3.25 lb. a.i./acre for fruit, and 0.5 lb. a.i./acre for forage and grain crops. Mevinphos is a restricted use pesticide because of its high acute toxicity to humans. Therefore, it is for retail sale to and use only by certified applicators or persons under their supervision.

LABEL PRECAUTIONS

All mevinphos-containing products are toxicity category 1, carrying the signal word "Danger-Poison". These products are poisonous if ingested, inhaled, or absorbed through the skin. Mevinphos is rapidly absorbed through the skin. Repeated inhalation or skin contact may, without symptoms, progressively increase susceptibility to mevinphos poisoning. The following protective clothing and equipment must be worn during application, repair and cleaning of equipment, and disposal of mevinphos:

1. Protective suit of one or two pieces, made of cloth or chemical resistant material, that covers all parts of the body except head, hands, and feet (worn over normal work clothing).
2. Chemical resistant gloves.
3. Chemical resistant shoes, or shoe coverings, or boots.
4. Goggles or face shield.
5. Hood or wide brimmed hat.
6. NIOSH/MSHA approved respirator.

The following protective clothing and equipment must be worn during mixing/loading:

1. Long-sleeved shirt and long-legged pants.
2. Chemical resistant gloves.
3. Chemical resistant apron.
4. Shoes and socks.
5. Goggles or face shield when the system is under pressure.

If application is made using an enclosed cab or cockpit the following clothing and equipment must be worn as an alternative:

1. Long-sleeved shirt and long-legged pants.
2. Shoes and socks.
3. Chemical resistant gloves must be available in the cab or cockpit, and must be worn during entry to and exit from the application vehicle. For ground application, all other protective clothing and equipment required for use during application must be available in the cab and must be worn when exiting the cab into treated areas.

Human flaggers are strictly prohibited during aerial application unless they are in a totally enclosed vehicle. Reentry to treated citrus, grapes, peaches and nectarines is prohibited for 4 days. The reentry interval for other treated crops is two days (Title 3, CAC).

WORKER ILLNESSES

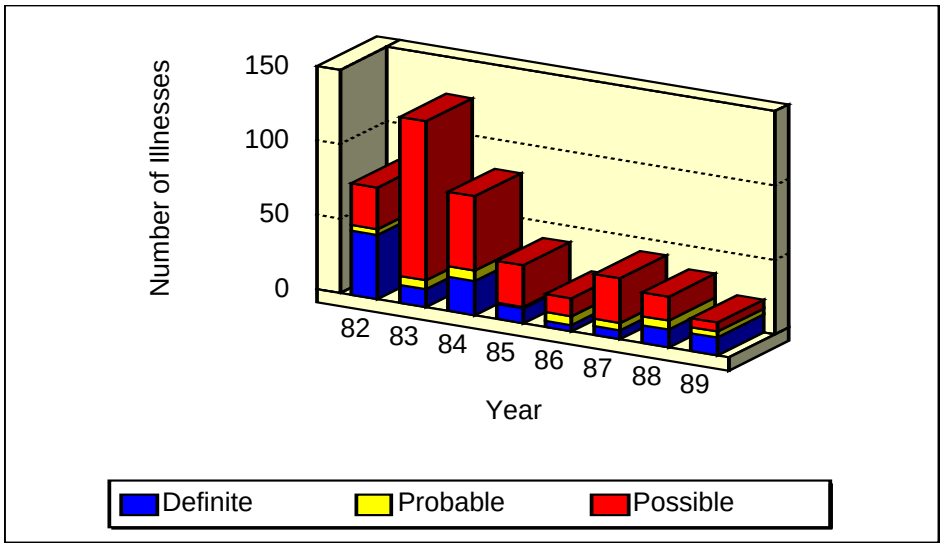
Of the 578 illnesses reported that might be due to exposure to mevinphos alone and mevinphos tank mixed with other cholinesterase inhibiting pesticides, there were 122 definite, 38 probable, 278 possible, and 140 unlikely/unrelated/no symptom cases during 1982 to 1989. The number of cases in definite, probable, and possible categories is shown in Figure 1. A statistical analysis of trend for these cases using Sen's nonparametric test (Gilbert, 1987) indicates a significant (α=0.1) downward trend with an estimated slope of -11.6 (regardless of use trend). The downward trend is marginally but still significant at $\alpha = 0.05$. The Mann-Kendall nonparametric test for trend also supports the conclusion drawn from Sen's test but the later test is preferred when no data are missing (Gilbert, 1987). Even where the estimate of trend is assumed to have a parametric type distribution, the linear regression analysis still indicates a noticeable decline (α= 0.05) in cases, with a regression coefficient of 11.4 and $r = 0.78$.

There were 438 cases of suspected systemic illness associated with exposure to mevinphos in California during 1982 to 1989. Of these cases, 109 identified mevinphos as the primary pesticide and 329 involved exposure to mixtures of mevinphos and other cholinesterase inhibitors. There were 102 cases involving one or more days of hospitalization and 278 cases involving one or more lost workdays. Of the 438 cases, 267 cases resulted from drift exposure, 70 cases were associated with application, 52 cases from field residue, 37 cases from direct exposure, and 12 cases from miscellaneous exposure (O'Malley, 1992).

Drift accounted for 61 percent of all illnesses, mostly as a result of tank mixes. Most of the drift cases were associated with a foul odor due to the organophosphate pesticides tank mixed with mevinphos. Mixer/loader/applicators accounted for 16 percent of all illnesses. Most of the mixer/loader/applicator cases involved direct exposure (O'Malley, 1992).

Figure 1

Mevinphos Yearly Illness Trend In Definite, Probable, and Possible Categories*



- - O'Malley, 1992

DERMAL ABSORPTION

Preliminary data from a mevinphos dermal absorption study in rats indicate rapid absorption in all tested dose levels (Jeffcoat 1993). ^{14}C-mevinphos (vinyl) was applied to the back skin of rats at dose levels of 12.5, 2.5, and 0.4 µg/cm^2. The administered skin area was protected by a non-occluding device equipped with a charcoal-impregnated covering to absorb evaporating mevinphos. The administered skin area was washed just prior to sacrifice or at ten hours after the dose application, whichever occurred first. A group of four rats were sacrificed at six, ten, 24, and 48 hours after the dosing for each dose level. For the low dose level, a group of four animals were also sacrificed at 72 hours after the dosing. Urine, feces, cage wash, expired air,

blood, carcass, administered skin site, skin wash, and protective coverings and traps were analyzed for radioactivity. Radioactivity levels remained fairly unchanged in all media that were collected at six, ten, 24, 48, or 72 hours after the dosing, indicating a saturation point at six hours. The administered skin site contained 33 and 32 percent of the applied radioactivity six and 48 hours after the dosing, respectively. There was no evidence of bioavailability of ^{14}C-mevinphos bound to the administered skin site six hours after the dosing. The sum of radioactivity found in urine, feces, cage wash, expired air, blood, and carcass at 48 hours after the dosing was 15.4 percent of the administered dose. A dermal absorption rate of 16.8 was obtained after a correction for a 92 $\pm$2 percent recovery observed in the study. A dermal absorption rate of 16.8 percent will be used in this document.

METABOLISM

Early metabolism studies have shown that mevinphos is rapidly metabolized and excreted by cows administered mevinphos orally (Casida *et al.,* 1958). The elimination was mostly in urine. DMP was the main metabolite from both alpha and beta isomers of mevinphos, together with small amounts of free carboxylic acid of mevinphos.

Metabolism of mevinphos was also studied in Sprague-Dawley rats (Reddy *et al.,* 1991). Rats were administered a single dose of ^{14}C-vinyl-mevinphos orally (0.15 mg/kg, 1.5 mg/kg), a single dose intravenously (0.15 mg/kg), or a multiple (16 days) dose orally. Most of the radioactivity was eliminated within eight hours of oral or intravenous administration. After 24 hours, 61% to 78% and 14% to 24% of the administered dose was eliminated in the exhaled air ($^{14}CO_2$) and in urine, respectively. Radioactivity in the feces accounted for only 0.5% to 1.4% of the administered dose. The level of radioactivity in all tissues together ranged from 5.4% to 7.5% of the administered dose. Urinary metabolites were identified as O-desmethyl mevinphos acid, O-desmethyl mevinphos, mevinphos, and unknown, comprising approximately 18% of the administered dose. The authors suggested that mevinphos hydrolysis yields acetoacetate which is ultimately converted to $^{14}CO_2$. Hydrolysis would release an equal amount of DMP. The suggested metabolic pathway of mevinphos in rats is shown in Figure 2.

DISLODGEABLE FOLIAR RESIDUE

The Worker Health and Safety Branch conducted a study in 1984 in Salinas, California to monitor dislodgeable foliar residues (DFR) of the alpha isomer of mevinphos on lettuce cauliflower, and Chinese cabbage (Maddy et al., 1985). Mevinphos (Phosdrin® 4E) was used in tank mixes with other pesticides. The rates of application were 0.5 lb. a.i./acre on head lettuce, 0.25 lb. a.i./acre on Chinese cabbage, and 1.0 lb. a.i./acre on cauliflower and leaf lettuce. The pesticides were diluted in 60 to 100 gallons of water per acre and applied using ground rigs with boom sprayers. Leaf samples were collected prior to the application and at several intervals following the applications of mevinphos. Samples were kept on ice and delivered to a mobile laboratory within one hour of collection. Foliar residues were dislodged using a water/dioctyl sodium sulfosuccinate solution and extracted from this aqueous solution into an organic solvent.

Residues were analyzed using a gas-liquid chromatograph. A linear regression from the observed residues was developed for each crop and is shown in Table 2.

Table 2

Dislodgeable Foliar Residues of the Alpha Isomer of Mevinphos on Lettuce, Cauliflower and Chinese Cabbage during 1984 in Salinas

	Predicted Dislodgeable Foliar Residues ($\mu g/cm^2$)				
	Lettuce		Cauliflower		Chinese
	Leaf	Head	Mature	Young	Cabbage
Initial Deposition	0.363	0.239	0.086	0.161	0.666
At 48 hours Post Application	0.036	0.009	0.019	0.029	0.122
At Harvest	**neg.**	**0.009**	**0.009**	**0.012**	**0.122**
PHI (days)	7-10	2-4	3	3	2-3
$t_{1/2}$ (hours)	14	10	22	20	20
r^2	0.69	0.82	0.88	0.76	0.71
n	12	18	27	27	12

PHI - Preharvest Interval
n - number of samples
neg - negligible (<0.0001 $\mu g/cm^2$)

Formoli, WH&S, 1992

The dissipation of mevinphos on lettuce, cauliflower, and celery was monitored by Worker Health and Safety Branch in the summer and fall of 1990 (Spencer *et al.,* 1991). In general, dissipation was rapid. All June applications were made by helicopter and the October applications were made by either helicopter or ground rig. Mevinphos was used at a rate of 0.25 to 0.5 lb. a.i./acre. Samples were taken prior to the application and at several intervals post-application. The samples were extracted within a few hours and stored frozen until delivery to the laboratory. Dislodgeable foliar residues of both isomers (alpha and beta) of mevinphos were summed and reported. The reported data were analyzed using linear least squares regression on the natural log of the total residues versus time of post-application. The results are shown in Table 3.

Table 3

Dislodgeable Foliar Residues of Both Alpha and Beta Isomers of Mevinphos on Lettuce Cauliflower, and Celery during 1.990 Seasons in Monterey County

	Predicted Dislodgeable Foliar Residues (µg/cm²)					
	Lettuce		Cauliflower		Celery	
	June	Oct.	June	Oct.	June	Oct.
Initial Deposition	0.066	0.027	0.304	0.160	0.051	0.074
At 48 hours post application	0.016	0.006	0.155	0.025	0.018	0.009
At harvest	**0.016**	**0.006**	**0.111**	**0.010**	**0.011**	**0.003**
PHI (days)	2-4	2-4	3	3	3-5	3-5
$t_{1/2}$ (hr)	23	22	50	18	31	16
r^2	0.55	0.15	0.54	0.84	0.59	0.75
n	133	133	50	50	36	36

Formoli, WH&S, 1992

No mevinphos DFR studies are available in the Department of Pesticide Regulations (DPR) files on grapes or other fruit crops. Use of mevinphos on grapes contributed 3.1 percent to the total use reported for 1990. The use on other fruit crops is very limited. The DFR on grapes and fruit trees were assumed to be equivalent to those of vegetable crops. The assumed DFR value (geometric mean) at the expiration of reentry interval was adjusted for maximum labeled application rate of 1 lb. a.i./acre for grapes, 2.5 lb. a.i./acre for citrus peaches and nectarines, and 3.25 lb. a.i./acre for apples. The adjusted DFR values at reentry were 0.006 µg/cm² for gapes, 0.014 µg/cm² for peaches, nectarines, and citrus, and 0.15 µg/cm² for apples.

WORKER EXPOSURE

Ground Application

A mevinphos mixer/loader/applicator exposure study monitored daily (24-hr) DMP urinary excretion of 45 workers for six days during the peak use season in 1992 in Salinas, California (Krieger *et* al., 1993). This study was determined scientifically flawed and inappropriate for exposure assessment of mevinphos (Whalan, 1993; O'Malley, 1993; Fukuto, 1993; Oshima, 1993, Sanborn, 1993). There is no other mevinphos ground handler exposure studies available. Surrogate data are used as an alternative to estimate ground mixer/loader/applicators exposure to mevinphos. Because of the critical factors that must be considered in use of appropriate surrogate data, the choices are very limited. A study that monitored the exposure of workers to

oxydemeton-methyl was selected as the appropriate surrogate data to estimate ground handlers' dermal exposure to mevinphos, considering the following factors:

1. Data availability.
2. Both chemicals are liquid at room temperature.
3. Both chemicals are water and organic solvent soluble.
4. Both chemicals have a boiling point of 100 to 106 ^{o}C.
5. Identical end-use formulations.
6. Identical rates of application.
7. Identical crop uses.
8. Identical application method and equipment.
9. Identical use restrictions (closed system mixing/loading).
10. Comparable personal protective equipment requirements.

In this study, an emulsifiable concentrate formulation of oxydemeton-methyl was applied at a rate of 0.5 to 0.75 lb. a.i./acre to cabbage, broccoli, cauliflower, and Brussels sprouts, using either boom-type ground sprayers or airplanes (Oshita et al., 1988). A total of eleven workers were monitored during 24 applications. Each worker wore a shirt, long pants, socks, and cloth coveralls. Chemical resistant gloves, boots, rainsuit or standard Tyvek coveralls, hat, respirator, and a face shield or goggles were worn consistent with the use permit conditions. The mixing/loading operation was a closed system. Dosimeters were placed at several locations both under the cloth coveralls (protected) and outside of the rainsuits (unprotected). Hand exposure was measured using hand washes and knit nylon gloves worn under chemical resistant gloves. Chemical resistant gloves were worn only during mixing/loading and repair but not during application. Portable personal air sampling pumps were worn by the workers to sample air concentration. There were four applications using an enclosed cab, 17 applications using open cab spray rigs, and three applications by airplane. Dermal exposure was estimated based on residues found on protected dosimeters. Dosimeters with no detectable residues were assumed at 1/2 the minimum detectable level (MDL = 0.2 µg/sample). Body surface area and body weight as described in the exposure assessment guideline (Thongsinthusak et al., 1993) were used to calculate dermal exposure. Detectable levels of oxydemeton-methyl were found in the air samples only during six of the 24 exposure periods but at very low levels (0.76 µg/m^3 to 4.8 µg/m^3).

Because of the relatively high vapor pressure of mevinphos, inhalation exposure from the oxydemeton-methyl study is not an appropriate surrogate to estimate workers inhalation exposure to mevinphos. As a conservative measure, it was assumed that a ground mixer/loader/applicator (closed system mixing/loading and closed-cab application without respirator or open-cab application with respirator) will have the same level of inhalation exposure as a mevinphos mixer/loader of aerial application (see Table 5).

Dermal and inhalation exposure of mixer/loader/applicators using open-cab or closed-cab application equipment is shown in Table 4.

Table 4

Estimating Ground Mixer/Loader/Applicator
Exposure to Mevinphos Based on Surrogate Data

Work Task	Application Equipment	Dermal exposure µg/person/day	Inhalation exposure µg/person/day	ADD* µg/kg/day
M/L/A (n=17)	Open-cab	984 (±2.20)**	40.0	3.8
M/L/A (n=4)	Closed-cab	805 (±1.90)**	40.0	3.2

* Dermal absorption of 16.8 percent, body weight of 75.9 kg, eight-hour workday, 50 percent inhalation uptake, adjusted for 1 lb. a.i./acre.
**Geometric mean and standard deviation (log-normally distributed).

Personal protective equipment consisting of long-sleeved shirt, long-legged pants, Tyvek coveralls or rainsuit, chemical resistant gloves (during mixing/loading only), boots, hat, respirator (during open-cab application), and face shield or goggles.

Formoli WH&S, 1993

The use of mevinphos by airblast application equipment is not prohibited on the product label. However, it is not customary in California to use mevinphos by airblast. Application of mevinphos by such equipment in the past had been observed to associate with illness to workers (Ibarra, 1992).

Aerial Application

The estimates of exposure of mixer/loaders, pilots, and flaggers during aerial applications of mevinphos were obtained from studies conducted in Monterey and Imperial counties in 1991 (Maddy *et al*., 1981 and 1982).

For the study in Monterey County, an experienced crew of one major aerial pest control operator firm participated in a 3-day monitoring program. This firm had an excellent record of compliance with established safe use regulations and work practices. A closed system was used in mixing and loading mevinphos and transferring the resulting application mixture to the helicopter. The system had a manually operated probe to transfer the pesticide from the concentrate containers into the mix tank. A pump was used to load the application mixture to a helicopter, which took place every five to seven minutes.

The mixer/loaders wore shirts and pants under clean long-sleeved and long-legged coveralls, heavy rubber gloves, and rubber boots. Respirators were worn by all workers with the exception of the pilot on day two. Dermal and inhalation exposures were monitored. Patches were constructed of an outer layer of seven-ounce 65 percent Dacron polyester, 35 percent cotton twill and an inner layer of 100 percent cotton gauze backed by aluminum foil. Each patch had an exposed area of 49 cm^2. Patches were placed on the back of the neck, on each upper arm, on

each thigh, and on each side of the chest. Cotton gauze and outer cloth patches were analyzed separately. Pre- and postexposure hand rinses were performed using 250 mL distilled water. Inhalation exposure monitoring was accomplished by using a MSA Model S portable air pump drawing air at a rate of 1 liter per minute from the worker's breathing zone. The monitoring period ranged from 1.13 to 2.80 hours. Worker exposure estimates (Table 5) were extrapolated from exposures during these monitoring periods to a seven-hour workday. A seven-hour workday was used under the assumption that workers had to travel and prepare equipment and chemicals prior to and during the operation. This exposure time was also used by the referenced studies (Maddy, 1981 and 1982).

Dermal exposures were estimated from residues found in gauze pads. Half of the MDL (MDL = 0.005 µg/cm²) was used when the residue in the gauze pad indicated "ND". A clothing protection factor of 90 percent was assumed when cloth pad residue also indicated "ND" (Reinert *et al.,* 1986). Thigh and leg dermal exposures were extrapolated from the mean residues in gauze pads attached to thighs. Body surface areas, inhalation rate, and male body weight reported in the exposure assessment guidelines (Thongsinthusak *et al.,* 1993) were used in the estimation of exposure. Exposure estimates in Table 5 reflect the requirements of engineering controls and protective clothing by the current regulations and product labels. Enclosed cab or cockpit was assumed to provide 90 percent protection for dermal and inhalation exposure (Thongsinthusak *et al.,* 1991). Chemical resistant aprons worn by the mixers/loaders are assumed to provide 50 percent protection of the body exposure (exclude head, face, neck and hands). Goggles or face shields provide approximately 25 percent protection to the head, face, and neck (H F, N).

The second study was conducted in Imperial County and utilized fixed-wing airplanes where reloading of the airplanes took place every 30-40 minutes. Monitoring of worker exposure was done during routine commercial applications. One aerial pest control operator firm was monitored for a period of four days. Monitoring methods were similar to that used in the first study. The duration of monitoring ranged from 0.97 to 2.18 hours. Results in Table 5 for fixed-wing airplanes also represent the engineering controls and protective clothing as required by current regulations and the product labels. The seven-hour exposure estimates (Table 5) for a typical workday were extrapolated from exposures during these monitoring periods.

Table 5

Exposure of Mixers/loaders, Flaggers
and Pilots to Mevinphos During Aerial Application[a]

Work Task	Exposure (µg/7-hr day) Dermal H.F.N.	Body	Hands	Total	Inhalation	ADD[b] (ug/kg/day)
Helicopters						
Mixer/loader[c] (n=3)	287	334	325	1006+5.4	18+1.4	2.4+5.0
Pilot[d] (n=3)	80	42	80	207+1.6	8+1.6	0.5+1.6
Fixed-wing airplanes						
Mixer/loader[c] (n=4)	18	18	424	584+2.3	35+2.1	1.6+2.2
pilot[d] (n=4)	27	24	10	65+4.0	43+1.8	0.5+2.2
Flagger[e] (n=7)	3	4	2	11+13.0	1+13.8	0.04+11.3

a Geometric mean ± standard deviation. Total dermal exposure was calculated from total exposure of each worker, e. i. H.F.N. + Body + Hands. Body exposure excludes head (H), face (F), neck (N), and hand exposure.

b The dermal absorption is 16.8 percent. Body weight is 75.9 kg. Inhalation uptake and inhalation absorption are 50 percent (Raabe, 1988) and 100 percent, respectively.

c M/Ls: Engineering controls and clothing requirements - closed mixing and loading system, long-sleeved shirt, long-legged pants, chemical resistant gloves, chemical resistant apron, shoes and socks. Goggles or face shield must be worn when the system is under pressure.

d Pilot: Engineering controls and clothing requirements - enclosed cockpit, long-sleeved shirts, long-legged pants, shoes and socks.

e Flaggers: Engineering controls and clothing requirements - totally enclosed vehicle, long-sleeved shirts, long-legged pants, shoes and socks.

Thongsinthusak, WH&S, 1993

Applications Using Hand-Held Equipment

A mevinphos exposure study of greenhouse workers was conducted in Finland in 1990 (Jauhiainen *et al.,* 1992). Applicators used high pressure or knapsack sprayers to apply mevinphos to ornamentals. Significant decreases from the baselines were observed in RBC and plasma cholinesterase activities of applicators. Urinary DMP peaked 18 hours after the application and dropped below the detection limit of 0.02 µg/mL two days after the application. Urinary DMP 18 hours after the application was measured at 0.11 µg/mL for the applicator with 26% and 29% reduction in RBC and plasma cholinesterase activities, respectively. Mevinphos is no longer registered in California for use in the greenhouse.

Field Worker Exposure

The reentry interval for vegetable crops is 48 hours. However, harvesting is not permitted until the preharvest interval (PHI) has expired. The PHI varies with crop and the rate of application.

A study of lettuce harvesters' exposure to folpet estimated dermal transfer factors of 710 cm²/hour and 364 cm²/hour during cutting and packing of lettuce, respectively (Blewett *et al.*, 1989). A transfer factor of 710 cm²/hour was used to estimate vegetable crop harvesters' exposure to mevinphos. Exposure was calculated by multiplying the DFR values at the expiration of PHI for each crop by the transfer factor (710 cm²/hour).

The PHIs for mevinphos treated fruit trees in California are analogous to their respective reentry intervals. The PHI for grapes is five days but the reentry interval for other work activities is four days. Dermal transfer factors of 3,250 cm²/hr, 3,635 cm²/hr, and 9,500 cm²/hr were calculated for grape suckering/pulling leaves, girdling, and cane turning, respectively (Haskell, 1992). These transfer factors were based on propargite, methomyl, and captan worker exposure studies during these work activities in grapes. Dermal transfer factors of 4,180 cm²/hr and 3,315 cm²/hr were calculated for harvesting and thinning fruit trees (Formoli and Fong, 1993). The transfer factor for harvesters and thinners were calculated based on azinphos-methyl worker exposure studies during these work activities in apples, peaches, and nectarines. The exposures to field workers of grapes and fruit trees were calculated using the DFR values estimated at DFR section of this document. The estimates of exposure shown in Table 6 are for an eight-hour workday.

Table 6

Estimate of Field Workers' Exposure to Mevinphos

Activity	Crop	PHI days	DFR µg/cm²	Transfer cm²/hr	ADD µg/kg/day
Harvesting	Lettuce (Head)	2	0.016	710	0.20
Harvesting	Lettuce (Leaf)	7	neg	710	neg
Harvesting	Cauliflower	3	0.111	710	1.40
Harvesting	Celery	3	0.011	710	0.14
Harvesting	Chinese Cabbage	2	0.122	710	1.53
Harvesting	Peaches, Nectarines, Citrus	4**	0.014	4,180	1.04
Thinning	Peaches, Nectarines, Citrus	4**	0.014	3,315	0.82
Harvesting	Apples	2**	0.150	4,180	11.10
Thinning	Apples	2**	0.150	3,315	8.81
Suckering	grapes	4**	0.006	3,250	0.35
Girdling	rapes	4**	0.006	3,635	0.39
Cane turning	grapes	4**	0.006	9,500	1.01

* Eight-hour workday, 75.9 kg body weight and 16.8% dermal absorption.
** Reentry interval
neg = negligible

Formoli, WH&S, 1992

Table 7

Estimated Mevinphos
Absorbed Daily Dosages for Different Work Activities

Task	Application Equipment	Crop	ADD µg/kg/day	AADD* µg/kg/day
Pilot	Aerial	Artichoke	0.5	0.03
M/L	Aerial	Vegetable	2.4	0.14
Flagger	Aerial	Artichoke	0.04	0.002
M/L/A	Ground	Vegetables	3.8	0.22
Harvesters		Vegetables	neg. - 1.5	neg. - 0.09
Field workers		Fruit trees	0.8-11.1	0.05-0.64
Field workers		Grapes	0.4-1.0	0.02-0.06

* 21 workdays a year (Haskell, 1993).

Clothing and Equipment:

M/L/As: Closed mixing and loading system, long-sleeved shirt, long-legged pants, Tyvek coveralls or rainsuits, chemical resistant gloves, chemical resistant shoes or boots, goggles or face shield, a hat, and a NIOSH/MSHA approved respirator.

M/Ls (aerial): Closed mixing and loading system, long-sleeved shirt, long-legged pants, chemical resistant gloves, chemical resistant apron, shoes and socks. Goggles or face shield when the system is under pressure.

Flaggers: Totally enclosed vehicle, long-sleeved shirts, long-legged pants, shoes and socks.

Pilots: Cockpit, long-sleeved shirts, long-legged pants, shoes and socks.

Vegetable harvesters: Long- or short-sleeved shirt, long-legged pants, gloves and shoes.

Grape and fruit tree field workers: Long-sleeved shirt, long-legged pants, and shoes.

neg - negligible

Formoli, WH&S, 1993

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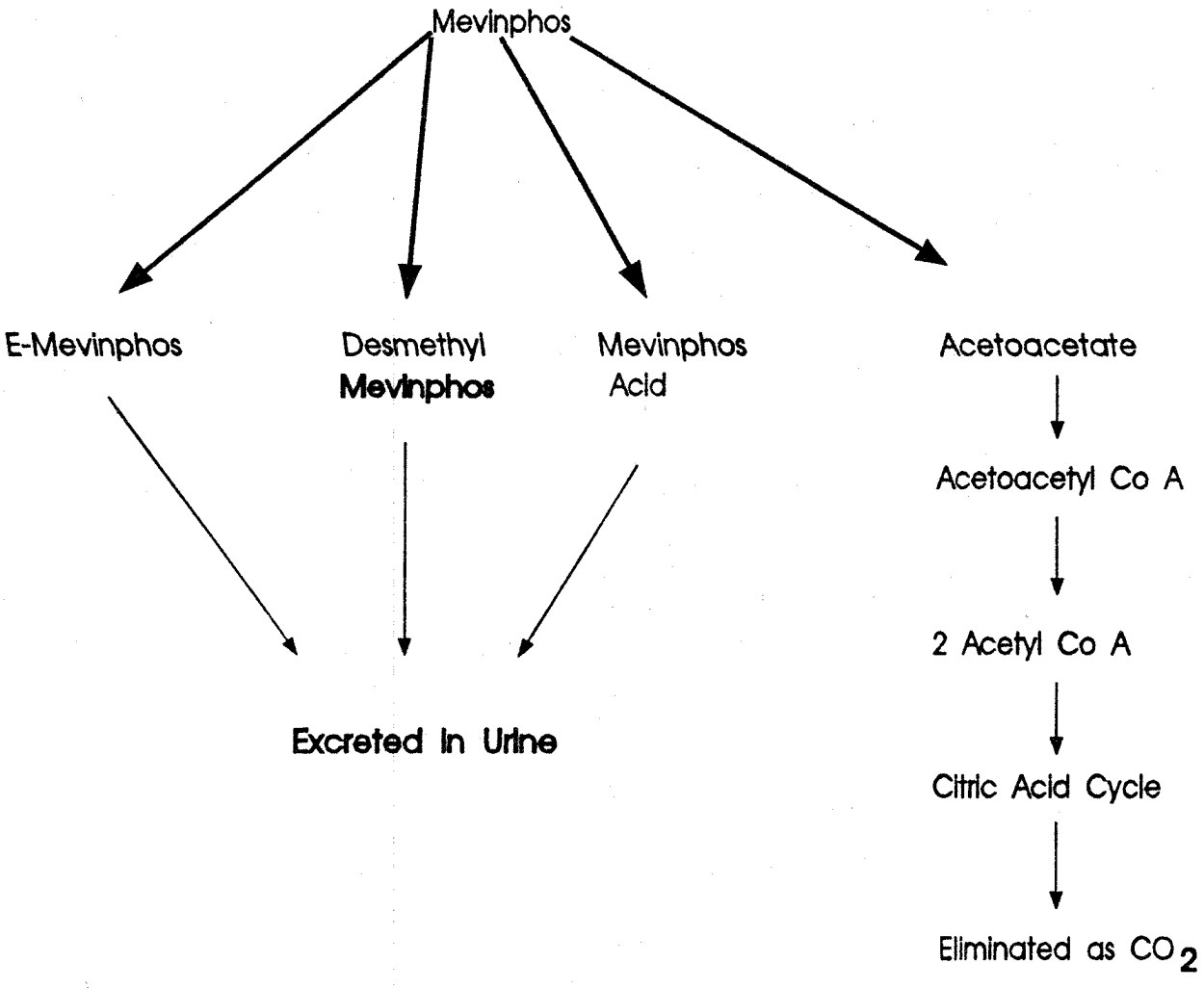
Figure 2

Possible Metabolic Pathway of Mevinphos in Sprague-Dawley Rats*



* Adopted from Reddy, 1991.

APPENDIX C

Acute and Chronic

Dietary Exposure Analysis

and

Residue File

Commodity	DPR Monitoring 1989-1991 Sample #	High (ppm)	Average (ppm)	FDA Monitoring Sample #	High (ppm)	Average (ppm)
Apples	981	0.11	0.0051 ± 0.0033			
Artichokes	174	0.91	0.026 ± 0.105	1	0.22	
Beans	575	0.01	0.005	1	0.01	
Beets	160	0.37	0.0073 ± 0.029			
Bok Choy	107	0.01	0.005	10	0.025	0.116 ± 0.077
Broccoli	376	0.3	0.0062 ± 0.017			
Brussels Sprts	175	0.01	0.005			
Cabbage	460	0.42	0.0059 ± 0.019	4	0.2	0.109 ± 0.069
Cantaloupe	359	0.01	0.005			
Carrots	364	0.01	0.005			
Casaba	8	0.01	0.005			
Cauliflower	232	0.05	0.0052 ± 0.0029	3	0.17	0.11 ± 0.054
Celery	518	0.18	0.0053 ± 0.0077	7	0.17	0.073 ± 0.054
Cherry	135	0.01	0.005			
Collards	114	0.54	0.023 ± 0.078	43	1	0.55 ± 0.49
Corn	488	0.01	0.005			
Cucumber	960	0.01	0.005			
Eggplant	292	0.27	0.0066 ± 0.018	2	0.002	0.002
Endive	68	0.77	0.021 ± 0.099	35	1	0.139 ± 0.177
Grapes	1174	0.01	0.005	1	0.01	0.01
Grapefruit	342	0.01	0.005			
Honeydew	151	0.01	0.005			
Kale	61	0.01	0.005	33	1	0.31 ± 0.26
Kumquats	12	0.01	0.005			
Lemons	279	0.01	0.005			
l Lettuce	816	0.5	0.021 ± 0.073	1041	0.5	0.14 ± 0.36
h Lettuce	649	0.5	0.017 ± 0.06	39	0.5	0.28 ± 0.24
unsp. Lettuce	116	0.5	0.018 ± 0.057	21	0.5	0.12 ± 0.17
Limes	272	0.01	0.005			
Mustard	77	0.49	0.015 ± 0.059	82	1	0.51 ± 0.70
Okra	76	0.01	0.005			
Oranges	560	0.01	0.005			
Parsley	40	0.15	0.009 ± 0.022	1	0.25	0.25
Peach	335	0.01	0.005	5	0.065	0.024 ± 0.021
Pear	575	0.1	0.005 ± 0.005			
Peas	361	0.01	0.005			
Pepper	1023	0.1	0.005 ± 0.005			
Plums	332	0.01	0.005			
Potatoes	1079	0.01	0.005			
Raspberry	81	0.01	0.005	1	0.15	0.15
Spinach	490	0.01	0.005	41	1	0.18 ± 0.24
Strawberry	367	0.48	0.006 ± 0.025	185	1	0.28 ± 0.24
Summer Squash	218	0.01	0.005			
Turnip green	17	0.5	0.034 ± 0.12	72	1	0.34 ± 0.30
Turnip root	46	0.01	0.005	4	0.65	0.37 ± 0.20
Walnuts	3	0.01	0.005			
Watercress	29	0.01	0.005	4	1	0.55 ± 0.45
Watermellon	44	0.01	0.005	1	0.01	0.005

ACUTE EXPOSURE ANALYSIS (EX4) FOR Mevinphos Section 3 Registration
RESIDUE FILE NAME: MVINFSAX Analysis Date 09-07-1993
DPR NOEL = 0.025 MG/KG BODY WT-DAY
COMMENT 1: Residue values from monitoring data
COMMENT 2: All label-approved uses for mevinphos

U.S. POP - ALL SEASONS

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
95.8%	0.000466	54

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000033	764	20.0	0.000677	37
80.0	0.000072	348	10.0	0.001077	23
70.0	0.000123	203	5.0	0.001541	16
60.0	0.000181	138	2.5	0.002178	11
50.0	0.000264	95	1.0	0.003427	7
40.0	0.000364	69	0.5	0.004559	5
30.0	0.000498	50	0.0	0.050906	0

WESTERN REGION

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
96.9%	0.000484	52

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000032	770	20.0	0.000709	35
80.0	0.000073	343	10.0	0.001107	23
70.0	0.000129	194	5.0	0.001608	16
60.0	0.000194	129	2.5	0.002319	11
50.0	0.000287	87	1.0	0.003474	7
40.0	0.000393	64	0.5	0.004637	5
30.0	0.000535	47	0.0	0.012749	2

ACUTE EXPOSURE ANALYSIS (EX4) FOR Mevinphos Section 3 Registration
RESIDUE FILE NAME: MVINFSAX Analysis Date 09-07-1993
DPR NOEL = 0.025 MG/KG BODY WT-DAY
COMMENT 1: Residue values from monitoring data
COMMENT 2: All label-approved uses for mevinphos

HISPANICS

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
97.9%	0.000393	64

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000041	609	20.0	0.000572	44
80.0	0.000078	322	10.0	0.000946	26
70.0	0.000122	205	5.0	0.001363	18
60.0	0.000171	147	2.5	0.001799	14
50.0	0.000244	102	1.0	0.002711	9
40.0	0.000323	77	0.5	0.003488	7
30.0	0.000422	59	0.0	0.007109	4

NON-HISPANIC WHITES

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
96.5%	0.000469	53

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000035	719	20.0	0.000681	37
80.0	0.000076	331	10.0	0.001065	23
70.0	0.000129	194	5.0	0.001503	17
60.0	0.000189	133	2.5	0.002142	12
50.0	0.000271	92	1.0	0.003402	7
40.0	0.000372	67	0.5	0.004592	5
30.0	0.000503	50	0.0	0.050906	0

ACUTE EXPOSURE ANALYSIS (EX4) FOR Mevinphos Section 3 Registration
RESIDUE FILE NAME: MVINFSAX Analysis Date 09-07-1993
DPR NOEL = 0.025 MG/KG BODY WT-DAY
COMMENT 1: Residue values from monitoring data
COMMENT 2: All label-approved uses for mevinphos

NON-HISPANIC BLACKS

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
91.1%	0.000476	53

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000024	1037	20.0	0.000698	36
80.0	0.000050	496	10.0	0.001213	21
70.0	0.000093	269	5.0	0.001783	14
60.0	0.000149	168	2.5	0.002692	9
50.0	0.000217	115	1.0	0.003984	6
40.0	0.000319	78	0.5	0.005072	5
30.0	0.000478	52	0.0	0.011131	2

NON-HISPANIC OTHER

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
95.9%	0.000443	56

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000027	935	20.0	0.000665	38
80.0	0.000059	421	10.0	0.001009	25
70.0	0.000106	236	5.0	0.001500	17
60.0	0.000157	159	2.5	0.002068	12
50.0	0.000250	100	1.0	0.003082	8
40.0	0.000369	68	0.5	0.004274	6
30.0	0.000492	51	0.0	0.007066	4

ACUTE EXPOSURE ANALYSIS (EX4) FOR Mevinphos Section 3 Registration
RESIDUE FILE NAME: MVINFSAX Analysis Date 09-07-1993
DPR NOEL = 0.025 MG/KG BODY WT-DAY
COMMENT 1: Residue values from monitoring data
COMMENT 2: All label-approved uses for mevinphos

NURSING INFANTS (<1 YEAR)

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
47.2%	0.000796	31

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000057	438	20.0	0.001480	17
80.0	0.000083	302	10.0	0.001851	14
70.0	0.000270	93	5.0	0.002037	12
60.0	0.000416	60	2.5	0.002756	9
50.0	0.000568	44	1.0	0.003505	7
40.0	0.000785	32	0.5	0.003759	7
30.0	0.001000	25	0.0	0.004014	6

NON-NURSING INFANTS (<1)

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
65.1%	0.001219	21

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000135	185	20.0	0.001907	13
80.0	0.000262	95	10.0	0.002578	10
70.0	0.000421	59	5.0	0.003288	8
60.0	0.000592	42	2.5	0.005657	4
50.0	0.000759	33	1.0	0.009184	3
40.0	0.001000	25	0.5	0.009874	3
30.0	0.001318	19	0.0	0.010565	2

ACUTE EXPOSURE ANALYSIS (EX4) FOR Mevinphos Section 3 Registration
RESIDUE FILE NAME: MVINFSAX Analysis Date 09-07-1993
DPR NOEL = 0.025 MG/KG BODY WT-DAY
COMMENT 1: Residue values from monitoring data
COMMENT 2: All label-approved uses for mevinphos

FEMALES (13+/PREG/NOT NSG)

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
98.2%	0.000317	79

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000026	956	20.0	0.000549	46
80.0	0.000050	502	10.0	0.000817	31
70.0	0.000080	314	5.0	0.001038	24
60.0	0.000118	211	2.5	0.001216	21
50.0	0.000185	135	1.0	0.001748	14
40.0	0.000274	91	0.5	0.002478	10
30.0	0.000370	68	0.0	0.003771	7

FEMALES (13+/NURSING)

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
96.9%	0.000430	58

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000056	443	20.0	0.000614	41
80.0	0.000097	257	10.0	0.001055	24
70.0	0.000154	162	5.0	0.001351	19
60.0	0.000202	124	2.5	0.001528	16
50.0	0.000270	93	1.0	0.002215	11
40.0	0.000416	60	0.5	0.002611	10
30.0	0.000507	49	0.0	0.003137	8

ACUTE EXPOSURE ANALYSIS (EX4) FOR Mevinphos Section 3 Registration
RESIDUE FILE NAME: MVINFSAX Analysis Date 09-07-1993
DPR NOEL = 0.025 MG/KG BODY WT-DAY
COMMENT 1: Residue values from monitoring data
COMMENT 2: All label-approved uses for mevinphos

CHILDREN (1-6 YEARS)

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
94.9%	0.000777	32

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000058	429	20.0	0.001072	23
80.0	0.000125	199	10.0	0.001652	15
70.0	0.000211	119	5.0	0.002163	12
60.0	0.000306	82	2.5	0.003439	7
50.0	0.000426	59	1.0	0.006550	4
40.0	0.000575	43	0.5	0.009871	3
30.0	0.000787	32	0.0	0.050906	0

CHILDREN (7-12 YEARS)

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
98.1%	0.000499	50

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000037	677	20.0	0.000761	33
80.0	0.000086	292	10.0	0.001201	21
70.0	0.000152	165	5.0	0.001550	16
60.0	0.000228	110	2.5	0.002008	12
50.0	0.000321	78	1.0	0.003038	8
40.0	0.000439	57	0.5	0.004334	6
30.0	0.000591	42	0.0	0.007547	3

ACUTE EXPOSURE ANALYSIS (EX4) FOR Mevinphos Section 3 Registration
RESIDUE FILE NAME: MVINFSAX Analysis Date 09-07-1993
DPR NOEL = 0.025 MG/KG BODY WT-DAY
COMMENT 1: Residue values from monitoring data
COMMENT 2: All label-approved uses for mevinphos

MALES (13-19 YEARS)

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
97.1%	0.000367	68

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000025	981	20.0	0.000540	46
80.0	0.000059	423	10.0	0.000837	30
70.0	0.000102	244	5.0	0.001211	21
60.0	0.000147	171	2.5	0.001570	16
50.0	0.000205	122	1.0	0.003337	7
40.0	0.000280	89	0.5	0.004645	5
30.0	0.000393	64	0.0	0.007654	3

FEMALES (13-19 YRS/NP/NN)

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
96.4%	0.000378	66

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000028	881	20.0	0.000577	43
80.0	0.000060	413	10.0	0.000867	29
70.0	0.000108	232	5.0	0.001161	22
60.0	0.000167	150	2.5	0.001653	15
50.0	0.000238	105	1.0	0.002367	11
40.0	0.000318	79	0.5	0.003496	7
30.0	0.000432	58	0.0	0.006148	4

ACUTE EXPOSURE ANALYSIS (EX4) FOR Mevinphos Section 3 Registration
RESIDUE FILE NAME: MVINFSAX Analysis Date 09-07-1993
DPR NOEL = 0.025 MG/KG BODY WT-DAY
COMMENT 1: Residue values from monitoring data
COMMENT 2: All label-approved uses for mevinphos

MALES (20+ YEARS)

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
96.7%	0.000393	64

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000030	845	20.0	0.000580	43
80.0	0.000066	378	10.0	0.000912	27
70.0	0.000111	225	5.0	0.001267	20
60.0	0.000159	158	2.5	0.001808	14
50.0	0.000229	109	1.0	0.002725	9
40.0	0.000317	79	0.5	0.003915	6
30.0	0.000435	57	0.0	0.009886	3

FEMALES (20+ YEARS/NP/NN)

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
95.7%	0.000462	54

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000032	789	20.0	0.000673	37
80.0	0.000069	361	10.0	0.001079	23
70.0	0.000119	209	5.0	0.001551	16
60.0	0.000178	140	2.5	0.002358	11
50.0	0.000263	95	1.0	0.003588	7
40.0	0.000368	68	0.5	0.004387	6
30.0	0.000492	51	0.0	0.008910	3

ACUTE EXPOSURE ANALYSIS (EX4) FOR Mevinphos Section 3 Registration
RESIDUE FILE NAME: MVINFSAX Analysis Date 09-07-1993
DPR NOEL = 0.025 MG/KG BODY WT-DAY
COMMENT 1: Residue values from monitoring data
COMMENT 2: All label-approved uses for mevinphos

CUSTOM DEMOGRAPHICS 1: Seniors aged 55+
All Seasons Region(s): W Sex: M F-all
All Races Age-Low: 55 yrs High: 110 yrs

ESTIMATED PERCENT OF PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY: MG/KG BODY WT/DAY	MEAN DAILY EXPOSURE PER USER-DAY: MARGIN OF SAFTEY
97.3%	0.000576	43

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000042	594	20.0	0.000835	30
80.0	0.000093	268	10.0	0.001372	18
70.0	0.000156	160	5.0	0.002119	12
60.0	0.000244	103	2.5	0.003021	8
50.0	0.000360	69	1.0	0.003912	6
40.0	0.000462	54	0.5	0.004566	5
30.0	0.000615	41	0.0	0.007366	3

CHRONIC EXPOSURE ANALYSIS (EX1) FOR Mevinphos — Section 3 Registration
RESIDUE FILE NAME: MVINFSCX — Analysis DATE 09-23-1993
DPR NOEL = 0.025000 MG/KG BODY WT/DAY
COMMENT 1: Residue values from monitoring data
COMMENT 2: All label-approved uses for mevinphos

TOTAL EXPOSURE BY POPULATION SUBGROUP

POPULATION SUBGROUP	TOTAL EXPOSURE MG/KG BODY WT/DAY	TOTAL EXPOSURE MARGIN OF SAFETY
U.S. POP - 48 STATES - ALL SEASONS	0.000038	658
U.S. POPULATION - SPRING SEASON	0.000036	694
U.S. POPULATION - SUMMER SEASON	0.000038	658
U.S. POPULATION - AUTUMN SEASON	0.000037	676
U.S. POPULATION - WINTER SEASON	0.000039	641
NORTHEAST REGION	0.000041	610
NORTH CENTRAL REGION	0.000037	676
SOUTHERN REGION	0.000036	694
WESTERN REGION	0.000037	676
HISPANICS	0.000038	658
NON-HISPANIC WHITES	0.000037	676
NON-HISPANIC BLACKS	0.000039	641
NON-HISPANIC OTHER THAN BLACK OR WHITE	0.000040	625
NURSING INFANTS (<1 YEAR OLD)	0.000020	1250
NON-NURSING INFANTS (<1 YEAR OLD)	0.000067	373
FEMALES (13+/PREGNANT/NOT NURSING)	0.000029	862
FEMALES (13+/NURSING)	0.000034	735
CHILDREN (1-6 YEARS)	0.000074	338
CHILDREN (7-12 YEARS)	0.000052	481
MALES (13-19 YEARS)	0.000038	658
FEMALES (13-19 YRS/NOT PREG. OR NURSING)	0.000035	714
MALES (20+ YEARS)	0.000030	833
FEMALES (20+ YEARS/NOT PREG. OR NURSING)	0.000031	806

Appendix D

MEVINPHOS

MITIGATION PROPOSAL FOR REDUCTION OF HUMAN EXPOSURE

December 17, 1993

Worker Health and Safety Branch
Department of Pesticide Regulation
California Environmental Protection Agency

Current Use Practice:
All four registered mevinphos-containing products are liquid concentrate/emulsifiable concentrate formulations. Mevinphos is used on a variety of crops. Approximately 80 percent of the mevinphos used in California is applied to vegetable crops (PUR, 1992). Mevinphos can be applied by air or ground power equipment. All mevinphos-containing product labels, except Phosdrin^{R} 4 EC, prohibit the use of hand-held application equipment. The estimated Absorbed Daily Dosages (ADD) for various work categories are shown in Appendix B.

Current Mitigation Measures:
Mevinphos is a restricted use pesticide because of its high acute toxicity to humans. Therefore, it is for retail sale to and use only by certified applicators or persons under their supervision. Closed system mixing and loading is required during handling of mevinphos in California. The following personal protective equipment (PPE) must be worn during application, repair and cleaning of equipment, and disposal of mevinphos:

1- Protective suit of one or two pieces that covers all parts of the body except head, hands, and feet (worn over normal work clothing).
2- Chemical resistant gloves.
3- Chemical resistant footwear.
4- Protective eyewear.
5- Hood or wide brimmed hat.
6- NIOSH/MSHA approved respirator.

The following PPE must be worn during mixing/loading:

1- Work clothing.
2- Chemical resistant gloves.
3- Chemical resistant apron.
4- Footwear and socks.
5- Protective eyewear when the system is under pressure.

If an application is made using an enclosed cab or cockpit, the following PPE may be worn as an alternative:

1- Work clothing.
2- Shoes and socks.

3- Chemical resistant gloves must be available in the cab or cockpit, and must be worn during entry to and exit from the application vehicle. For ground application, all other protective clothing and equipment required for use during application must be available in the cab and must be worn when exiting the cab into treated areas.

Human flaggers are strictly prohibited during aerial application unless they are in a totally enclosed vehicle. Reentry to treated citrus, grapes, peaches and nectarines is prohibited for four days. The reentry interval for other treated crops including apples is two days (Title 3, CAC).

Mitigation Adequacy for Various Work Tasks:

Mevinphos is a highly acutely toxic organophosphate insecticide. The No Observed Effect Level (NOEL) for cholinergic signs (loose stool) in humans is 25 ug/kg. Exposures requiring additional mitigation are as follows:

1. Workers:
   With strict adherence to the current mitigation measures, the estimated ADD for mixer/loader/applicators using ground boom application equipment is at an unacceptable level. Additional mitigation measures would be very difficult to implement.

   Based on the estimated ADDs, the current mitigation measures for apple harvesters and thinners do not provide adequate protection for these workers . The ADDs for these work tasks were estimated assuming 16.8 percent dermal absorption. The DFR value for apples was based on surrogate data (vegetables) adjusted for the maximum application rate of 3.25 lb. of the active ingredient (a.i.)/acre for apples. The rate of application for pears is identical to that of apples. Work activities in pear orchards are also similar to those of apple orchards. In the absence of any data to substantiate adequate protection, these work tasks for both apples and pears require further mitigation.

   The exposure to hand-held applicators is unacceptably high.

   Air blast application of mevinphos is not common in California, possibly due to illnesses associated with this type of application of mevinphos (Ibarra, 1992). Mevinphos product labels contain no statement to prohibit the use of air blast application equipment.

   Of the 578 illness cases that were identified with exposure to mevinphos alone and tank mixes containing mevinphos, there were 438 cases of suspected systemic illness in California during 1982 to 1989 (O'Malley, 1992). The remaining 140 cases were classified as unlikely/unrelated/no symptom. Most of the illness cases involved tank mixes containing mevinphos. Drift accounted for more than 60 percent of all the illness cases. Most of the drift cases were associated with foul odor and decreased in frequency with increasing distance from the application. Attachment "I" illustrates the mevinphos illness trend during this period. There appears to be a downward trend in illness cases regardless of the fairly steady use.

   Mixer/loader/applicators accounted for 20 percent of all these illnesses. Most of the mixer/loader/applicator cases involved direct exposure.

2. Residents
   There are no home garden or household uses of mevinphos. With the exception of drift, no significant non-dietary exposure is anticipated to the general populace.

Conclusion:

- The number of definite/probable illnesses appears to be fairly constant over the last several years.
- Mevinphos is responsible for more acute illnesses than any other insecticide currently in use.
- Combined occupational and dietary exposures are unacceptably high for mixer/loaders of aircraft (helicopter or fixed-wing) and mixer/loader/applicators using ground boom.

- A single excessive exposure event (e.g. splash or spill) can result in illness. These illnesses continue to occur despite the maximum level of protective clothing and equipment required . Additional protective equipment or protective clothing does not seem possible at this time.
- It is theoretically possible to mitigate reentry and drift exposures through administrative controls (reentry intervals and buffer zones), however, this was not considered further because of excessive mixer/loader/applicator exposures.
- The current PPE required for mevinphos handlers is close to the maximum level under California's climate. Additional mitigation measures that are practical and reasonable will not reduce the estimated upper bound (95th percentile) exposure to an acceptable level for ground mixer/loader/applicators and mixer/loaders of helicopter applications. Therefore, no further mitigation measures are proposed.

Representative Current Labels:
See attachment "II" for copies of currently registered mevinphos product labels in California.

Table 1

Summary of Case-by- Case Review of 1982 to 1989 Drift Illnesses
with Information About Equipment and Distance from the Application Site:

Application Equipment:
Aerial = 354 (at least 327 (92%) involving helicopters)
Ground = 2
Total = 356

Distance:	*Number of Cases*
100 meters or less (overhead and adjacent included)	= 101 or 28%
200 meters or less	= 278 or 78%
400 meters or less	= 332 or 93%
1200 meters or less (nearby included)	= 356 or 100%

Formoli, WH&S, 1993

Bibliography

Ibarra, M. February 5, 1992. Telephone conversation, Pesticide Enforcement Branch, Department of Pesticide Regulation, Fresno, CA.

O'Malley, M. 1992. Systemic illnesses associated with exposure to mevinphos in California, 1982-1989. Worker Health and Safety Branch, Department of Pesticide Regulation, Sacramento, CA. HS-1626.

Pesticide Use Report (PUR) Annual 1990, indexed by chemical. 1992. Department of Pesticide Regulation, Sacramento, CA.

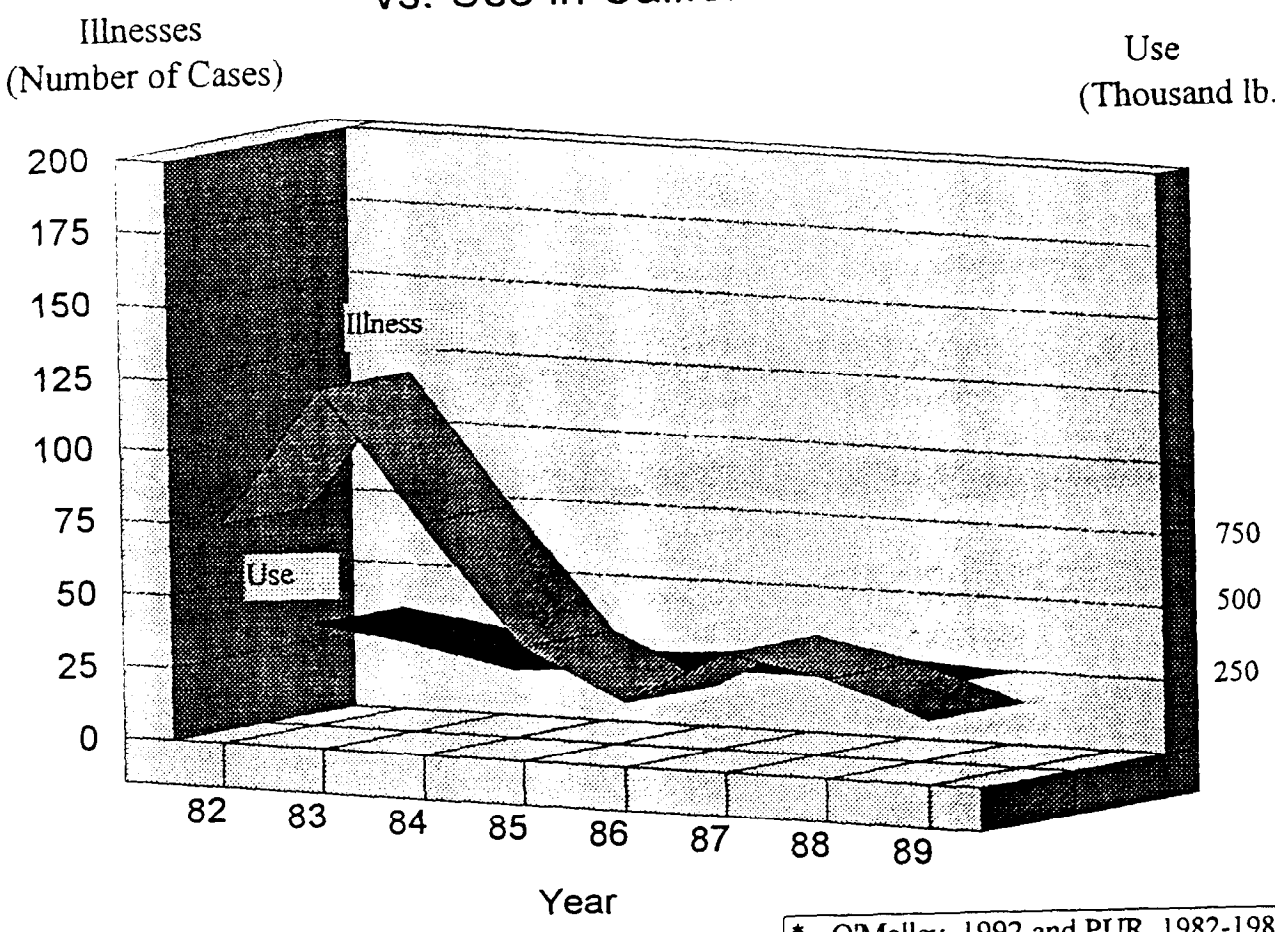
Pesticide Use Report (PUR) Annual 1982 to 1988, indexed by chemical. California Department of Food and Agriculture (CDFA), Sacramento, CA.

Title 3, California Administrative Code (CAC). Division 6, Pesticides and pest control operations. Chapter 3, Pest control operations, Subchapter 3 (Extracts). Pesticide Worker Safety. Sacramento, CA. HS-036.

Attachment I

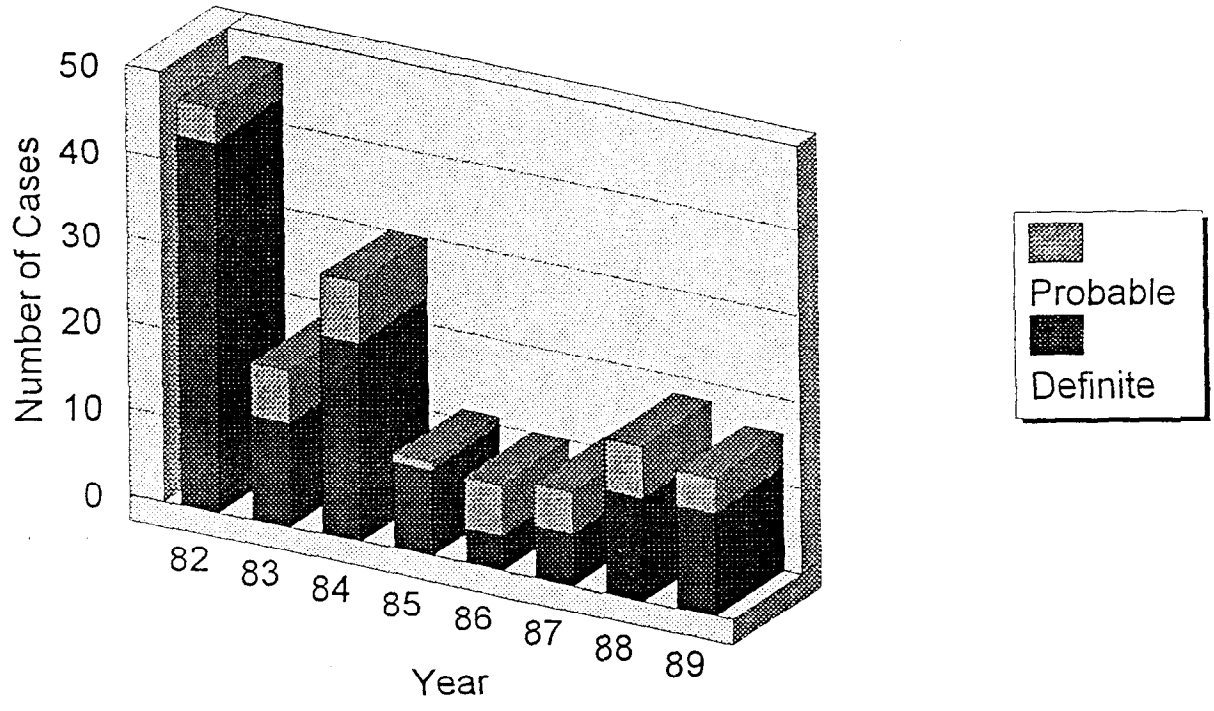
Mevinphos Illness Trend During 1982 to 1989

Mevinphos Yearly Systemic Illnesses vs. Use in California*



* - O'Malley, 1992 and PUR, 1982-1988

Mevinphos Yearly Systemic Illnesses in Definite and Probable Categories*



* - O'Malley, 1992

Attachment II

Copies of Currently Registered Mevinphos Product Labels in California

PROTECTIVE EQUIPMENT & WORK SAFETY STATEMENT (Continued from preceding panel)

REMEMBER THIS CLOTHING (long-sleeved shirt, long legged pants, shoes and socks) IS NOT ADEQUATE TO PROTECT YOU DURING REPAIR AND CLEANING OF APPLICATION EQUIPMENT AND EARLY REENTRY TO TREATED AREAS. YOU MUST REFER TO AND WEAR OTHER PROTECTIVE CLOTHING AND EQUIPMENT DESCRIBED EARLIER IN THIS SAME SECTION.

IMPORTANT!

IMPORTANT! If pesticide comes in contact with skin, wash off with soap and water and contact a physician immediately. Always wash hands, face, and arms with soap and water before smoking, eating, drinking, or toileting.

....HUMAN FLAGGERS ARE STRICTLY PROHIBITED during aerial application of this product unless they are in a totally enclosed vehicle.

AFTER WORK: Before removing gloves, wash them with soap and water. Take off all work clothes and shoes. Shower using soap and water. Wear only clean clothes when leaving job – do not wear contaminated clothing. Personal and protective clothing worn during work must be stored and laundered *separately from household articles. Store protective clothing separately from personal clothing.* Clean or launder protective clothing after each use. Respirators must be cleaned and filters replaced according to instructions included with the respirators. Protective clothing and protective equipment that becomes heavily contaminated or drenched with Mevinphos must be destroyed according to state and local regulations.

HEAVILY CONTAMINATED OR DRENCHED CLOTHING CANNOT BE ADEQUATELY DECONTAMINATED.

The National Pesticide Telecommunication Network is available for recommendations regarding poisoning management, emergency treatment, and other information regarding the toxicity of mevinphos. The toll free number for the National Pesticide Telecommunication Network is 1-800-858-7378.

IF PRODUCT IS HANDLED INDOORS provide mechanical exhaust ventilation. Keep all unprotected person, children livestock and pets away from treated areas or where there is danger of drift. Do not rub eyes or mouth with hands. If you feel sick in any way, STOP WORK and get help right away, see the first aid Statements of Practical Treatment section on this label.

IMPORTANT Wear clean clothes daily. Pilot should not assist in mixing and loading operation. Do not contaminate or store near food or feedstuff. Note Reentry Statements section. This product is not for use or storage in or around the home. In case of spillage, decontaminate areas and equipment by washing with a dilute solution of alkali (less than 5%) and detergent and rinse with water.

NOTE TO PHYSICIAN - - - POISONING SYMPTOMS

Symptoms include weakness, headache, tightness in chest, blurred vision, non reactive pin point pupils, salivation, sweating, nausea, vomiting, diarrhea, and abdominal cramps.

TREATMENT - Atropine is the specific therapeutic antagonist of choice against parasympathetic nervous stimulation. If there are signs *of parasympathetic stimulation Atropine Sulfate should be injected at 10 minute intervals in doses of 1 to 2 milligrams until complete* atropinization has occurred. Pralidoxime chloride (2-PAM chloride) may also be used as an effective antidote in addition to and while maintaining full atropinization. In adults, an initial dose of 1 gram of 2-PAM should be injected, preferably as an infusion, in 250 cc *of saline over a 15 to 20 minute period. If this is not practical, 2-PAM may be administered slowly by intravenous injection as a 5%* solution in water over not less than 2 minutes. After about an hour, a second dose of 1 gram of 2-PAM will be indicated if muscle weakness has not been relieved. For infants and children, the dose of 2-PAM is 0.25 grams. Morphine is an improper treatment.

Clear chest by postural drainage. Oxygen administration may be necessary. Observe patient continuously for 48 hours. Repeated exposure to cholinesterase inhibitors may without warning cause prolonged susceptibility to very small doses of any cholinesterase inhibitor. Allow no further exposure until time for cholinesterase regeneration has been attained as determined by a blood test.

FOR 24 HOURS EMERGENCY MEDICAL ASSISTANCE CALL (213) 264-3910.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Do not apply this product through any type of irrigation system.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish and wildlife. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not apply directly to water or wetlands (swamps, bogs, marshes, and potholes). Do not contaminate water when disposing of equipment *washwaters. This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product* or allow it to drift to blooming crops or weed, while bees are actively visiting the treatment area.

PHYSICAL & CHEMICAL HAZARDS

FLAMMABLE - Keep away from heat or open flame.

REENTRY AND WORKER SAFETY STATEMENT

Reentry into treated CITRUS GROVES, GRAPE VINEYARDS, and PEACH orchards is prohibited for 96 hours (4 days) after the end of application, unless the protective clothing specified on this label for early reentry is worn. Reentry into all other treated areas is prohibited for 48 hours (2 days) after the end of application, unless the protective clothing specified on this label for early reentry is worn. IMPORTANT: When a mixture of 2 or more organophosphates pesticides is applied, the reentry interval shall be extended by adding to the longest applicable interval an additional 50% of that interval!

FOR EARLY REENTRY INTO TREATED AREAS BEFORE SPRAYS HAVE DRIED,
wear all protective clothing specified on this label for an applicator.

FOR EARLY REENTRY INTO TREATED AREAS AFTER SPRAYS HAVE DRIED,
wear protective suit of one or two piece covering all parts of the body except head, hands, and feet; chemical resistant gloves; chemical resistant shoes (or chemical resistant shoe coverings or chemical resistant boots)

Written or oral warnings must be given to workers who are expected to be in treated areas or in an area to be treated with this product. (Indicate specific oral warnings which inform workers of areas of fields that may not be entered without specific protective clothing, period of time field must be vacated, and appropriate action to take in case of accidental exposure.) When oral warnings are given, warnings shall be given in a language customarily understood by workers. Oral warnings must be given when there is reason to believe that written warnings cannot be understood by workers. Written warnings must include the following information:

"DANGER. Area to be treated with MEVINPHOS on (Date). Do not enter without appropriate protective clothing until (insert here the date/time set forth on this label). In case of accidental exposure see STATEMENTS OF PRACTICAL TREATMENT found on the DURAPHOS EM-4 product label."

02-89

RESTRICTED USE PESTICIDE

Due to Very High Acute Toxicity to Humans and Residue effects on Avian, Mammalian and Aquatic Species. For Retail Sale To and Use Only by Certified Applicators or Persons Under Their Direct Supervision and Only for Those Uses Covered by the Certified Applicators Certification. Direct supervision for this product is defined as "the certified applicator being physically present during application, mixing, loading, repair and cleaning of application equipment." Certified applicators must also ensure that all persons involved in these activities are informed of the precautionary statements.

DURHAM DURAPHOS EM-4

ORGANOPHOSPHORUS INSECTICIDE

Contains 4 lbs. MEVINPHOS per Gallon

ACTIVE INGREDIENTS:	
Mevinphos (2-Carbomethoxy-1-methylvinyl dimethyl phosphate, alpha isomer)	28.2%
Related Compounds	18.8%
INERT INGREDIENTS:*	53.0%
Total	100.0%

Equivalent to 47% /w MEVINPHOS Insecticide

*Product contains Aromatic Solvent

KEEP OUT OF REACH OF CHILDREN

DANGER - POISON
PELIGRO

"PRECAUCION AL USUARIO: Si usted no lee ingles, no use este producto hasta que la etiqueta haya sido explicado ampliamente"

STATEMENTS OF PRACTICAL TREATMENT

IF SWALLOWED: Call a physician or Poison Control Center immediately. Induce vomiting by giving victim 1 or 2 glasses of water & touching back of throat with finger. Never induce vomiting or give anything by mouth to an unconscious or convulsing person.

IF INHALED: Remove victim to fresh air immediately. Apply artificial respiration if indicated. Get medical attention.

IF IN EYES: Flush eyes with plenty of water for 10 minutes. Get medical attention immediately.

IF ON SKIN: Remove contaminated clothing and immediately wash affected area with soap and water. Call a physician immediately. Wash clothing before reuse.

IF POISONING SYMPTOMS APPEAR (See POISONING SYMPTOMS under NOTE TO PHYSICIAN.) Keep patient prone and quiet. Start artificial respiration immediately if patient is not breathing. Transport the patient immediately to the nearest hospital.

SEE ANTIDOTE AND OTHER PRECAUTIONS ON SIDE PANEL

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

DANGER: Poisonous if swallowed, inhaled or absorbed through the skin. Rapidly absorbed through the skin. Repeated inhalation or skin contact may without symptoms, progressively increase susceptibility to MEVINPHOS insecticide poisoning. Do not swallow or get in eyes, on skin or on clothing. Do not breathe vapors. Do not contaminate food of feed products.

PRECAUTIONS IN USING

PROTECTIVE EQUIPMENT & WORK SAFETY STATEMENT

USE ONLY WHEN WEARING THE FOLLOWING PERSONAL PROTECTIVE EQUIPMENT DURING MIXING/LOADING, APPLICATION, REPAIR AND CLEANING OF APPLICATION EQUIPMENT, AND DISPOSAL OF PESTICIDE: protective suit of one or two pieces that *covers all parts of the body except head, hands, and feet; chemical resistant cloves; chemical resistant shoes (or chemical resistant* shoe coverings or chemical resistant boots); goggles or face shield; hood or wide brimmed hat; NIOSH or MSHA approved respiratory protection breathing device.

IF MIXING/LOADING IS PERFORMED USING A CLOSED SYSTEM, THE FOLLOWING PROTECTIVE CLOTHING AND EQUIPMENT MAY BE WORN AS AN ALTERNATIVE. Long sleeved shirt; long legged pants; chemical resistant gloves; chemical resistant apron; shoes and socks; Goggles or face shield must be worn when the system is under pressure. All other protective clothing and equipment required for use with open systems must be available nearby.

IF APPLICATION IS PERFORMED USING AN ENCLOSED CAB (Ground Application) OR COCKPIT (Aerial Application), THE FOLLOWING PROTECTIVE CLOTHING AND EQUIPMENT MAY BE WORN AS AN ALTERNATIVE. Long-sleeved shirt and long-legged pants; shoes and socks. Chemical resistant gloves must be available in the cab or cockpit and must be worn during entry to and exit from the application vehicle. For ground application all other protective clothing and equipment required for use during application must be available in the cab and must be worn when exiting the cab into treated areas. When used for this purpose, contaminated clothing may not be brought back into the cab unless in an enclosure such as a plastic bag. (this Section in continued on next panel).

EPA REG. NO. 5481-113-AA

EPA EST. NO. 5481-CA-1

NET CONTENTS 5 GALLONS

AMVAC CHEMICAL CORPORATION
4100 EAST WASHINGTON BLVD - LOS ANGELES, CALIFORNIA 90023

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

STORAGE: Store product in original container in a cool, dry, locked place out of reach of children. Product is flammable. Keep away from heat and open flame. If spilled, avoid exposure. If significant spill, call CHEMTREC (800) 424-9300 or (213)264-3910. Spill can be contained by covering with a sufficient amount of absorbent material such as clay, diatomaceous earth, sand, sawdust, or sweeping compound. Place in drum, label contents, & dispose of according to the instructions below in pesticide disposal. CAUTION: Wear a pesticide respirator and avoid forming dust clouds during clean-up. PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your nearest State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA regional office for guidance. CONTAINER DISPOSAL: (Metal) Triple rinse (or equivalent) Then offer for recycling or reconditioning, or puncture & dispose of in a sanitary landfill, or by other procedures approved by State and local authorities. (Plastic) Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill or incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

READ THE DIRECTIONS CAREFULLY AND FOLLOW THEM AT ALL TIMES

Application can be made by aircraft or ground power equipment by trained personnel only using approved protective equipment. Do not apply with hand equipment. Pour specified amount of this product into nearly filled spray tank. Add balance of water to fill tank. Keep agitator running during filling and spraying operation. If mixture does not mix readily, but tends to separate as an oily layer, do not use as injury to plants may result. Do not combine with wettable powders unless previous use of the mixture has proven physically compatible and safe to plants. Always thoroughly emulsify this product with at least half of total water before adding wettable powder.

SUGGESTED WATER RATES TO USE PER ACRE
FOR AIRCRAFT AND GROUND APPLICATION

The actual rate required to provide thorough, uniform coverage varies with plant growth at time of application. Except as specified for certain uses, mix the recommended rate of DURAPHOS EM-4 in the following amounts of water to cover a broad range of conditions. Therefore, always use higher rates of water/mix per acre to give thorough spray coverage of mature plants with heavier foliage.

CROP	APPLIED BY AIR	APPLIED BY GROUND
Vegetable and Field Crops	5-20 Gals. Water /Acre	20-125 Gals. Water /Acre
Grapes	7-25 " " "	20-200 " " "
Orchard Crops	10-20 " " "	40-800 " " "

FRUIT AND NUT CROPS

IMPORTANT: SEE REENTRY AND WORKER SAFETY STATEMENT ON THIS LABEL CONCERNING ALL CROPS.

APPLES, PEACHES, PEARS, PLUMS: For control of Aphids, and Mites use 1/4 to 1/2 pt. per 100 gals. water. For control of Grasshoppers, Lygus Bugs, and Red-Banded Leaf Roller use 1/2 to 2/3 pt. per 100 gals. water. Do not treat within 1 day of harvest or apply more than 5 pts. per acre on peaches and plums, 8 1/2 pts. per acre on apples and pears.

CHERRIES (SOUR ONLY): For control of Aphids and Mites use 1/2 to 2/3 pt. per 100 gals. water. Do not treat within 2 days of harvest, or apply more than 5 pts. per acre.

CITRUS - ORANGES, LEMONS, GRAPEFRUIT: For control of Aphids use 1 to 2 pts. per acre in 200 or more gals. water. For control of Fruit Tree Leafroller, Orange Tortrix and Omnivorous Leafroller, use 1 qt. per acre in 500 gals. water. For control of Western Tussock Moth larvae, Citrus Cutworm, Varigated Cutworm and Pink Scavenger Caterpillar use 2 qt. per acre in 1200 gallons water. Allow at least 7 days between application. Do not treat within 1 day of harvest.

GRAPES: For control of Aphids use 1/2 to 1 pt. per acre. Do not treat within 2 day of harvest. For control of Leaf Folder, Leafhoppers, Mites, Red Banded Leafroller and Lygus Bugs use 1 qt. per acre. At the 1 qt. dosage do not treat within 5 days of harvest.

STRAWBERRIES: For control of Aphids and Mites use 1/4 to 1/2 pt. per 100 gals. water. For control of Grasshoppers, Strawberry Leafroller, Salt-marsh Caterpillar and Lygus Bugs use 1/2 to 1 pt. per 100 gals water. Do not treat within 1 day of harvest. For hard-to-kill Aphids and Mites use 1 qt. per 100 gals. water but do not treat within 2 days of harvest or apply more than 1 qt. per acre.

DURHAM DURAPHOS EM-4 EPA REG. NO. 5481-113-AA

WALNUTS: For control of Aphids and Alfalfa Caterpillar use 1/4 to 1/2 pt. per 100 gals. water. For control of Mites, Omnivorous Looper, Orange Tortrix, Fruit Tree Leafroller, and Western Tussock Moth use 1/2 pt. per 100 gals. water. Do not treat within 1 day of harvest or apply more than 5 pts. per acre.

FIELD CROPS

IMPORTANT: SEE REENTRY AND WORKER SAFETY STATEMENT ON THIS LABEL CONCERNING ALL CROPS

ALFALFA, CLOVER: For control of Aphids and Alfalfa Caterpillar use 1/4 to 1/2 pt. per acre. For control of Grasshoppers, Leafhoppers, Cutworms (climbing), Mites, Alfalfa Weevil larvae and Lygus Bugs use 1/2 to 1 pts. per acre. Do not treat within 1 day of harvest.

CORN (FIELD & POPCORN) FOR FORAGE & GRAIN: For control of Aphids use 1/4 to 1 pt. per acre. Do not treat within 1 day of harvest .DURAPHOS EM-4 may cause a red or purple discoloration of corn plants similar to other organophosphate compounds.

MUSTARD GREENS, TURNIP TOPS: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Imported Cabbage Worm, False Chinch Bug, Dipterous Leafminer(adults), Grasshoppers, Leafhoppers, and Mites use 1/2 to 1 pt. per acre. Do not treat within 3 days of harvest.

SORGHUM (FOR FORAGE AND GRAIN): For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Corn Earworm, and Webworm use 1/2 to 1 pt. per acre. For control of Fall Armyworms use 1 pt. per acre. Do not treat within 3 days of harvest. .DURAPHOS EM-4 may cause a red or purple discoloration of corn plants similar to other organophosphate compounds.

VEGETABLE CROPS

IMPORTANT: SEE REENTRY AND WORKER SAFETY STATEMENT ON THIS LABEL CONCERNING ALL CROPS

ARTICHOKES: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Plume Moths (species of Leafrollers or Stem Borers) use 1 to 2 pts. per acre. Do not treat within 2 day of harvest.

BEANS: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Grasshoppers, Leafhoppers, Mites, and Mexican Bean Beetle use 1/2 to 1 pt. per acre. Do not treat within 1 day of harvest.

BEETS (INCLUDING TOPS): For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Cutworm(climbing), Dipterous Leafminer(adults), False Chinch bugs, Grasshoppers, Imported Cabbage worm, Leafhoppers, Mites and Salt-marsh Caterpillar use 1/2 to 1 pt. per acre. Do not treat within 3 days of harvest.

BROCCOLI, CABBAGE: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Imported Cabbage worm, Grasshoppers, Leafhoppers, Salt-marsh Caterpillar, Mites, Cutworms,(climbing), Dipterous Leafminer(adults), and Lygus Bugs use 1/2 to 1 pt. per acre. Do not treat within 1 day of harvest. For hard-to-kill Aphids use 1 qt. per acre but do not treat within 3 days of harvest.

BRUSSELS SPROUTS, CAULIFLOWER, COLLARDS, KALE: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Imported Cabbageworm, Grasshoppers, Leafhoppers, Salt-marsh Caterpillar, Mites, Cutworms (climbing), Dipterous Leafminer(adults), and Lygus Bugs use 1/2 to 1 pt. per acre. Do not treat within 3 days of harvest. For hard-to-kill Aphids use 1 qt. per acre, but do not treat COLLARDS and KALE within 7 days of harvest; 3 days on BRUSSELS SPROUTS and CAULIFLOWER.

CARROTS: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Leafhoppers, Lygus Bugs, Mites, Cabbage Looper, Dipterous Leafminer(adult), Cutworms(climbing), and Salt-marsh Caterpillar use 1/2 to 1 pt. per acre. Do not treat within 2 day of harvest.

CELERY: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Dipterous Leafminer(adults), Lygus Bugs, Salt-marsh Caterpillar, Leafhoppers, Cabbage Loopers and Mites use 1/2 to 1 pt. per acre. Do not treat within 3 days of harvest. For hard-to-kill Aphids use 1 qt. per acre but do not treat within 5 days of harvest.

CORN (SWEET) FOR GRAIN & FORAGE: For control of Aphids use 1/4 to 1 pt. per acre. Do not treat within 1 day of harvest. DURAPHOS EM-4 may cause a red or purple discoloration of corn plants similar to other organophosphate compounds.

CUCUMBER: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Grasshoppers, Leafhoppers, and Mites, use 1/2 to 1 pt. per acre. Do not treat within 1 day of harvest.

EGGPLANT, PEPPERS: for control of Aphids use 1/4 to 1/2 pt. per acre. For control of Grasshoppers, Leafhoppers, and Mites use 1/2 to 1 pt. per acre. Do not treat within 2 day of harvest.

LETTUCE: For control of Aphids use 1/4 to 1/2 pt per acre. For control of Corn Earworm, Cutworms,(climbing), Dipterous Leafminer(adults), Cabbage Looper, Imported Cabbageworm, Grasshoppers, Mites, Lygus Bugs, Salt-marsh Caterpillar, False Chinch Bugs, and Thrips use 1/2 to 1 pt. per acre. Do not treat within 2 days of harvest. For hard-to-kill Aphids use 1 qt. per acre but do not treat within 4 days of harvest.

MELONS (INCLUDING CANTALOUPES, HONEY-DEW MELONS, MUSKMELONS, WATERMELONS): For control of Aphids use 1/4 to 1/2 pt. per acre. For Cabbage Looper, Dipterous Leafminer(adults), Leafhoppers, Lygus Bugs, Mites, False Chinch Bugs, Salt-marsh Caterpillar, Cutworms(climbing), and Grasshoppers use 1/2 TO 1 pt. per acre. To control Rindworms (Cabbage Looper, Cutworms, Salt-marsh Caterpillars, Tobacco Budworms) on WATERMELONS apply 1/2 pt. per acre. Do not treat CANTALOUPES, HONEY-DEW MELONS, MUSKMELONS OR WATERMELONS within 1 day of harvest.

ONIONS (INCLUDING GREEN ONIONS): For control of Thrips and Cutworms(climbing) use 1/2 to 1 pt. per acre. Do not treat within 1 day of harvest.

PEAS (INCLUDING VINES): For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Grasshoppers, Leafhoppers, Mites and Cutworms(climbing) use 1/2 to 1 pt. per acre. Do not treat within 1 day of harvest.

POTATOES: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Grasshoppers, Leafhoppers, and Mites use 1/2 pt. per acre. Do not treat within 1 day of harvest.

SPINACH: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Imported Cabbageworm, Grasshoppers, Leafhoppers, Mites, Dipterous Leafminer(adults), Cutworms(climbing), Salt-marsh Caterpillar, and False Chinch Bug use 1/2 to 1 pt. per acre. Do not treat within 4 days of harvest. For hard to kill Aphids use 1 qt. per acre but do not treat within 7 days of harvest.

SUMMER SQUASH: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Dipterous Leafminer(adults), Leafhoppers, Lygus Bugs, Mites, False Chinch bugs, Salt-marsh Caterpillar, Cutworms(climbing), and Grasshoppers use 1/2 to 1 pt. per acre. Do not treat within 1 day of harvest.

TOMATOES: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Grasshoppers, Leafhoppers, and Mites use 1/2 to 1 pt. per acre. Do not treat within 1 day of harvest.

TURNIPS: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Imported Cabbage worm, Grasshoppers, Leafhoppers, Mites False Chinch Bug and Dipterous Leafminer(adults) use 1/2 to 1 pt. per acre. Do not treat within 3 day of harvest.

NOTICE: This product conforms to its chemical description and is reasonably fit for the purpose stated on the label, when used in accordance with directions under normal conditions of use. Manufacturer is not responsible for the use of product contrary to the label instructions, or under abnormal conditions, or under conditions not reasonably foreseeable to the manufacturer and/or seller and the buyer assumes the risk of any such use.

ORGANOPHOSPHORUS PESTICIDE, LIQUID, N.O.S.
(MEVINPHOS) POISON, UN 2783 (RQ-1/0.454)
DURHAM DURAPHOS EM-4 EPA REG. NO. 5481-113-AA

2-80

AMVAC CHEMICAL CORPORATION
4100 EAST WASHINGTON BLVD
LOS ANGELES CALIFORNIA 90023

(2)

PROTECTIVE EQUIPMENT & WORK SAFETY STATEMENT (continued from preceding panel)

REMEMBER THIS CLOTHING (long-sleeved shirt, long-legged pants, shoes and socks) IS NOT ADEQUATE TO PROTECT YOU DURING REPAIR AND CLEANING OF APPLICATION EQUIPMENT AND EARLY REENTRY TO TREATED AREAS. YOU MUST REFER TO AND WEAR OTHER PROTECTIVE CLOTHING AND EQUIPMENT DESCRIBED EARLIER IN THIS SAME SECTION.

IMPORTANT!

IMPORTANT! If pesticide comes in contact with skin, wash off with soap and water and contact a physician immediately. Always wash hands, face, and arms with soap and water before smoking, eating, drinking, or toileting.

....HUMAN FLAGGERS ARE STRICTLY PROHIBITED

during aerial application of this product unless they are in a totally enclosed vehicle.

AFTER WORK: Before removing gloves, wash them with soap and water. Take off all work clothes and shoes. Shower using soap and water. Wear only clean clothes when leaving job – do not wear contaminated clothing. Personal and protective clothing worn during work must be stored and laundered separately from household articles. Store protective clothing separately from personal clothing. Clean or launder protective clothing after each use. Respirators must be cleaned and filters replaced according to instructions included with the respirators. Protective clothing and protective equipment that becomes heavily contaminated or drenched with Mevinphos must be destroyed according to state and local regulations.

HEAVILY CONTAMINATED OR DRENCHED CLOTHING CANNOT BE ADEQUATELY DECONTAMINATED.

The National Pesticide Telecommunication Network is available for recommendations regarding poisoning management, emergency treatment, and other information regarding the toxicity of mevinphos. The toll free number for the National Pesticide Telecommunication Network is 1-800-858-7378.

IF PRODUCT IS HANDLED INDOORS provide mechanical exhaust ventilation. Keep all unprotected persons, children, livestock and pets away from treated areas or where there is danger of drift. Do not rub eyes or mouth with hands. If you feel sick in any way, STOP WORK and get help right away, see the first aid Statements of Practical Treatment section on this label.

IMPORTANT Wear clean clothes daily. Pilot should not assist in mixing and loading operation. Do not contaminate or store near food or feedstuff. This product is not for use or storage in or around the home. In case of spillage, decontaminate areas and equipment by washing with a dilute solution of alkali (less than 5%) and detergent and rinse with water.

NOTE TO PHYSICIAN - - - POISONING SYMPTOMS

Symptoms include weakness, headache, tightness in chest, blurred vision, non reactive pin point pupils, salivation, sweating, nausea, vomiting, diarrhea, and abdominal cramps.

TREATMENT - Atropine is the specific therapeutic antagonist of choice against parasympathetic nervous stimulation. If there are signs of parasympathetic stimulation Atropine Sulfate should be injected at 10 minute intervals in doses of 1 to 2 milligrams until complete atropinization has occurred. Pralidoxime chloride (2-PAM chloride) may also be used as an effective antidote in addition to and while maintaining full atropinization. In adults, an initial dose of 1 gram of 2-PAM should be injected, preferably as an infusion, in 250 cc of saline over a 15 to 20 minute period. If this is not practical, 2-PAM may be administered slowly by intravenous injection as a 5% solution in water over not less than 2 minutes. After about an hour, a second dose of 1 gram of 2-PAM will be indicated if muscle weakness has not been relieved. For infants and children, the dose of 2-PAM is 0.25 grams. Morphine is an improper treatment.

Clear chest by postural drainage. Oxygen administration may be necessary. Observe patient continuously for 48 hours. Repeated exposure to cholinesterase inhibitors may without warning cause prolonged susceptibility to very small doses of any cholinesterase inhibitor. Allow no further exposure until time for cholinesterase regeneration has been attained as determined by a blood test.

FOR 24 HOURS EMERGENCY MEDICAL ASSISTANCE CALL (213) 264-3910.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Do not apply this product through any type of irrigation system.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish and wildlife. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not apply directly to water or wetlands (swamps, bogs, marshes, and potholes). Do not contaminate water when disposing of equipment washwaters. This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weed, while bees are actively visiting the treatment area.

PHYSICAL & CHEMICAL HAZARDS

FLAMMABLE - Keep away from heat or open flame.

REENTRY AND WORKER SAFETY STATEMENT

Reentry into treated CITRUS GROVES, GRAPE VINEYARDS and PEACH orchards is prohibited for 96 hours (4 days) after the end of application, unless the protective clothing specified on this label for early reentry is worn. Reentry into all other treated areas is prohibited for 48 hours (2 days) after the end of application, unless the protective clothing specified on this label for early reentry is worn.

IMPORTANT: When a mixture of 2 or more organophosphates pesticides is applied, the reentry interval shall be extended by adding to the longest applicable interval an additional 50% of that interval.

FOR EARLY REENTRY INTO TREATED AREAS BEFORE SPRAYS HAVE DRIED,

Wear all protective clothing specified on this label for an applicator.

FOR EARLY REENTRY INTO TREATED AREAS AFTER SPRAYS HAVE DRIED,

Wear protective suit of one or two piece covering all parts of the body except head, hands, and feet; chemical resistant gloves; chemical resistant shoes (or chemical resistant shoe coverings or chemical resistant boots)

Written or oral warnings must be given to workers who are expected to be in treated areas or in an area to be treated with this product. (Indicate specific oral warnings which inform workers of areas of fields that may not be entered without specific protective clothing, period of time field must be vacated, and appropriate action to take in case of accidental exposure.) When oral warnings are given, warnings shall be given in a language customarily understood by workers. Oral warnings must be given when there is reason to believe that written warnings cannot be understood by workers. Written warnings must include the following information:

"DANGER Area to be treated with MEVINPHOS ... on (Date)... Do not enter without appropriate protective clothing until (insert here the date/time set forth on this label). In case of accidental exposure see STATEMENTS OF PRACTICAL TREATMENT found on the Phosdrin IPA 4 INSECTICIDE product label."

L.L. - PHI Amd 06-20-90

-45-

RESTRICTED USE PESTICIDE

Due to Very High Acute Toxicity to Humans and Fesique effects on Avian, Mammalian and Aquatic Species. For Retail Sale To and Use Only by Certified Applicators or Persons Under Their Direct Supervision and Only for Those Uses Covered by the Certified Applicators Certification. Direct supervision for this product is defined as "the certified applicator being physically present during application, mixing, loading, repair and cleaning of application equipment." Certified applicators must also ensure that all persons involved in these activities are informed of the precautionary statements.

Phosdrin® IPA 4

INSECTICIDE

Contains 4 lbs. MEVINPHOS per Gallon

ACTIVE INGREDIENTS:	
Mevinphos (2-Carbomethoxy-1-methylvinyl dimethyl phosphate, alpha isomer).....	30.0%
Related Compounds.....	20.0%
INERT INGREDIENTS:.....	50.0%
Total	100.0%

Equivalent to 50.0% /w MEVINPHOS Insecticide

Phosdrin® IPA 4 is a Registered Trade Mark of the Amvac Chemical Corporation

KEEP OUT OF REACH OF CHILDREN

DANGER - POISON

PELIGRO

"PRECAUCION AL USUARIO: Si usted no lee ingles, no use este producto hasta que la etiqueta haya sido explicado ampliamente"

STATEMENTS OF PRACTICAL TREATMENT

IF SWALLOWED: Call a physician or Poison Control Center immediately. Induce vomiting by giving victim 1 or 2 glasses of water & touching back of throat with finger. Never induce vomiting or give anything by mouth to an unconscious or convulsing person.

IF INHALED: Remove victim to fresh air immediately. Apply artificial respiration if indicated. Get medical attention.

IF IN EYES: Flush eyes with plenty of water for 10 minutes. Get medical attention immediately.

IF ON SKIN: Remove contaminated clothing and immediately wash affected area with soap and water. Call a physician immediately. Wash clothing before reuse.

IF POISONING SYMPTOMS APPEAR (See POISONING SYMPTOMS under NOTE TO PHYSICIAN.) Keep patient prone and quiet. Start artificial respiration immediately if patient is not breathing. Transport the patient immediately to the nearest hospital.

SEE ANTIDOTE AND OTHER PRECAUTIONS ON SIDE PANEL

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

DANGER: Poisonous if swallowed, inhaled or absorbed through the skin. Rapidly absorbed through the skin. Repeated inhalation or skin contact may without symptoms, progressively increase susceptibility to MEVINPHOS insecticide poisoning. Do not swallow or get in eyes, on skin or on clothing. Do not breathe vapors. Do not contaminate food of feed products.

PRECAUTIONS IN USING

PROTECTIVE EQUIPMENT & WORK SAFETY STATEMENT

USE ONLY WHEN WEARING THE FOLLOWING PERSONAL PROTECTIVE EQUIPMENT DURING MIXING/LOADING, APPLICATION, REPAIR AND CLEANING OF APPLICATION EQUIPMENT, AND DISPOSAL OF PESTICIDE: protective suit of one or two pieces that covers all parts of the body except head, hands, and feet; chemical resistant gloves; chemical resistant shoes (or chemical resistant shoe coverings or chemical resistant boots); goggles or face shield; hood or wide brimmed hat; NIOSH or MSHA approved respiratory protection breathing device.

IF MIXING/LOADING IS PERFORMED USING A CLOSED SYSTEM, THE FOLLOWING PROTECTIVE CLOTHING AND EQUIPMENT MAY BE WORN AS AN ALTERNATIVE. Long sleeved shirt; long legged pants; chemical resistant gloves; chemical-resistant apron; shoes and socks; Goggles or face shield must be worn when the system is under pressure. All other protective clothing and equipment required for use with open systems must be available nearby.

IF APPLICATION IS PERFORMED USING AN ENCLOSED CAB (Ground Application) OR COCKPIT (Aerial Application), THE FOLLOWING PROTECTIVE CLOTHING AND EQUIPMENT MAY BE WORN AS AN ALTERNATIVE. Long-sleeved shirt and long-legged pants; shoes and socks. Chemical resistant gloves must be available in the cab or cockpit and must be worn during entry to and exit from the application vehicle. For ground application all other protective clothing and equipment required for use during application must be available in the cab and must be worn when exiting the cab into treated areas. When used for this purpose, contaminated clothing may not be brought back into the cab unless in an enclosure such as a plastic bag. (this Section continued on next panel)

EPA REG. NO. 5481-114 EPA EST. NO. 5481-CA-1

NET CONTENTS 5 GALLONS

AMVAC CHEMICAL CORPORATION
4100 EAST WASHINGTON BLVD. - LOS ANGELES, CALIFORNIA 90023

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

STORAGE: Store product in original container in a cool, dry, locked place out of reach of children. Product is flammable. Keep away from heat and open flame. If spilled, avoid exposure. If significant spill, call CHEMTREC (800) 424-9300 or (213)264-3910. Spill can be contained by covering with a sufficient amount of absorbent material such as clay, diatomaceous earth, sand, sawdust, or sweeping compound. Place in drum, label contents, & dispose of according to the instructions below in pesticide disposal. CAUTION: Wear a pesticide respirator and avoid forming dust clouds during clean-up. PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your nearest State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA regional office for guidance. CONTAINER DISPOSAL: (Metal) Triple rinse (or equivalent) Then offer for recycling or reconditioning, or puncture & dispose of in a sanitary landfill, or by other procedures approved by State and local authorities. (Plastic) Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill or incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

READ THE DIRECTIONS CAREFULLY AND FOLLOW THEM AT ALL TIMES

Application can be made by aircraft or ground power equipment by trained personnel only using approved protective equipment. Do not apply with hand equipment. Pour specified amount of this product into nearly filled spray tank. Add balance of water to fill tank. Do not combine with wettable powders unless previous use of the mixture has proven physically compatible and safe to plants. Always thoroughly mix this product with at least half of total water before adding wettable powder.

SUGGESTED WATER RATES TO USE PER ACRE
FOR AIRCRAFT AND GROUND APPLICATION

The actual rate required to provide thorough, uniform coverage varies with plant growth at time of application. Except as specified for certain uses, mix the recommended rate of Phosdrin IPA 4 in the following amounts of water to cover a broad range of conditions. Therefore, always use higher rates of water mix per acre to give thorough spray coverage of mature plants with heavier foliage.

CROP	APPLIED BY AIR	APPLIED BY GROUND
Vegetable and Field Crops	5-20 Gals. Water /Acre	20-125 Gals. Water /Acre
Grapes	7-25 " " "	20-200 " " "
Orchard Crops	10-20 " " "	40-800 " " "

FRUIT AND NUT CROPS

IMPORTANT: SEE REENTRY AND WORKER SAFETY STATEMENT ON THIS LABEL CONCERNING ALL CROPS

APPLES, PEACHES, PEARS, PLUMS: For control of Aphics, and Mites use 1/4 to 1/2 pt. per 100 gals. water. For control of Grasshoppers, Lygus Bugs, and Red-Banded Leaf Roller use 1/2 to 2/3 pt. per 100 gals. water. Do not treat within 1 day of harvest or apply more than 5 pts. per acre on peaches and plums, 6 1/2 pts. per acre on apples and pears.

CHERRIES (SOUR ONLY): For control of Aphids and Mites use 1/2 to 2/3 pt. per 100 gals. water. Do not treat within 2 days of harvest, or apply more than 5 pts. per acre.

CITRUS - ORANGES, LEMONS, GRAPEFRUIT: For control of Aphids use 1 to 2 pts. per acre in 200 or more gals. water. For control of Fruit Tree Leafroller, Orange Tortrix and Omnivorous Leafroller, use 1 qt. per acre in 500 gals. water. For control of Western Tussock Moth larvae, Citrus Cutworm, Variegated Cutworm, and Pink Scavenger Caterpillar use 2 qt. per acre in 1200 gallons water. Allow at least 7 days between application. Do not treat within 1 day of harvest.

GRAPES: For control of Aphids use 1/2 to 1 pt. per acre. Do not treat within 2 day of harvest. For control of Leaf Folder, Leafhoppers, Mites, Red Banded Leafroller and Lygus Bugs use 1 qt. per acre. At the 1 qt. rate do not treat within 5 days of harvest.

STRAWBERRIES: For control of Aphids and Mites use 1/4 to 1/2 pt. per 100 gals. water. For control of Grasshoppers, Strawberry Leafroller, Salt-marsh Caterpillar and Lygus Bugs use 1/2 to 1 pt. per 100 gals water. Do not treat within 1 day of harvest. For hard-to-kill Aphids and Mites use 1 qt. per 100 gals. water, but do not treat within 2 days of harvest or apply more than 1 qt. per acre.

WALNUTS: For control of Aphids and Alfalfa Caterpillar use 1/4 to 1/2 pt. per 100 gals. water. For control of Mites, Omnivorous Looper, Orange Tortrix, Fruit Tree Leafroller, and Western Tussock Moth use 1/2 pt. per 100 gals. water. Do not treat within 1 day of harvest or apply more than 5 pts. per acre.

FIELD CROPS

IMPORTANT: SEE REENTRY AND WORKER SAFETY STATEMENT ON THIS LABEL CONCERNING ALL CROPS

ALFALFA, CLOVER: For control of Aphids and Alfalfa Caterpillar use 1/4 to 1/2 pt. per acre. For control of Grasshoppers, Leafhoppers, Cutworms (climbing), Mites, Alfalfa Weevil larvae and Lygus Bugs use 1/2 to 1 pts. per acre. Do not treat within 1 day of harvest.

CORN, FIELD & POPCORN (FOR FORAGE & GRAIN): For control of Aphids use 1/4 to 1 pt. per acre. Do not treat within 1 day of harvest. Phosdrin IPA 4 may cause a red or purple discoloration of corn plants similar to other organophosphate compounds.

MUSTARD GREENS, TURNIP TOPS: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Imported Cabbage Worm, False Chinch Bug, Dipterous Leafminer(adults), Grasshoppers, Leafhoppers, and Mites use 1/2 to 1 pt. per acre. Do not treat within 3 days of harvest.

SORGHUM (FOR FORAGE AND GRAIN): For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Corn Earworm, and Webworm use 1/2 to 1 pt. per acre. For control of Fall Armyworms use 1 pt. per acre. Do not treat within 3 days of harvest. Phosdrin IPA 4 may cause a red or purple discoloration of the sorghum plants similar to other organophosphate compounds.

VEGETABLE CROPS

IMPORTANT: SEE REENTRY AND WORKER SAFETY STATEMENT ON THIS LABEL CONCERNING ALL CROPS

ARTICHOKES: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Plume Moths (species of Leafrollers or Stem Borers) use 1 to 2 pts. per acre. Do not treat within 2 day of harvest.

BEANS: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Grasshoppers, Leafhoppers, Mites, and Mexican Bean Beetle use 1/2 to 1 pt. per acre. Do not treat within 1 day of harvest.

BEETS (INCLUDING TOPS): For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Cutworm(climbing), Dipterous Leafminer(adults), False Chinch bugs, Grasshoppers, Imported Cabbage worm, Leafhoppers, Mites and Salt-marsh Caterpillar use 1/2 to 1 pt. per acre. Do not treat within 3 days of harvest.

BROCCOLI, CABBAGE: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Imported Cabbage worm, Grasshoppers, Leafhoppers, Salt-marsh Caterpillar, Mites, Cutworms,(climbing), Dipterous Leaf miner(adults), and Lygus Bugs use 1/2 to 1 pt. per acre. Do not treat within 1 day of harvest. For hard-to-kill Aphids use 1 qt. per acre but do not treat within 3 days of harvest.

BRUSSELS SPROUTS, CAULIFLOWER, COLLARDS, KALE: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Imported Cabbage worm, Grasshoppers, Leafhoppers, Salt-marsh Caterpillar, Mites, Cutworms (climbing), Dipterous Leafminer(adults), and Lygus Bugs use 1/2 to 1 pt. per acre. Do not treat within 3 days of harvest. For hard-to-kill Aphids use 1 qt. per acre, but do not treat COLLARDS and KALE within 7 days of harvest; 3 days on BRUSSELS SPROUTS and CAULIFLOWER.

CARROTS: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Leafhoppers, Lygus Bugs, Mites, Cabbage Looper, Dipterous Leafminer(adult), Cutworms(climbing), and Salt-marsh Caterpillar use 1/2 to 1 pt. per acre. Do not treat within 2 days of harvest.

CELERY: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Dipterous Leafminer(adults), Lygus Bugs, Salt-marsh Caterpillar, Leafhoppers, Cabbage Loopers and Mites use 1/2 to 1 pt. per acre. Do not treat within 3 days of harvest. For hard-to-kill Aphids use 1 qt. per acre but do not treat within 5 days of harvest.

CORN, SWEET (FOR GRAIN & FORAGE): For control of Aphids use 1/4 to 1 pt. per acre. Do not treat within 1 day of harvest. Phosdrin IPA 4 may cause a red or purple discoloration of corn plants similar to other organophosphate compounds.

CUCUMBER: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Grass

EGGPLANT, PEPPERS: for control of Aphids use 1/4 to 1/2 pt. per acre. For control of Grasshoppers, Leafhoppers, and Mites use 1/2 to 1 pt. per acre. Do not treat within 2 days of harvest.

LETTUCE: For control of Aphids, use 1/4 to 1/2 pint per acre. For control of Corn Earworm, Cutworms (climbing), Dipterous Leafminer (adults), Cabbage Looper, Imported Cabbage Worm, Grasshoppers, Mites, Lygus Bugs, Salt-marsh Caterpillar, False Chinch Bugs, and Thrips, use 1/2 to 1 pint per acre.

Keep a 7 day interval between applications.

Head Lettuce - When applying 1 pint or less per acre, do not treat within 2 days of harvest. For hard-to-kill insects, including Aphids, use 1 quart per acre but do not treat within 4 days of harvest.

Leaf Lettuce - (including Butter or Boston, Greenleaf, Redleaf and Romaine): When applying 1 pint or less per acre, do not treat within 7 days of harvest. For hard-to-kill insects, including Aphids, use 1 quart per acre but do not treat within 10 days of harvest.

MELONS (INCLUDING CANTALOUPES, HONEY-DEW MELONS, MUSKMELONS, WATERMELONS): For control of Aphids use 1/4 to 1/2 pt. per acre. For Cabbage Looper, Dipterous Leafminer(adults), Leafhoppers, Lygus Bugs, Mites, False Chinch Bugs, Salt-marsh Caterpillar, Cutworms(climbing), and Grasshoppers use 1/2 TO 1 pt. per acre. To control Rindworms (Cabbage Looper, Cutworms, Salt-marsh Caterpillars, Tobacco Budworms) on WATERMELONS apply 1/2 pt. per acre. Do not treat CANTALOUPES, HONEY-DEW MELONS, MUSKMELONS OR WATERMELONS within 1 day of harvest.

ONIONS (INCLUDING GREEN ONIONS): For control of Thrips and Cutworms (climbing) use 1/2 to 1 pt. per acre. Do not treat within 1 day of harvest.

PEAS (INCLUDING VINES): For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Grasshoppers, Leafhoppers, Mites and Cutworms(climbing) use 1/2 to 1 pt. per acre. Do not treat within 1 day of harvest.

POTATOES: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Grasshoppers, Leafhoppers, and Mites use 1/2 pt. per acre. Do not treat within 1 day of harvest.

SPINACH: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Imported Cabbageworm, Grasshoppers, Leafhoppers, Mites, Dipterous Leafminer(adults), Cutworms(climbing), Salt-marsh Caterpillar, and False Chinch Bug use 1/2 to 1 pt. per acre. Do not treat within 4 days of harvest. For hard-to-kill Aphids use 1 qt. per acre but do not treat within 7 days of harvest.

SUMMER SQUASH: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Dipterous Leafminer(adults), Leafhoppers, Lygus Bugs, Mites, False Chinch bugs, Salt-marsh Caterpillar, Cutworms(climbing), and Grasshoppers use 1/2 to 1 pt. per acre. Do not treat within 1 day of harvest.

TOMATOES: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Grasshoppers, Leafhoppers, and Mites use 1/2 to 1 pt. per acre. Do not treat within 1 day of harvest.

TURNIPS: For control of Aphids use 1/4 to 1/2 pt. per acre. For control of Cabbage Looper, Imported Cabbage worm, Grasshoppers, Leafhoppers, Mites, False Chinch Bug and Dipterous Leafminer(adults) use 1/2 to 1 pt. per acre. Do not treat within 3 day of harvest.

NOTICE: This product conforms to its chemical description and is reasonably fit for the purpose stated on the label, when used in accordance with directions under normal conditions of use. Manufacturer is not responsible for the use of product contrary to the label instructions, or under abnormal conditions, or under conditions not reasonably foreseeable to the manufacturer and/or seller and the buyer assumes the risk of any such use.

LL - PHI Amd. 06-20-90

ORGANOPHOSPHORUS PESTICIDE, LIQUID, N.O.S.
(50% MEVINPHOS IN ISOPROPANOL)
FLAMMABLE LIQUID, UN 2784 - POISON (RQ-1/0.454)

Phosdrin® IPA 4 EPA REG. NO. 5481-114

AMVAC CHEMICAL CORPORATION
4100 EAST WASHINGTON BLVD.

PROTECTIVE EQUIPMENT & WORK SAFETY STATEMENT (continued from preceding panel)

REMEMBER THIS CLOTHING;(long-sleeved shirt, long-legged pants, shoes and socks) IS NOT ADEQUATE TO PROTECT YOU DURING REPAIR AND CLEANING OF APPLICATION EQUIPMENT AND EARLY REENTRY TO TREATED AREAS. YOU MUST REFER TO AND WEAR OTHER PROTECTIVE CLOTHING AND EQUIPMENT DESCRIBED EARLIER IN THIS SAME SECTION.

IMPORTANT!

IMPORTANT! If pesticide comes in contact with skin, wash off with soap and water and contact a physician immediately. Always wash hands, face, and arms with soap and water before smoking, eating, drinking, or toileting.

....HUMAN FLAGGERS ARE STRICTLY PROHIBITED

during aerial application of this product unless they are in a totally enclosed vehicle.

AFTER WORK: Before removing gloves, wash them with soap and water. Take off all work clothes and shoes. Shower using soap and water. Wear only clean clothes when leaving job -- do not wear contaminated clothing. Personal and protective clothing worn during work must be stored and laundered separately from household articles. Store protective clothing separately from personal clothing. Clean or launder protective clothing after each use. Respirators must be cleaned and filters replaced according to instructions included with the respirators. Protective clothing and protective equipment that becomes heavily contaminated or drenched with Mevinphos must be destroyed according to state and local regulations.

HEAVILY CONTAMINATED OR DRENCHED CLOTHING CANNOT BE ADEQUATELY DECONTAMINATED.

The National Pesticide Telecommunication Network is available for recommendations regarding poisoning management, emergency treatment, and other information regarding the toxicity of mevinphos. The toll free number for the National Pesticide Telecommunication Network is 1-800-856-7378.

IF PRODUCT IS HANDLED INDOORS provide mechanical exhaust ventilation. Keep all unprotected persons, children, livestock and pets away from treated areas or where there is danger of drift. Do not rub eyes or mouth with hands. If you feel sick in any way, STOP WORK and get help right away, see the first aid Statements of Practical Treatment section on this label.

IMPORTANT Wear clean clothes daily. Pilot should not assist in mixing and loading operation. Do not contaminate or store near food or feedstuff. This product is not for use or storage in or around the home. In case of spillage, decontaminate areas and equipment by washing with a dilute solution of alkali (less than 5%) and detergent and rinse with water.

NOTE TO PHYSICIAN - - - POISONING SYMPTOMS

Symptoms include weakness, headache, tightness in chest, blurred vision, non reactive pin point pupils, salivation, sweating, nausea, vomiting, diarrhea, and abdominal cramps.

TREATMENT - Atropine is the specific therapeutic antagonist of choice against parasympathetic nervous stimulation. If there are signs of parasympathetic stimulation Atropine Sulfate should be injected at 10 minute intervals in doses of 1 to 2 milligrams until complete atropinization has occurred. Pralidoxime chloride (2-PAM chloride) may also be used as an effective antidote in addition to and while maintaining full atropinization. In adults, an initial dose of 1 gram of 2-PAM should be injected, preferably as an infusion, in 250 cc of saline over a 15 to 20 minute period. If this is not practical, 2-PAM may be administered slowly by intravenous injection as a 5% solution *in water over not less than 2 minutes. After about an hour, a second dose of 1 gram of 2-PAM will be indicated if muscle weakness has* not been relieved. For infants and children, the dose of 2-PAM is 0.25 grams. Morphine is an improper treatment.

Clear chest by postural drainage. Oxygen administration may be necessary. Observe patient continuously for 48 hours. Repeated exposure to cholinesterase inhibitors may without warning cause prolonged susceptibility to very small doses of any cholinesterase inhibitor. Allow no further exposure until time for cholinesterase regeneration has been attained as determined by a blood test.

FOR 24 HOURS EMERGENCY MEDICAL ASSISTANCE CALL (213) 264-3910.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Do not apply this product through any type of irrigation system.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish and wildlife. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not apply directly to water or wetlands(swamps, bogs, marshes, and potholes). Do not contaminate water when disposing of equipment washwaters. This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weed, while bees are actively visiting the treatment area.

PHYSICAL & CHEMICAL HAZARDS

Do not use, pour, spill or store near heat or open flame.

REENTRY AND WORKER SAFETY STATEMENT

Reentry into treated CITRUS GROVES, GRAPE VINEYARDS, and PEACH orchards is prohibited for 96 hours (4 days) after the end of application unless the protective clothing specified on this label for early reentry is worn. Reentry into all other treated areas is prohibited for 48 hours (2 days) after the end of application, unless the protective clothing specified on this label for early reentry is worn.

IMPORTANT: When a mixture of 2 or more organophosphates pesticides is applied, the reentry interval shall be extended by adding to the longest applicable interval an additional 50% of that interval!

FOR EARLY REENTRY INTO TREATED AREAS BEFORE SPRAYS HAVE DRIED,

Wear all protective clothing specified on this label for an applicator.

FOR EARLY REENTRY INTO TREATED AREAS AFTER SPRAYS HAVE DRIED,

Wear protective suit of one or two piece covering all parts of the body except head, hands, and feet; chemical resistant gloves; chemical resistant shoes (or chemical resistant shoe coverings or chemical resistant boots)

Written or oral warnings must be given to workers who are expected to be in treated areas or in an area to be treated with this product. (Indicate specific oral warnings which inform workers of areas of fields that may not be entered without specific protective clothing, period of time field must be vacated, and appropriate action to take in case of accidental exposure.) When oral warnings are given, warnings shall be given in a language customarily understood by workers. Oral warnings must be given when there is reason to believe that written warnings cannot be understood by workers. Written warnings must include the following information;

"DANGER. Area to be treated with MEVINPHOS ... on (Date) ...Do not enter without appropriate protective clothing until (insert here the date/time set forth on this label). In case of accidental exposure see STATEMENTS OF PRACTICAL TREATMENT found on the *Phosdrin 10.3 W S Insecticide product label.*"

03-10-88

(3)

RESTRICTED USE PESTICIDE

Due to Very High Acute Toxicity to Humans and Residue effects on Avian, Mammalian and Aquatic Species. For Retail Sale To and Use Only by Certified Applicators or Persons Under Their Direct Supervision and Only for Those Uses Covered by the Certified Applicators Certification. Direct supervision for this product is defined as "the certified applicator being physically present during application, mixing, loading, repair and cleaning of application equipment." Certified applicators must also ensure that all persons involved in these activities are informed of the precautionary statements.

Phosdrin® 10.3

W S INSECTICIDE

Contains 10.3 lbs. MEVINPHOS per Gallon

ACTIVE INGREDIENTS:

Mevinphos (2-Carbomethoxy-1-methylvinyl dimethyl phosphate, alpha isomer)	60.0%*
Related Compounds	40.0%*
Total	100.0%

Phosdrin Is a Reg. Trade Mark of Amvac Chemical Corporation

*Equivalent to 100.0% /w MEVINPHOS Insecticide

KEEP OUT OF REACH OF CHILDREN

DANGER - POISON

PELIGRO

"PRECAUCION AL USUARIO: Si usted no lee Ingles, no use este producto hasta que la etiqueta haya sido explicada ampliamente"

STATEMENTS OF PRACTICAL TREATMENT

IF SWALLOWED: Call a physician or Poison Control Center immediately. Induce vomiting by giving victim 1 or 2 glasses of water & touching back of throat with finger. Never induce vomiting or give anything by mouth to an unconscious or convulsing person.

IF INHALED: Remove victim to fresh air immediately. Apply artificial respiration if indicated. Get medical attention.

IF IN EYES: Flush eyes with plenty of water for 10 minutes. Get medical attention immediately.

IF ON SKIN: Remove contaminated clothing and immediately wash affected area with soap and water. Call a physician immediately. Wash clothing before reuse.

IF POISONING SYMPTOMS APPEAR (See POISONING SYMPTOMS under NOTE TO PHYSICIAN.) Keep patient prone and quiet. Start artificial respiration immediately if patient is not breathing. Transport the patient immediately to the nearest hospital.

SEE ANTIDOTE AND OTHER PRECAUTIONS ON SIDE PANEL

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

DANGER: Poisonous if swallowed, inhaled or absorbed through the skin. Rapidly absorbed through the skin. Repeated inhalation or skin contact may without symptoms, progressively increase susceptibility to MEVINPHOS insecticide poisoning. Do not swallow or get in eyes, on skin or on clothing. Do not breathe vapors. Do not contaminate food of feed products.

PRECAUTIONS IN USING

PROTECTIVE EQUIPMENT & WORK SAFETY STATEMENT

USE ONLY WHEN WEARING THE FOLLOWING PERSONAL PROTECTIVE EQUIPMENT DURING MIXING/LOADING, APPLICATION, REPAIR AND CLEANING OF APPLICATION EQUIPMENT, AND DISPOSAL OF PESTICIDE: protective suit of one or two pieces that covers all parts of the body except head, hands, and feet; chemical resistant gloves; chemical resistant shoes (or chemical resistant shoe coverings or chemical resistant boots); goggles or face shield; hood or wide brimmed hat; NIOSH (or MSHA approved respiratory protection breathing device.

IF MIXING/LOADING IS PERFORMED USING A CLOSED SYSTEM, THE FOLLOWING PROTECTIVE CLOTHING AND EQUIPMENT MAY BE WORN AS AN ALTERNATIVE. Long sleeved shirt; long legged pants; chemical resistant gloves; chemical resistant apron; shoes and socks; Goggles or face shield must be worn when the system is under pressure. All other protective clothing and equipment required for use with open systems must be available nearby.

IF APPLICATION IS PERFORMED USING AN ENCLOSED CAB (Ground Application) OR COCKPIT (Aerial Application), THE FOLLOWING PROTECTIVE CLOTHING AND EQUIPMENT MAY BE WORN AS AN ALTERNATIVE. Long sleeved shirt and long-legged pants; shoes and socks. Chemical resistant gloves must be available in the cab or cockpit and must be worn during entry to and exit from the application vehicle. For ground application all other protective clothing and equipment required for use during application must be available in the cab and must be worn when exiting the cab into treated areas. When used for this purpose, contaminated clothing may not be brought back into the cab unless in an enclosure such as a plastic bag. (this Section continued on next panel).

EPA REG. NO. 5481-161 NET CONTENTS 5 GALLONS EPA EST. NO. 5481-CA-1

AMVAC CHEMICAL CORPORATION

4100 EAST WASHINGTON BLVD - LOS ANGELES, CALIFORNIA 90023

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

STORAGE Store product in original container in a cool, dry, locked place out of reach of children. Product is flammable. Keep away from heat and open flame. If spilled, avoid exposure. If significant spill, call CHEMTREC (800) 424-9300 or (213)264-3910. Spill can be contained by covering with a sufficient amount of absorbent material such as clay, diatomaceous earth, sand, sawdust, or sweeping compound. Place in drum, label contents, & dispose of according to the instructions below in pesticide disposal. CAUTION: Wear a pesticide respirator and avoid forming dust clouds during clean-up. PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your nearest State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA regional office for guidance. CONTAINER DISPOSAL: (Metal) Triple rinse (or equivalent) Then offer for recycling or reconditioning, or puncture & dispose of in a sanitary landfill, or by other procedures approved by State and local authorities. (Plastic) Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill or incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

READ THE DIRECTIONS CAREFULLY AND FOLLOW THEM AT ALL TIMES

Application can be made by aircraft or ground power equipment by trained personnel only using approved protective equipment. Do not apply with hand equipment. Pour specified amount of this product into nearly filled spray tank. Add balance of water to fill tank. Do not combine with wettable powders unless previous use of the mixture has proven physically compatible and safe to plants. Always thoroughly mix this product with at least half of total water before adding wettable powder.

SUGGESTED WATER RATES TO USE PER ACRE
FOR AIRCRAFT AND GROUND APPLICATION

The actual rate required to provide thorough, uniform coverage varies with plant growth at time of application. Except as specified for certain uses, mix the recommended rate of Phosdrin 10.3 in the following amounts of water to cover a broad range of conditions. Therefore, always use higher rates of water mix per acre to give thorough spray coverage of mature plants with heavier foliage.

CROP	APPLIED BY AIR	APPLIED BY GROUND
Vegetable and Field Crops	5-20 Gals. Water /Acre	20-125 Gals. Water /Acre
Grapes	7-25 " " "	20-200 " " "
Orchard Crops	10-20 " " "	40-800 " " "

FRUIT AND NUT CROPS

IMPORTANT: SEE REENTRY AND WORKER SAFETY STATEMENT ON THIS LABEL CONCERNING ALL CROPS.

APPLES, PEACHES, PEARS, PLUMS: For control of Aphids, and Mites use 1.5 to 3 fl. oz./100 gals. water. For control of Grasshoppers, Lygus Bugs, and Red-Banded Leaf Roller use 3 to 4 fl. oz./100 gals. water. Do not treat within 1 day of harvest or apply more than 750 gals./acre on peaches and plums, 900 gals./acre on apples and pears.

CHERRIES (SOUR ONLY): For Aphids and Mites use 3 to 4 fl. oz./100 gals. water. Do not treat within 2 days of harvest, or apply more than 750 gals./acre.

CITRUS - ORANGES, LEMONS, GRAPEFRUIT: For Aphids use 6 to 12.5 fl. oz./acre in 200 or more gals. water. For control of Fruit Tree Leafroller, Orange Tortrix and Omnivorous Leafroller use 12.5 fl. oz./acre in 500 gals. water. For control of Western Tussock Moth larvae, Citrus Cutworm, Varigated Cutworm, and Pink Scavenger Caterpillar use 25 fl. oz./acre in 1200 gallons water. Allow at least 7 days between application. Do not treat within 1 day of harvest.

RASPBERRIES For control of Aphids use 1.5 to 3 fl. oz./100 gals. water. For control of Mites, Leafhoppers, Fruit Tree Leafroller, and Orange Tortrix use 3 to 4 fl. oz./100 gals. of water. Apply both dosages in up to 200 gals. water/acre. Do not treat within 3 days of harvest.

GRAPES: For control of Aphids use 3 to 6 fl. oz./acre. Do not treat within 2 day of harvest. For control of Leaf Folder, Leafhoppers, Mites, Red Banded Leafroller and Lygus Bugs use 6 to 12.5 fl. oz./acre. At the 12.5 fl. oz. rate do not treat within 5 days of harvest.

STRAWBERRIES: For control of Aphids and Mites use 1.5 to 3 fl. oz./100 gals. water. For control of Grasshoppers, Strawberry Leafroller, Salt marsh Caterpillar and Lygus Bugs use 3 to 6 fl. oz./100 gals. water. Do not treat within 1 day of harvest. For hard-to-kill Aphids and Mites use 12.5 fl. oz./100 gals. water, but do not [illegible] more than 100 gals. finished spray/acre.

WALNUTS: For control of Aphids and Alfalfa Caterpillar use 1.5 to 3 fl. oz./100 gals. water. For control of Mites, Omnivorous Looper, Orange Tortrix, Fruit Tree Leafroller, and Western Tussock Moth use 3 fl. oz./100 gals. water. Do not treat within 1 day of harvest or apply more than 1000 gals./acre.

FIELD CROPS

IMPORTANT: SEE REENTRY AND WORKER SAFETY STATEMENT ON THIS LABEL CONCERNING ALL CROPS.

ALFALFA, CLOVER: For control of Aphids and Alfalfa Caterpillar use 1.5 to 3 fl. oz./ acre. For control of Grasshoppers, Leafhoppers, Cutworms (climbing), Mites, Alfalfa Weevil larvae and Lygus Bugs use 3 to 6 fl. oz./acre. Do not treat within 1 day of harvest.

CORN (FIELD & POPCORN) FOR FORAGE & GRAIN: For control of Aphids use 1.5 to 6 fl. oz./acre. Do not treat within 1 day of harvest. Phosdrin 10.3 may cause a red or purple discoloration of corn plants similar to other organophosphate compounds.

MUSTARD GREENS, TURNIP TOPS: For control of Aphids use 1.5 to 3 fl. oz./ acre. For control of Cabbage Looper, Imported Cabbage Worm, False Chinch Bug, Dipterous Leafminer(adults), Grasshoppers, Leafhoppers, and Mites use 3 to 6 fl. oz./acre. Do not treat within 3 days of harvest.

PEA VINES (FOR FORAGE ONLY): For control of Aphids use 1.5 to 3 fl. oz./ acre. For control of Grasshoppers, Leafhoppers, Mites and Cutworm(climbing) use 3 to 6 fl. oz./acre. Do not treat within 1 day of harvest.

SORGHUM (FOR FORAGE AND GRAIN): For control of Aphids use 1.5 to 3 fl. oz./ acre. For control of Corn Earworm, and Webworm use 3 to 6 fl. oz./acre. For control of Fall Armyworms use 6 fl. oz./ acre. Do not treat within 3 days of harvest. Phosdrin 10.3 may cause a red or purple discoloration of the sorghum plants similar to other organophosphate compounds.

VEGETABLE CROPS

IMPORTANT: SEE REENTRY AND WORKER SAFETY STATEMENT ON THIS LABEL CONCERNING ALL CROPS.

ARTICHOKES: For control of Aphids use 1.5 to 3 fl. oz./acre. For control of Plume Moths (species of Leafrollers or Stem Borers) use 6 to 12.5 fl. oz./acre. Do not treat within 2 day of harvest.

BEANS: For control of Aphids use 1.5 to 3 fl. oz./acre. For control of Grass hoppers, Leafhoppers, Mites, and Mexican Bean Beetle use 3 to 6 fl. oz./ acre. Do not treat within 1 day of harvest.

BEETS (INCLUDING TOPS): For Aphids use 1.5 to 3 fl. oz./acre. For control of Cabbage Looper, Cutworm(climbing), Dipterous Leafminer(adults), False Chinch bugs, Grasshoppers, Imported Cabbage worm, Leafhoppers, Mites and Salt-marsh Caterpillar use 3 to 6 fl. oz./acre. Do not treat within 3 days of harvest.

BROCCOLI, CABBAGE: For control of Aphids use 1.5 to 3 fl. oz./ acre. For Cabbage Looper, Imported Cabbage worm, Grasshoppers, Leafhoppers, Salt-marsh Caterpillar, Mites, Cutworms,(climbing), Dipterous Leaf miner(adults), and Lygus Bugs use 3 to 6 fl. oz./acre. Do not treat within 1 day of harvest. For hard-to-kill Aphids use 12.5 fl. oz./acre but do not treat within 3 days of harvest.

BRUSSELS SPROUTS, CAULIFLOWER, COLLARDS, KALE: For control of Aphids use 1.5 to 3 fl. oz./ acre. For control of Cabbage Looper, Imported Cabbage worm, Grasshoppers, Leafhoppers, Salt-marsh Caterpillar, Mites, Cutworms (climbing), Dipterous Leafminer(adults), and Lygus Bugs use 3 to 6 fl. oz./ acre. Do not treat within 3 days of harvest. For hard-to-kill Aphids use 12.5 fl. oz./ acre, but do not treat COLLARDS and KALE within 7 days of harvest; 3 days on BRUSSELS SPROUTS and CAULIFLOWER.

CARROTS: For control of Aphids use 1.5 to 3 fl. oz./acre. For control of Leafhoppers, Lygus Bugs, Mites, Cabbage Looper, Dipterous Leafminer(adult), Cutworms(climbing), and Salt-marsh Caterpillar use 3 to 6 fl. oz./acre. Do not treat within 2 days of harvest.

CELERY: For control of Aphids use 1.5 to 3 fl. oz./acre. For control of Dipterous Leafminer(adults), Lygus Bugs, Salt marsh Caterpillar, Leafhoppers, Cabbage Loopers and Mites use 3 to 6 fl. oz./acre. Do not treat within 3 days of harvest. For hard to kill Aphids use 12.5 fl. oz./acre but do not treat within 5 days of harvest.

CORN (SWEET) FOR GRAIN & FORAGE: For control of Aphids use 1.5 to 6 fl. oz./acre. Do not treat within 1 day of harvest. Phosdrin 10.3 may cause a red or purple discoloration of corn plants similar to other organophosphate compounds.

CUCUMBERS: For control of Aphids use 1.5 to 3 fl. oz./acre. For control of Grasshoppers, Leafhoppers, and Mites use 3 to 6 fl. oz./acre. Do not treat within 1 day of harvest.

EGGPLANT, PEPPERS: For control of Aphids use 1.5 to 3 fl. oz./ acre. For control of Grasshoppers, Leafhoppers, and Mites use 3 to 6 fl. oz./acre. Do not treat within 2 days of harvest.

LETTUCE: For control of Aphids use 1.5 to 3 fl. oz./acre. For control of Corn Earworm, Cutworms(climbing), Dipterous Leafminer(adults), Cabbage Looper, Imported Cabbageworm, Grasshoppers, Mites, Lygus Bugs, Salt-marsh Caterpillar, False Chinch Bugs, and Thrips use 3 to 6 fl. oz./acre. Do not treat within 2 days of harvest. For hard to kill Aphids use 12.5 fl. oz./acre but do not treat within 4 days of harvest.

MELONS (INCLUDING CANTALOUPES, HONEY-DEW MELONS, MUSK-MELONS, WATERMELONS): For control of Aphids use 1.5 to 3 fl. oz./acre. For Cabbage Looper, Dipterous Leafminer(adults), Leafhoppers, Lygus Bugs, Mites, False Chinch Bugs, Salt-marsh Caterpillar, Cutworms(climbing), and Grasshoppers use 3 to 6 fl. oz./acre. To control Blindworms (Cabbage Looper, Cutworms, Salt-marsh Caterpillars, Tobacco Budworms) on WATERMELONS apply 3 fl. oz./ acre. Do not treat CANTALOUPES, HONEY-DEW MELONS, MUSKMELONS or WATERMELONS within 1 day of harvest.

OKRA: For Aphids use 1.5 to 3 fl. oz./acre. For Cutworms(climbing), Corn Earworms, Green Stinkbug, Mites, and Velvet Bean Caterpillar use 3 to 6 fl. oz./acre. Do not treat within 1 day of harvest.

ONIONS (INCLUDING GREEN ONIONS): For control of Thrips and Cutworms(climbing) use 3 to 6 fl. oz./acre. Do not treat within 1 day of harvest.

PEAS (INCLUDING VINES): For control of Aphids use 1.5 to 3 fl. oz./ acre. For control of Grasshoppers, Leafhoppers, Mites and Cutworms(climbing) use 3 to 6 fl. oz./acre. Do not treat within 1 day of harvest.

POTATOES: For control of Aphids use 1.5 to 3 fl. oz./acre. For control of Grasshoppers, Leafhoppers, and Mites use 3 fl. oz./acre. Do not treat within 1 day of harvest.

SPINACH: For control of Aphids use 1.5 to 3 fl. oz./acre. For control of Cabbage Looper, Imported Cabbageworm, Grasshoppers, Leafhoppers, Mites, Dipterous Leafminer(adults), Cutworms(climbing), Salt-marsh Caterpillar, and False Chinch Bug use 3 to 6 fl. oz./acre. Do not treat within 4 days of harvest. For hard-to-kill Aphids use 12.5 fl. oz./acre but do not treat within 7 days of harvest.

SUMMER SQUASH: For control of Aphids use 1.5 to 3 fl. oz./acre. For control of Cabbage Looper, Dipterous Leafminer(adults), Leafhoppers, Lygus Bugs, Mites, False Chinch bugs, Salt-marsh Caterpillar, Cutworms(climbing), and Grasshoppers use 3 to 6 fl. oz./acre. Do not treat within 1 day of harvest.

TOMATOES: For control of Aphids use 1.5 to 3 fl. oz./acre. For control of Grasshoppers, Leafhoppers, and Mites use 3 to 6 fl. oz./acre. Do not treat within 1 day of harvest.

TURNIPS: For control of Aphids use 1.5 to 3 fl. oz./acre. For control of Cabbage Looper, Imported Cabbage worm, Grasshoppers, Leafhoppers, Mites, False Chinch Bug and Dipterous Leafminer(adults) use 3 to 6 fl. oz./acre. Do not treat within 3 day of harvest.

NOTICE: This product conforms to its chemical description and is reasonably fit for the purpose stated on the label, when used in accordance with directions under normal conditions of use. Manufacturer is not responsible for the use of product contrary to the label instructions, or under abnormal conditions, or under conditions not reasonably foreseeable to the manufacturer and/or seller and the buyer assumes the risk of any such use.

03 23 89

ORGANOPHOSPHORUS PESTICIDE, LIQUID, N.O.S.
UN 2783 - POISON (RQ-1/0.454)
Phosdrin 10.3 EPA REG. NO. 5481-161

AMVAC CHEMICAL CORPORATION
4100 EAST WASHINGTON BLVD
LOS ANGELES, CA 90023

accepted 5/23/92

(4)

AMVAC

Phosdrin® 4EC

INSECTICIDE

Chemistry for Life

RESTRICTED USE PESTICIDE

Due to Very High Acute Toxicity to Humans and Reckless effects on Avian, Mammalian and Aquatic Species. For Retail Sales to and Use Only by Certified Applicators or Persons Under Their Direct Supervision and Only for Those Uses Covered by the Certified Applicators Certification. Direct supervision for this product is defined as "the certified applicator being physically present during application, mixing, loading, repair and cleaning of application equipment." Certified applicators must also ensure that all persons involved in these activities are informed of the precautionary statements

Phosdrin® 4 EC

INSECTICIDE

Emulsifiable Concentrate - Contains 4 lbs. active ingredients per Gallon

ACTIVE INGREDIENTS:	
Mevinphos (2-Carbomethoxy-1-methylvinyl dimethyl phosphate, alpha isomer)	28.3%
Related Compounds	18.8%
INERT INGREDIENTS:	52.9%
*Equivalent of 47.1% w MEVINPHOS Insecticide	Total 100.0%

Phosdrin is a Registered Trade Mark of the AMVAC CHEMICAL CORPORATION

REG. NO. 5481-412 EPA EST. NO. 5481-CA-1

KEEP OUT OF REACH OF CHILDREN

DANGER - POISON

PELIGRO

PRECAUCION AL USUARIO: Si usted no lee ingles, no use este producto hasta que la etiqueta haya sido explicado ampliamente"

STATEMENTS OF PRACTICAL TREATMENT

ATROPINE IS AN ANTIDOTE. CALL A PHYSICIAN AT ONCE IN ALL CASES OF SUSPECTED POISONING

SWALLOWED: drink 1 or 2 glasses of water and induce vomiting by touching back of throat finger. NEVER induce vomiting or give anything by mouth to an unconscious or non-alert person.

INHALED: remove from exposure. Have patient lie down and keep quiet. If patient is not breathing start artificial respiration immediately. Get medical attention.

CASE OF CONTACT: wash skin with plenty of soap and water; for eyes, flush with water and get medical attention; remove and wash contaminated clothing before re-use.

WARNING SYMPTOMS APPEAR: (See WARNING SYMPTOMS Under "NOTE TO PHYSICIAN") Keep patient prone and quiet. Start artificial respiration immediately if patient is not breathing. Transport patient immediately to the nearest hospital.

For medical emergencies involving this product, call 1-(213) 264-3910

SEE ANTIDOTE AND OTHER PRECAUTIONS ON SIDE PANEL

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

DANGER! Poisonous if swallowed, inhaled or absorbed through the skin. Rapidly absorbed through skin. Repeated inhalation or skin contact may without symptoms, progressively increase susceptibility to PHOSDRIN Insecticide poisoning. Do not swallow or get in eyes, on skin or on clothing. Do not breathe vapors. Do not contaminate food or feed products. Keep away from heat or open flame.

PRECAUTIONS IN USING

USE ONLY WHEN WEARING THE FOLLOWING PERSONAL PROTECTIVE EQUIPMENT DURING MIXING/LOADING, APPLICATION, REPAIR AND CLEANING OF MIXING, LOADING, AND APPLICATION EQUIPMENT, AND DISPOSAL OF PESTICIDE: protective suit of one or two pieces that covers parts of the body except head, hands, and feet; chemical resistant gloves; chemical resistant shoes (chemical resistant shoe coverings or chemical resistant boots); goggles or face shield; hood or visor brimmed hat; NIOSH or MSHA approved respiratory protective device. In the case of aerial application, the pilot should not assist in the mixing and loading operation.

WHEN MIXING/LOADING IS PERFORMED USING A CLOSED SYSTEM, THE FOLLOWING PROTECTIVE CLOTHING AND EQUIPMENT MAY BE WORN AS AN ALTERNATIVE. Long sleeved shirt; long legged pants; chemical resistant gloves, chemical-resistant apron; shoes and socks; Goggles or face shield must be worn when the system is under pressure. All other protective clothing and equipment required for use with ocean systems must be available nearby.

WHEN APPLICATION IS PERFORMED USING AN ENCLOSED CAB OR COCKPIT, THE FOLLOWING PROTECTIVE CLOTHING AND EQUIPMENT MAY BE WORN AS AN ALTERNATIVE. Long sleeved shirt and long legged pants; shoes and socks. Chemical resistant gloves must be available in the cab or cockpit and must be worn during entry to and exit from the application vehicle. All other protective clothing and equipment required for use during application must be available in the cab and must be worn when exiting the cab into the treated area. When used for this purpose, contaminated clothing may not be brought back into the cab unless in an enclosure such as a plastic bag.

REMEMBER — THIS CLOTHING IS NOT ADEQUATE TO PROTECT YOU DURING REPAIR AND CLEANING OF APPLICATION EQUIPMENT AND EARLY REENTRY TO TREATED AREAS! REFER TO PROTECTIVE CLOTHING AND EQUIPMENT REQUIREMENTS ABOVE.

IMPORTANT! If pesticide comes in contact with skin, wash off with soap and water and contact a physician immediately. Always wash hands, face, and arms with soap and water before smoking, eating, drinking, or toileting.

AFTER WORK: Before removing gloves, wash them with soap and water. Take off all work clothes and shoes. Shower using soap and water. Wear only clean clothes when leaving job—do not wear contaminated clothing. Personal and protective clothing worn during work must be stored and laundered separately from household articles. Clean or launder protective clothing after each use. Respirators must be cleaned and filters replaced according to instructions included with the respirators. Protective clothing and protective equipment that becomes heavily contaminated or drenched with mevinphos must be destroyed according to State and local regulations. HEAVILY CONTAMINATED OR DRENCHED CLOTHING CANNOT BE ADEQUATELY DECONTAMINATED.

The National Pesticide Telecommunication Network is available for recommendations regarding poisoning management, emergency treatment, and other information regarding the toxicity of mevinphos. The toll free number for the National Pesticide Telecommunication Network is 1-800-858-7378.

IF HANDLED INDOORS provide mechanical exhaust ventilation. Keep all unprotected persons, children, livestock and pets away from treated areas or where there is danger of drift. Do not rub eyes or mouth with hands. If you feel sick in any way, STOP work and get medical help right away, see the First Aid (Practical Treatment) section on this label.

Do not contaminate or store near food or feedstuff. Note Reentry Statements Section. IMPORTANT: Not for use or storage in or around the home. Keep animals and unprotected persons out of operational areas and while there is a danger of drift.

In case of spillage, decontaminate areas and equipment by washing with a dilute solution of alkali (less than 5%) and detergent and rinse with water. In case of significant spill, call CHEMTREC (800) 424-9300.

NOTE TO PHYSICIAN

WARNING SYMPTOMS: Symptoms include weakness, headache, tightness in chest, blurred vision, nonreactive pinpoint pupils, salivation, sweating, nausea, vomiting, diarrhea, and abdominal cramps.

TREATMENT: Atropine is the specific therapeutic antagonist of choice against parasympathetic nervous stimulation. If there are signs of parasympathetic stimulation Atropine Sulfate should be injected at 10 minute intervals in doses of 1 to 2 milligrams until complete atropinization has occurred.

Pralidoxime chloride (2-PAM chloride) may also be used as an effective antidote in addition to and while maintaining full atropinization. In adults, an initial dose of 1 gram of 2-PAM should be injected, preferably as an infusion, in 250 cc of saline over a 15 to 20 minute period. If this is not practical, 2-PAM may be administered slowly by intravenous injection as a 5% solution in water over not less than 2 minutes. After about an hour, a second dose of 1 gram of 2-PAM will be indicated if muscle weakness has not been relieved. For infants and children, the dose of 2-PAM is 0.25 grams.

Morphine is an improper treatment.

Clear chest by postural drainage. Oxygen administration may be necessary. Observe patient continuously for 48 hours. Repeated exposure to cholinesterase inhibitors may, without warning, cause prolonged susceptibility to very small doses of any cholinesterase inhibitor. Allow no further exposure until cholinesterase regeneration has been attained as determined by a blood test.

FOR MEDICAL EMERGENCIES INVOLVING THIS PRODUCT, CALL 1-(213) 264-3910.

ENVIRONMENTAL HAZARDS

Terrestrial Food and Nonfood Uses.

This product is toxic to fish and wildlife. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not apply directly to water or wetlands (swamps, bogs, marshes, and potholes). Do not contaminate water when disposing of equipment washwaters.

Birds feeding on treated areas may be killed.

This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the treatment area. Protective information may be obtained from your Cooperative Agricultural Extension Service.

Do not apply when weather conditions favor drift from areas treated. Do not apply where runoff is likely to occur.

In case of a significant spill, call CHEMTREC 1-(800) 424-9300.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

REENTRY STATEMENT

Do not apply this product in such a manner as to directly or through drift expose workers or other persons. The area being treated must be vacated by unprotected persons.

HUMAN FLAGGERS ARE PROHIBITED during aerial application of this product unless in totally enclosed vehicles.

Reentry into treated CITRUS GROVES, GRAPE VINEYARDS, and NECTARINE and PEACH orchards is prohibited for 96 hours (4 days) after the end of application, unless the protective clothing specified on this label for early reentry is worn. Reentry into all other treated areas is prohibited for 48 hours (2 days) after the end of application, unless the protective clothing specified on this label for early reentry is worn.

FOR EARLY REENTRY INTO TREATED AREAS BEFORE SPRAYS HAVE DRIED.

Wear all protective clothing specified on this label for an applicator.

FOR EARLY REENTRY INTO TREATED AREAS AFTER SPRAYS HAVE DRIED.

Wear protective suit of one or two piece covering all parts of the body except head, hands, and feet; chemical resistant gloves; chemical resistant shoes (or chemical resistant shoes coverings or chemical resistant boots.)

Because certain States may require more restrictive reentry intervals for various crops treated with this product, consult your State Department or Agriculture for further information.

Written or oral warnings must be given to workers who are expected to be in treated areas or in an area to be treated with this product. (Indicate specific oral warnings which inform workers of areas or fields that may not be entered without specific protective clothing, period of time field must be vacated, and appropriate action to take in case of accidental exposure.) When oral warnings are given, warnings shall be given in a language customarily understood by workers. Oral warnings must be given if there is reason to believe that written warnings cannot be understood by workers. Written warnings must include the following information:

"DANGER: Area treated with MEVINPHOS on (Date) _____ Do not enter without appropriate protective clothing until (insert date/time reflecting end of reentry interval set forth on this label). In case of accidental exposure see STATEMENTS OF PRACTICAL TREATMENT found on the Phosdrin® 4EC product label.

USE AND APPLICATION DIRECTIONS

Do not apply this product through any type of irrigation system.

PHOSDRIN® 4EC can be used in conventional hydraulic sprayers, low-volume ground applications, or airplane sprayers. Use this product only for recommended purposes and at recommended dosages. For best results consult the State Agricultural Extension Service for exact dosage and timing recommendations. Mix with water by vigorous agitation; agitate the mixture while spraying. If allowed to stand, re-agitate before use. Apply when insects first appear and repeat application as often as necessary to maintain control. Apply in a suitable volume of water to give uniform coverage of foliage. For application by airplane, dilute this product with 3 to 10 gallons of water per acre.

READ THE DIRECTIONS CAREFULLY AND FOLLOW THEM AT ALL TIMES

AND NUT CROPS: Use recommended dosages in sufficient water to obtain thorough spray ge, but do not exceed indicated maximum gallonage for that crop. If concentrate ground applica- employed, do not apply less than 10 gallons of spray per acre, and adjust dosage of Phosdrin obtain same dosage per acre as recommended for full coverage application.

AND VEGETABLE CROPS: Use 10 to 125 gallons of spray per acre when using ground applica- uipment.

mit of this product to crops for which it is not registered or to crops for which its use may be registered plication would be closer to harvest than recommended.

FRUIT AND NUT CROPS

ES, PEACHES, PEARS, PLUMS: For control of Aphids, and Mites use ¼ to ½ pt. per 100 gals. Do not exceed 1,200 gallons of finished spray per acre on apples and pears when ½ pt. is used. ntrol of Grasshoppers, Lygus Bugs, and Red-Banded Leaf Roller Use ½ to ¾ pt. per 100 gals. Do not exceed 900 gals. of finished spray per acre on apples and pears when ¾ pt. is used. Do at within 1 day of harvest.Do not exceed 750 gals. finished spray per acre on peaches or plums.

RIES (SOUR ONLY): For control of Aphids and Mites use ½ to ¾ pt. per 100 gals. water. Do not nthin 2 days of harvest. Do not exceed 750 gals. finished spray per acre.

JS (ORANGES, LEMONS, GRAPEFRUIT): For control of Aphids use 1 to 2 pts. per acre in 200 e gals. water. For control of Fruit Tree Leafroller, Orange Tortrix and Omnivorous Leafroller, use er acre in 500 gals. water. For control of Western Tussock Moth larvae, Citrus Cutworm, Variegated rm, and Pink Scavenger Caterpillar use 2 qt. per acre in 1,200 gals. water. Allow at least 7 days en applications. Do not treat within 1 day of harvest.

ES. For control of Aphids use ½ to 1 pt. per acre. Do not treat within 2 days of harvest. For control d Foliar, Leafhoppers, Mites, Red-Banded Leafroller and Lygus Bugs use 1 to 2 pts. per acre. At pt. dosage do not treat within 5 days of harvest.

BERRIES. For control of Aphids, use ¼ to ½ pt. per 100 gals. water. For control of Mites, Leafhop- Fruit Tree Leafroller and Orange Tortrix, use ½ to ¾ pt. per 100 gals. water. Apply both dosages to 200 gals. water per acre. Do not treat within 3 days of harvest.

WBERRIES: For control of Aphids and Mites use ¼ to ½ pt. per 100 gals. water. For control of hoppers, Strawberry Leafroller, Salt-marsh Caterpillar and Lygus Bugs use ½ to 1 pt. per 100 gals. Do not treat within 1 day of harvest. For hard-to-kill insects, including Aphids and Mites, use 1 r 100 gals. water, but do not treat within 2 days of harvest. Do not exceed 100 gals. finished spray cre.

NUTS: For control of Aphids, use ¼ to ½ pt. per 100 gals. water. For control of Mites, Omnivorous er, Orange Tortrix, Fruit Tree Leafroller, and Western Tussock Moth use ½ pt. per 100 gals. water. t treat within 1 day of harvest. Do not exceed 1,000 gals. finished spray per acre.

FIELD CROPS

LFA, CLOVER: For control of Aphids and Alfalfa Caterpillar, use ¼ to ½ pt. per acre. For control asshoppers, Leafhopper, Cutworms (climbing), Mites, Alfalfa Weevil Larvae and Lygus Bugs use 1 pt. per acre. Do not treat within 1 day of harvest.

N (FIELD & POPCORN) FOR FORAGE & GRAIN: For control of Aphids, use ¼ to 1 pt. per acre. ot treat within 1 day of harvest.

SORIN® 4EC may cause a red or purple discoloration of the foliage on corn plants similar to other ophosphate compounds.

TARD GREENS, TURNIP TOPS: For control of Aphids use ¼ to ½ pt. per acre. For control of Cab- Looper, Imported Cabbage Worm, False Chinch Bug, Dipterous Leafminer (adults), Grasshoppers, hoppers and Mites use ½ to 1 pt. per acre. Do not treat within 3 days of harvest.

VINES (FOR FORAGE ONLY): For control of Aphids, use ¼ to ½ pt. per acre. For control of Grasshop- Leafhoppers, Mites and Cutworms (climbing), use ½ to 1 pt. per acre. Do not treat within 1 day arvest.

GHUM (FOR FORAGE AND GRAIN): For control of Aphids use ¼ to ½ pt. per acre. For control orn Earworm, and Webworm use ½ to 1 pt. per acre. For control of Fall Armyworms use 1 pt. per . Do not treat within 3 days of harvest.

SORIN® 4EC may cause a red or purple discoloration of the foliage on sorghum plants similar to r organophosphate compounds.

VEGETABLE CROPS

ICHOKES: For control of Aphids use ¼ to ½ pt. per acre. For control of Plume Moths, use 1 to 2 per acre. Do not treat within 2 days of harvest.

NS: For control of Aphids use ¼ to ½ pt. per acre. For control of Grasshoppers, Leafhoppers, Mites, Mexican Bean Beetle use ½ to 1 pt. per acre. Do not treat within 1 day of harvest.

TS (INCLUDING TOPS): For control of Aphids, use ¼ to ½ pt. per acre. For control of Cabbage per, Cutworm (climbing), Dipterous Leafminer (adults), False Chinch bugs, Grasshoppers, Imported bage worm, Leafhoppers, Mites and Salt-marsh caterpillars, use ½ to 1 pt. per acre. Do not treat in 3 days of harvest.

OCCOLI, CABBAGE: For control of Aphids use ¼ to ½ pt. per acre. For control of Cabbage Looper, orted Cabbage worm, Grasshoppers, Leafhoppers, Salt-marsh Caterpillar, Mites, Cutworms, (climb- , Dipterous Leafminer (adult), and Lygus Bugs use ½ to 1 pt. per acre. Do not treat within 1 day of est. For hard-to-kill insects, including Aphids, use 1 qt. per acre, but do not treat within 3 days of harvest.

USSEL [illegible]UTS, CAULIFLOWER, COLLARDS, KALE: For control of Aphids, use ¼ to ½ pt. per . For con[illegible] of Cabbage Looper, Imported Cabbage worm, Grasshoppers, Leafhoppers, Salt-marsh erpillar, Mites, Cutworms (climbing), Dipterous Leafminer (adults), and Lygus Bugs use ½ to 1 pt. acre. Do not treat within 3 days of harvest. For hard-to-kill insects, including Aphids, use 1 qt. per , but do not treat COLLARDS and KALE within 7 days of harvest.

ROTS: For control of Aphids, use ¼ to ½ pt. per acre. For control of Leafhoppers, Lygus Bugs, s, Cabbage Looper, Dipterous Leafminer (adult), Cutworms (climbing), and Salt-marsh Caterpillar ½ to 1 pt. per acre. Do not treat within 2 days of harvest.

ERY: For control of Aphids, use ¼ to ½ pt. per acre. For control of Dipterous Leafminer (adults), us Bugs, Salt-marsh Caterpillar, Leafhoppers, Cabbage Loopers and Mites, use ½ to 1 pt. per acre. not treat within 3 days of harvest. For hard-to-kill insects, including Aphids, use 1 qt. per acre, but not treat within 5 days of harvest.

RN, (SWEET) FOR GRAIN & FORAGE: For control of Aphids use ¼ to 1 pt. per acre. Do not treat in 1 day of harvest.

DSORIN® 4EC may cause a red or purple discoloration of the foliage on corn plants similar to other anophosphate compounds.

CUMBER (OUTDOOR): For control of Aphids, use ¼ to ½ pt. per acre. For control of Grasshoppers, hoppers, and Mites, use ½ to 1 pt. per acre. Do not treat within 1 day of harvest.

EGGPLANT, PEPPERS. For control of Aphids, use ¼ to ½ pt. per acre. For control of Grasshoppers, Leafhoppers, and Mites, use ½ to 1 pt. per acre. Do not treat within 2 days of harvest.

LETTUCE. For control of Aphids, use 1/4 to 1/2 pint per acre. For control of Corn Earworm, Cutworms (climbing), Dipterous Leafminer (adults), Cabbage Looper, Imported Cabbage Worm, Grasshoppers, Mites, Lygus Bugs, Salt-marsh Caterpillar, False Chinch Bugs, and Thrips, use 1/2 to 1 pint per acre.

Keep a 7 day interval between applications.

Head Lettuce - When applying 1 pint or less per acre, do not treat within 2 days of harvest. For hard-to-ki insects, including Aphids, use 1 quart per acre but do not treat within 4 days of harvest.

Leaf Lettuce - (Including Butter or Boston, Greenleaf, Redleaf and Romaine): When applying 1 pint o less per acre, do not treat within 7 days of harvest. For hard-to-kill insects, including Aphids, use 1 quar per acre but do not treat within 10 days of harvest.

MELONS (INCLUDING CANTALOUPES, HONEYDEW MELONS, MUSKMELONS, WATERMELONS): For control of Aphids, use ¼ to ½ pt. per acre. For control of Cabbage Looper, Dipterous Leafmine (adults), Leafhoppers, Lygus Bugs, Mites, False Chinch Bugs, Salt-marsh Caterpillar, Cutworms (climb- ing), and Grasshoppers use ½ to 1 pt. per acre. To control Ringworms (Cabbage Looper, Cutworms Salt-marsh Caterpillars, Tobacco Budworms) on WATERMELONS apply ½ pt. per acre. Do not trea CANTALOUPES, HONEY-DEW MELONS, MUSKMELONS OR WATERMELONS within 1 day of harvest.

OKRA: For control of Aphids, use ¼ to ½ pt. per acre. For control of Cutworms (climbing), Corn Ea worms, Green Stink Bug, Mites and Velvet Bean Caterpillar, use ½ to 1 pt. per acre. Do not treat withi 1 day of harvest.

ONIONS (INCLUDING GREEN ONIONS): For control of Thrips and Cutworms (climbing) use ½ to 1 p per acre. Do not treat within 1 day of harvest.

PARSLEY: For control of Aphids, apply 1 to 2 pt. (0.5 lb. to 1.0 lb. a.i./acre) as foliage applicabon usin a minimum of 40 gallons of water per acre be ground application or 10 to 15 gallons of water per acr by air application. For light infestations use lower dosage of 1 pt. (0.5 lb.a.i./acre). Do not treat later tha 5 days before harvest. For hard-to-kill insects and increased populations use 2 pt. (1.0 lb.a.i./acre). D not treat later than 8 days before harvest for higher dosage. Begin application when insects first appea and repeat as often as necessary to maintain control. Do not treat more than 3 times between harves

PEAS (INCLUDING VINES): For control of Aphids, use ¼ to ½ pt. per acre. For control of Grasshoppers Leafhoppers, Mites and Cutworms (climbing), use ½ to 1 pt. per acre. Do not treat within 1 day of harvest.

POTATOES: For control of Aphids, use ¼ to ½ pt. per acre. For control of Grasshoppers, Leafhoppers and Mites use ½ pt. per acre. Do not treat within 1 day of harvest.

SPINACH: For control of Aphids, use ¼ to ½ pt. per acre. For control of Cabbage Looper, Imported Cab bageworm, Grasshoppers, Leafhoppers, Mites, Dipterous Leafminer (adults), Cutworms (climbing), Salt marsh Caterpillar, and False Chinch Bug use ½ to 1 pt. per acre. Do not treat within 4 days of harvest For hard-to-kill insects, including Aphids, use 1 qt. per acre but do not treat within 7 days of harvest

SUMMER SQUASH: For control of Aphids, use ¼ to ½ pt. per acre. For control of Cabbage Looper Dipterous Leafminer (adults), Leafhoppers, Lygus Bugs, Mites, False Chinch Bug, Salt-marsh Caterpillar Cutworms (climbing), and Grasshoppers, use ½ to 1 pt. per acre. Do not treat within 1 day of harvest

TOMATOES (OUTDOOR): For control of Aphids, use ¼ to ½ pt. per acre. For control of Grasshoppers Leafhoppers, and Mites use ½ to 1 pt. per acre. Do not treat within 1 day of harvest.

TURNIPS: For control of Aphids, use ¼ to ½ pt. per acre. For control of Cabbage Looper, Imported Cab bage worm, Grasshoppers, Leafhoppers, Mites, False Chinch Bug and Dipterous Leafminer (adults), use ½ to 1 pt. per acre. Do not treat within 3 days of harvest.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal. Do not reuse empty container. Open dumping is prohibited.

STORAGE: Do not store in or around the home. Store in a secure, dry and temperate area. Store in original container only. Product is flammable. Keep away from heat, sparks or open flame. If spilled, avoid exposure. If significant spill, call CHEMTREC (800) 424-9300. Spill can be contained by covering with a sufficient amount of absorbent material such as clay, diatomaceous earth, sand, sawdust, or sweeping compound. Place in drum, label contents, & dispose of according to the instructions below in PESTICIDE DISPOSAL.

CAUTION: Wear all personal protective equipment required in the PRECAUTIONS IN USING section of this label including a pesticide respirator. Avoid forming dust clouds during clean-up.

PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal law. If the wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL: (Metal) Triple rinse (or equivalent) Then offer for recycling or reconditioning, or puncture & dispose of in a sanitary landfill, or by other procedures approved by State and local authorities. (Plastic) Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill or incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

NOTICE: This product conforms to its chemical description and is reasonably fit for the purpose stated on the label, when used in accordance with directions under normal conditions of use. Manufacturer is not responsible for the use of product contrary to the label instructions, or under abnormal conditions, or under conditions not reasonably foreseeable to the manufacturer and / or seller and the buyer assumes the risk of any such use. 9/90

APPENDIX E

USEPA Approved Tolerances

for Mevinphos

Apples	0.5
Artichokes	1.0
Beans	0.25
Beets, garden (incl. tops)	1.0
Broccoli	1.0
Brussel Sprouts	1.0
Cabbage	1.0
Carrots	0.25
Cauliflower	1.0
Celery	1.0
Cherries	1.0
Chicory	0.5
Citrus	0.2
Collards	1.0
Corn, grain, field	0.25
Corn, pop, grain	0.25
Corn, sweet	0.25
Cucumbers	0.2
Eggplant	0.25
Grapes	0.5
Kale	1.0
Lettuce	0.5
Melons (incl. cataloupes, honeydew mellon, and muskmellon, determined on the edible portion)	0.5
Mustard greens	1.0
Okra	0.25
Green onions	0.25
Parsley	1.0
Peaches	1.0
Pears	0.5
Peas	0.25
Peppers	0.25
Plums	1.0
Potatoes	0.25
Raspberries	1.0
Spinach	1.0
Squash, summer	0.25
Strawberries	1.0
Tomatoes	0.2
Turnips	0.25
Turnips, tops	1.0
Walnuts	0.25
Watercress	2.0
Watermelon	0.5