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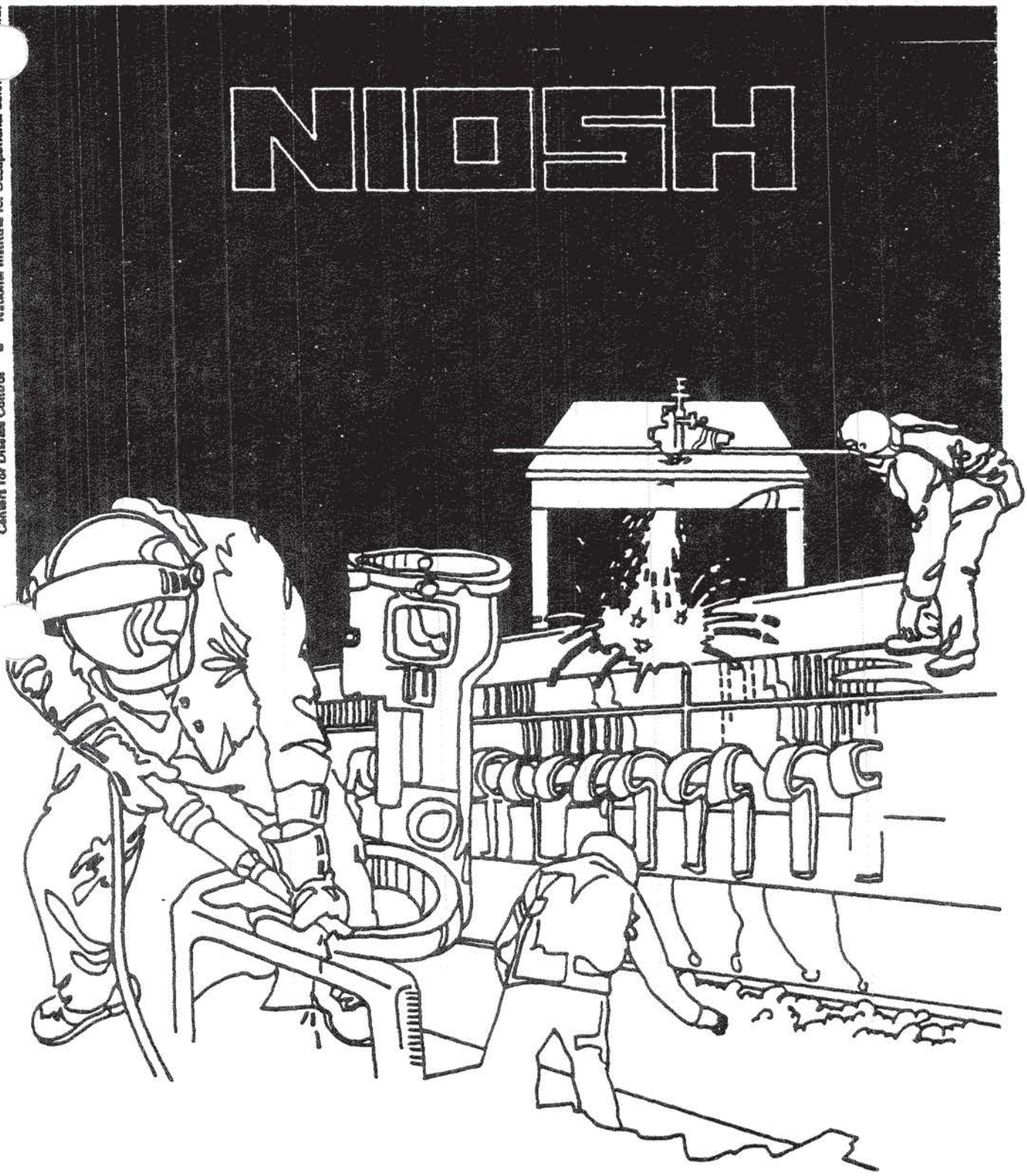

Health Hazard Evaluation Report

HETA 83-361-1463
AMFAC GARDEN PERRY'S
CARPENTERIA, CALIFORNIA

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 83-361-1463
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AMFAC GARDEN PERRY'S
CARPENTERIA, CALIFORNIA

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I. SUMMARY

On July 28, 1983, the National Institute for Occupational Safety and Health (NIOSH) received a request for a Health Hazard Evaluation from an authorized representative of employees at Amfac Garden Perry's, a bedding plant nursery in Carpenteria, California. The request was prompted by concerns regarding work practices during the application of pesticides, and particularly to the application of methyl parathion.

To determine whether a health hazard existed, NIOSH conducted site visits on August 1, September 15 and October 6-7, 1983. Personal air samples were obtained during the application of methyl parathion, and work practices and work conditions were observed. Workers were interviewed in all job categories, including the nursery health and safety committee. A list of all chemicals applied in the nursery, with the frequency and quantity applied, and copies of the worker training materials were obtained for evaluation.

All of the air concentrations of methyl parathion were below the limit of detection. Deficiencies in the training, work practices and personal protective equipment of the applicator were noted and recommendations for their improvement are provided in Section VII of this report. Workers reported, and NIOSH medical staff observed, dermatitis (skin rashes) on the arms, chest, back, neck and lower face of workers involved in plant tending. With the exception of two cases, these were irritant contact dermatitis associated with prolonged exposure to damp earth and possibly with low levels of pesticide residues or their hydrocarbon vehicles. A summary of the potential health effects of the pesticides used at Amfac was prepared, with recommendations for further training of the health and safety committee and a system for the provision of information to workers concerned about spraying and re-entry issues.

Based on the environmental air sampling results, no exposure to methyl parathion were measured on the dates of the survey. Recommendations are provided in Section VII of the report to improve training, personal protective equipment and work practices for the pesticide application program. Recomendations are also provided for training of the nursery health and safety committee, and for an information response system for concerned workers.

KEYWORDS: SIC 0181, (Ornimental Floriculture and Nursery Products), pesticides, Penncap M, methyl parathion, organophosphates, dermatitis, applicators.

II. INTRODUCTION

A wide variety of agricultural chemicals, including pesticides, growth regulating hormones, and herbicides, are used in nurseries. Workers may be in the same general area or growing house while a chemical is being applied, or they may enter soon enough after application to detect an odor or a residue on the plants themselves. At the Amfac Garden Perry's, the workers were concerned about the adequacy of protection afforded them by the work and re-entry practices associated with chemical applications, particularly with the application of methyl parathion, and secondarily about the frequency of skin rashes among workers in plant-car job categories. For this reason the United Farm Workers Union representative requested an evaluation of potential pesticide exposure, health effects and the need for further education and training of the workers.

III. BACKGROUND

Approximately 75 workers are permanently employed at Amfac Garden Perry's, almost all in planting, transplanting, trimming and other forms of direct care for the plants. Employees work for eight hours or less per day, except for seasonal overtime form March through May during which time most workers average ten hours per day. The plants are grown in large growing houses, which are wooden frames and roofs with plastic sheeting for side walls; the houses are not fully enclosed. Workers move frequently from house to house as the cultivation schedules require.

One worker is employed full time as a pesticide applicator. He is trained and supervised by an agronomist, who also determines and schedules the pesticides and other chemicals to be applied during two days of spraying each week. The applicator is provided rubber boots, apron, and gloves, a respirator and goggles. Because the applicator handles organophosphate pesticides for less than thrity hours per month, no medical surveillance is required by California regulations, and none is performed.

Other workers are frequently in the same growing house while certain chemicals are applied. The supervisors are given a list of pesticides to be applied in each growing house for each week, and it is their responsibility to inform the workers when they should leave or not re-enter a house which has been treated. In some cases a dye is added to the chemical so that workers can see that a chemical has recently been applied to the plant. A complete list of the pesticides applied is included in Table I.

One of the pesticides used at Amfac is methyl parathion, in a miscroencapsulated formulation with the brand name Penncap M. It is ued on flowers from May through October to control the minor leaf worm, in applications twice a week which last approximately 2.5 - 3.0 hours each morning. Spraying is done in the open and in the partially enclosed growing houses.

The preparation of the methyl parathion solution for application was observed. The applicator wore cotton coveralls, rubber gloves, boots, apron and goggles and used a respirator with a pesticide cartridge appropriate to this operation. Penncap was poured into a glass measuring jar, which was then poured into the mixer (spray applicator). Penncap is diluted at a rate of eight ounces (21% methyl parathion) per 100 gallons of water. Any employees working in the area to be sprayed are asked to leave for the duration of the application.

IV. METHODS AND MATERIALS

A. Environmental

Environmental air samples were collected for methyl parathion on a combination sampling device .13 millimeter glass fiber filter connected to a 150 milligram porous polymer tube (ORBO-42), which was connected to a vacuum pump that operated at 0.2 liters per minute for four hours.

The tubes were prepared for analysis by desorbtion in 2 milliter (ml) of toluene with sonication for one hour. The glass fiber filter samples were prepared for analysis by desorbtion in 1 ml toluene with rotation for one hour. [1,2]

The samples were analyzed on a gas chromatograph equipped with an electron capture detector. The limit of detection was 0.01 micrograms per cubic meter (ug/m) for the ORBO tubes and 0.005 ug/m for the glass fiber filters.

B. Medical

Fifteen workers were interviewed during two site visits on August 1 and September 15 for symptoms potentially associated with exposure to the pesticides listed in Table I, as well as for dermatitis, musculoskeletal and other potentially work-related health problems common among agricultural workers. Approximately 12 workers were examined for dermatitis on their hands, arms, neck and face during the site visit on August 1.

Workers were also interviewed regarding their knowledge of the pesticides applied at Amfac, the potential health effects and symptoms of exposure related to these pesticides, and their concerns regarding information and work practices at the nursery. Health and safety education materials used for worker training at Amfac were provided to NIOSH for evaluation.

V. EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaulation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to ten hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace expoosures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus, potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Treshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV'S are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based solely on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet only those levels specified by OSHA standard.

A time weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

EVALUATION CRITERIA

CONCENTRATION/EXPOSURE PERIOD (mg/m^3) [1]

SUBSTANCE	8-Hour TWA	Up to 10-Hour TWA	Ceiling	Source
Methyl parathion (skin)	---	0.2	---	NIOSH
	0.2	---	---	CAL-OSHA
	0.2	---	0.6 (15min)	ACGIH

1) mg/m^3- milligrams of a substance per cubic meter of air.

According to the field worker safety regulations of the California Department of Food and Agriculture, employers may not permit exployees to enter any area treated with an EPA Category I pesticide for 24 hours after application, unless they wear the same protective equipment required for a ground applicator of that pesticide. Areas treated with Category II or III pesticides may be re-entered within 24 hours only if the spray has dried or the dust has settled.

B. Toxicological

Because of the great variety of pesticides used in Amfac Garden Perry's, as in most nurseries, the following discussion of the potential toxic effects of exposure is simplified. The pesticides are listed in Table I, with their EPA Category indicating relative acute toxicity. Absorption of pesticides under field conditions is primarily dermal (skin), although inhalation during spray applications or accidental ingestion may occur.

It should be remembered that in addition to the acute effects mentioned below, many pesticides and/or their hydrocarbon vehicles may cause dermatitis (direct irritant and in some cases allergic contact), and that experiments with laboratory animals have demonstrated possible carcinogenic and reporductive impairment associated with chronic exposure to some pesticides. A more detailed ;discussion of the health effects of pesticides may be found in refers (4) and (5).

1. Organophosphate Pesticides

Organophosphate insecticides produce their effect by inhibition of acetylcholinesterase at cholinergic synapeses, resulting in an exaggeration of the muscarinic, nicotinic and central nervous system actions of acetylcholine. Diagnosis of acute organophosphate poisoning is made by a history of exposure and clinlcal signs and symptoms, and may be confirmed by response to a test dose of atropine; treatment should not await laboratory confirmation. For moderate exposure, symptoms include headache, dizziness, weakness, anusea and vomiting, eyelid and skin fasciculations, miosis and blurred vision, and seating. More toxic exposures may cause abdominal cramps, muscular tremors, dyspnea, and utimately death from respiratory paralysis.

Confirmation by laboratory analysis depends upon demonstration of depressed levels of plasma or erythrocyte (red blood cell, RCB) cholinesterase activity. Plasma (serum) cholinesterase is more labile than RBC cholinesterase; it is generated in the liver and therefore may be affected by any factor or disease process which interferes with liver function. RBC cholinesterase, because it is analogous to the enzyme active in nerve tissue, is the preferred index of toxicologic effect.

Chronic exposure to organophosphates over a prolonged time period may result in extreme inhibition of cholinesterases in the absence of symptoms; on the other hand, a more rapid but smaller inhibition may provoke moderate but disabling symptoms, and symptoms may occur in the absence of detectable inhibition [5]. Workers who are re-exposed to organophosphates before cholinesterase regeneration is complete, are at greater risk of poisoning because their threshold is depressed.

2. Carbamate Pesticides

The symptoms and mechanism of action of carbamate pesticides are similar to those of organophosphate pesticides, with the exception that carbamate pesticides are much more rapidly inactivated in the human body. As a result, carbamate poisonings are usually of much shorter duration, and cholinesterase measurements are often unreliable as a means of diagnosis because the levels regenerate so rapidly. Nevertheless, excessive exposure to carbamates in the absence of prompt recognition and treatment can be serious and even life-threatening.

3. Organochlorine Pesticides

Thiodan (endosulfan) is the only organochlorine used currently at Amfac. It is of very high toxicity; absorption by mouth or skin may result in confusion, agitation, convulsions and loss of consciousness. The LD/50 for endosulfan is 43 mg/kg (male rates) [5].

4. Permethrin Pesticides

The permethrins are of very low toxicity, and are not well absorbed through the skin. No symptoms have been reported among workers evaluated after moderate exposure.

5. Organometal Pesticides

The only organometal currently used at Amfac is Vendex (fenbutatin). When absorbed orally, the organotin compounds may be very toxic, but there is no evidence that field use as fungicides, acaricides and insecticides has caused symptoms in humans.

6. Fungicides

The category of fungicides includes many distinct chemical families. Among those used at Amfac, the only recognized acute health effects at low levels of exposure are dermatitis, including irritant and allergic contact dermatitis. Several, including benomyl, dithane, and daconil have been associated with reproductive or carcinogenic effects in animals.

7. Herbicides

Like fungicides, herbicides include a wide variety of chemicals. Of those used at Amfac, skin, eye, nose and throat irritation is a common health effect. Diquat is potentially much more toxic than other herbicides if absorbed orally.

8. Growth Regulators

Although these plant hormones have been used for many years, symptoms other than mild skin irritation have been reported, and there are no known long-term health problems associated with their use.

VI. RESULTS AND DISCUSSION

A. Environmental

Five personal air samples were collected for methyl parathion during the preparation and application of this pesticide solution. Airborne concentrations were below the limit of detection.

Work practices and personal protective equipment were also evaluated. No shower facilities were observed to exist for emrgency use in case of an accident. There is no formal respirator program, with elements of training, fit testing, storage etc. [6] No criteria had been established to determine when the respirator cartridge should be replaced; the applicator reported that he was to throw out the respirator itself at the end of each month. In one instance observed, the applicator's respirator was used by the supervisor, incorrectly, during the pouring of sulfuric acid from a one gallon container into a water bucket, and no face shield was used.

B. Medical

No symptoms of acute or chronic systemic pesticide poisoning were found among the workers interviewed. Many of the workers exhibited moderate to severe irritant dermatitis on the upper extremities or neck and face, associated with prolonged exposure to the soil which is damp and may contain very low levels of pesticides or of their hydrocarbon vehicles. In two cases, allergic contact dermatitis to one pesticide or a mixture of pesticides was suspected, and further evaluation recommended.

The fact that workers did not know what pesticides were being sprayed near their work areas, or in areas which they subsequently entered (often detecting an odor or residue on the foliage), had resulted in some anxiety about the potential long-term effects of such exposures. The supervising agronomist suggested that the weekly application schedules could be posted in each house, so that workers could look for the names of the chemicals applied. In addition, NIOSH prepared a summary list of the pesticides used in the nursery, with a brief discussion of the potential toxic effects and important protective work practices, for the use of the health and safety committee. The practice of posting the spray schedules, combined with a somewhat more detailed education program for the plant health and safety committee to prepare them to interpret this information for the workers, may help to relieve the workers' concerns at Amfac in the future.

VII. RECOMMENDATIONS

1. The company should institute a formal respirator program in accordance with the Occupational Safety and Health Act (OSHA) requirements outlined in 29 CFR Part 1910.134. The respirators program should include the following: proper respirator selection, training and education of the user, fit testing, maintenance of equipment, proper and adequate storage, periodic inspection, surveillance of work area condition, periodic inspection of program to determine continued effectiveness and medical determination of user.

2. Respirator cartridges should only be used for the chemical for which it is approved.

3. A face shield should be used when pouring sulfuric acid into the water bucket.

4. Each person requiring the use of a respirator should have a specific respirator assigned them.

5. Showering facilities should be installed in case of accidental exposure to the applicator during the preparation of chemicals which are to be sprayed.

6. It is suggested that a chemical dye be added to methyl parathion so that the workers are aware that the pesticide has been applied.

7. Weekly schedules of pesticide application should be posted in each growing house.

8. The health and safety committee should be provided with copies of the educational materials prepared by NIOSH, and trained in the use and interpretation of the weekly application schedules.

VII. REFERENCES

1. NIOSH Manual of Analytical Methods, Volume No. 3, HEW Publication No. (NIOSH) 77-157-C.

2. NIOSH Manual of Analytical Methods, Volume No. 6, HHS Publication No. (NIOSH) 80-125.

3. State of California Department of Food and Agriculture. 1982 Extracts from the Food and Agricultural Code and Title 3 Administrative cvode Pertaining to Pesticides and Pest Control Operations. Division of Pest Management, Environmental Protection and Worker Safety, 1220 N. Street, Sacramento, California 95814.

4. NIOSH. Occupation Diseases: A Guide to Their Recognition. US DHEW/PHS/CDC, 1977. Publication No. 77-181.

5. Hayes, Wayland J. Pesticides Studies in Man. Baltimore: Williams &Wilkins, 1982.

6. A guide to Industrial Repspiratory Protection, HEW Publication No. (NIOSH) 76-189.

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IX. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology, Information Resouces and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publication Office, at the cincinnati address.

1. United Farm Workers Union, AFL-CIO.

2. Amfac Garden Perry's.

3. NIOSH - Region IX.

4. Cal-OSHA.

5. Federal-OSHA.

For the purpose of informing the affected employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE #1

PESTICIDES USED AT AMFAC FARDEN PERRY'S

Commerical Name	Use	Chemical Family	Catetory*
Agri-Strep	fungicide	antibiotic	III
B-Nine	growth regulator	vitamin	III
Banrot	fungicide	etridiazole	I
Benlate	fungicide	benomyl	III
Bluestone	fungicide	copper sulfate	I
Cycocel	growth regulator	chlormequat chloride	III
Daconil	fungicide	chlorothalonil	I
Devrinol	herbicide	napropamide	III
Diazinon	insecticide	organophosphate	II
Diphos	insecticide	organophosphate	II
Diquat	herbicide	dipyridyl	II
Dithane	fungicide	dithiocarbamate	III
Dursban	insecticide	organophosphate	II
Karmex	herbicide	diuron	III
Kocide	fungicide	copper hydroxide	III
Lannate	insecticide	carbamate	I
Lesan	fungicide	fenaminosulf	II
Mesurol	insecticide	carbamate	II
Metasystox	insecticide	carbamate	II
Ornalin	fungicide	oxazolidinedione	III
Orthene	insecticide	organophosphate	III
Parnon	fungicide	pyridine	III
Pencap	insecticide	organophosphate	II
Plantvax	fungicide	carboximide	III
Pramex	insecticide	permethrin	II
Princep	herbicide	simazine	II
Pounce	insecticide	permethrin	I
Roundup	herbicide	glyphosate	II
Ronstar	herbicide	ozadiazon	II
Subdue	fungicide	alanine methyl ester	I
Temik	insecticide	carbamate	I
Terrachlor	fungicide	pentachloronitrobenzene	I
Thiodan	insecticide	organochlorine	I
Vendex	insecticide	organotin	I
Vydate	insecticide	carbamate	I

* EPA Toxicity Categories:

I	= DANGER	LD/50	50 mg/kg (rat)
II	= WARNING	LD/50	500 mg/kg (rat)
III	= CAUTION	LD/50	5000 mg/kg (rat)

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