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OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

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MEMORANDUM

SUBJECT: Review of Dichlorvos Incident Reports
DP Barcode D242971, Chemical #084001, Reregistration
Case #0310

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BACKGROUND

The following data bases have been consulted for the poisoning incident data on the active ingredient Disulfoton (PC Code: 084001):

1) OPP Incident Data System (IDS) - reports of incidents from various sources, including registrants, other federal and state health and environmental agencies and individual consumers, submitted to OPP since 1992. Reports submitted to the Incident Data System represent anecdotal reports or allegations only, unless otherwise stated. Typically no conclusions can be drawn implicating the pesticide as a cause of any of the reported health effects. Nevertheless, sometimes with enough cases and/or enough documentation risk mitigation measures may be suggested.

2) Poison Control Centers - as the result of Data-Call-Ins issued in 1993, OPP received Poison Control Center data covering the years 1985 through 1992 for 28 organophosphate and carbamate chemicals. Most of the national Poison Control Centers (PCCs) participate in a national data collection system, the Toxic Exposure Surveillance

System which obtains data from about 70 centers at hospitals and universities. PCCs provide telephone consultation for individuals and health care providers on suspected poisonings, involving drugs, household products, pesticides, etc.

3) California Department of Food and Agriculture (replaced by the Department of Pesticide Regulation in 1991) - California has collected uniform data on suspected pesticide poisonings since 1982. Physicians are required, by statute, to report to their local health officer all occurrences of illness suspected of being related to exposure to pesticides. The majority of the incidents involve workers. Information on exposure (worker activity), type of illness (systemic, eye, skin, eye/skin and respiratory), likelihood of a causal relationship, and number of days off work and in the hospital are provided.

4) National Pesticide Telecommunications Network (NPTN) - NPTN is a toll-free information service supported by OPP. A ranking of the top 200 active ingredients for which telephone calls were received during calendar years 1984-1991, inclusive has been prepared. The total number of calls was tabulated for the categories human incidents, animal incidents, calls for information, and others.

DICHLORVOS REVIEW

I. Incident Data System

Please note that the following cases from the IDS do not have documentation confirming exposure or health effects unless otherwise noted.

Incident#770-1

A pesticide incident occurred in 1991, when a farm employee, who was not wearing PPE, was exposed to dichlorvos and diesel oil when the hose broke on a gasoline-powered backpack sprayer while the employee was spraying a poultry house. The applicator was applying an overly concentrated solution without proper protective clothing. The majority of exposure was down the applicator's back. Typical organophosphate poisoning symptoms developed (not specified) within one hour and later he experienced convulsions. No further information on the disposition of the case was reported.

Incident#2796-3

A pesticide incident occurred in 1994, when an individual sprayed cucumbers and experienced sweating, dizziness, nausea, exhaustion, stomach cramps, and difficulty breathing. No further information on the disposition of the case was reported.

Incident#2903-5

A pesticide incident occurred in 1995, when more than sixty residents were evacuated from a twelve unit apartment complex that was treated with dichlorvos by an unlicensed pest control operator. Specific symptoms were not mentioned. No further information on the disposition of the case was reported.

Incident#2903-11

A pesticide incident occurred in 1994, when an almond processing plant was treated with dichlorvos and twelve hours later the next day, thirteen workers reentered the plant and experienced difficulty breathing, headaches, dizziness, nausea, and fatigue. A six hour reentry period is required for the dichlorvos product used. No further information on the disposition of the case was reported.

Incident#3263-13

A pesticide incident occurred in 1993, when two employees unknowingly reentered an office area of a small warehouse one hour after the application to take inventory after the building was treated with dichlorvos. A six hour reentry period is required for the dichlorvos product used. Specific symptoms were not mentioned. No further information on the disposition of the case was reported.

Incident#5024-1

A pesticide incident occurred in 1988, when thirty employees in a building experienced flu symptoms, headaches, and sinus problems and an individual experienced headaches, dizziness, malaise, impaired concentration, and phlebitis. No further information on the disposition of the case was reported.

II. Poison Control Center Data

Dichlorvos was one of 28 chemicals for which Poison Control Center (PCC) data were requested. The following text and statistics are taken from an analysis of these data; see December 5, 1994 memo from Jerome Blondell to Joshua First.

The 28 chemicals were ranked using three types of measures: (A) number and percent occupational and non-occupational adult exposures reported to PCCs requiring treatment, hospitalization, displaying symptoms or serious life-threatening effects; (B) California data for handlers and field workers comparing number of agricultural poisonings to reported applications; and (c) ratios of poisonings and hospitalization for PCC cases to estimated pounds reported in agriculture for pesticides used primarily in agriculture.

A. Occupational and Non-occupational Exposure

There were a total of 19,666 dichlorvos cases in the PCC data base. Of these, 316 cases were occupational exposure; 259 (82.0%) involved exposure to dichlorvos alone and 57 (18.0%) involved exposure to multiple chemicals, including dichlorvos. There were a total of 9043 adult non-occupational exposures; 8575 (94.8%) involved this chemical alone and 468 (5.2%) were attributed to multiple chemicals.¹

In this analysis, four measures of hazard were developed based on the Poison Control Center data, as listed below.

1. Percent of all accidental cases that were seen in or referred to a health care facility (HCF).
2. Percent of these cases (seen in or referred to HCF) that were admitted for medical care.
3. Percent of cases reporting symptoms based on just those cases where the medical outcome could be determined.
4. Percent of those cases that had a major medical outcome which could be defined as life-threatening or resulting in permanent disability.

Exposure to dichlorvos alone or in combination with other chemicals was evaluated for each of these categories, giving a total of 8 measures. A ranking of the 28 chemicals was done based on these measures with the lowest number being the most frequently implicated in adverse effects. Table 1 presents the analyses for occupational and non-occupational exposures.

¹ Workers who were indirectly exposed (not handlers) were classified as non-occupational cases.

Table 1: Measures of Risk From Occupational and Non-occupational Exposure to Dichlorvos Using Poison Control Center Data from 1985-1992^a

	Occupational Exposure	Non-occupational Exposure
Percent Seen in HCF		
Single chemical exposure	51.4 (68.2)	24.0 (44.0)
Multiple chemical exposure	50.3 (69.8)	24.9 (46.1)
Percent Hospitalized		
Single chemical exposure	9.8 (12.2)	5.4 (9.9)
Multiple chemical exposure	10.7 (14.3)	6.0 (12.6)
Percent with Symptoms		
Single chemical exposure	81.8 (85.8)	69.5 (74.0)
Multiple chemical exposure	84.4 (85.8)	70.3 (75.2)
Percent with Life-threatening Symptoms		
Single chemical exposure	0.6 ^b (0.0)	0.1 ^b (0.0)
Multiple chemical exposure	0.5 ^b (0.5)	0.1 ^b (0.05)

^a Extracted from Tables 2, 3, 5 and 6 in December 5, 1994 memo from Jerome Blondell to Joshua First; number in parentheses is median score for that category.

^b The percent calculated here is based on a single case for a single chemical exposure. The percent calculated here is based on between 6 to 8 cases for multiple chemical exposures.

* Top 25% of chemicals are ranked with a superscript of 1 to 7

Compared to other organophosphate and carbamate insecticides, dichlorvos had average or below average evidence of effects (Table 1). For non-occupational exposure, six life-threatening cases were reported for exposure to dichlorvos alone and eight life-threatening cases were reported which involved exposure to dichlorvos and other products. Among cases seen in a health care facility, dichlorvos cases were much less likely to be hospitalized

than the other insecticides. On other measures of hazard (percent seen in a health care facility or percent with symptoms), dichlorvos had percents similar to the median for other cholinesterase-inhibitors.

B. Ratios of poisoning - California Data

It is not possible to compare numbers of dichlorvos poisoning in California to the number of applications because the pattern of use is different from other organophosphates that are used primarily on crops.

C. Exposure in Children

A separate analysis of the number of exposures in children five years of age and under from 1985-1992 was conducted. For dichlorvos, there were 10307 incidents; 10070 involved exposure to dichlorvos alone and 237 involved other pesticides as well. Compared to 14 other organophosphates and carbamates that 25 or more children were exposed to, dichlorvos cases were less than half as likely to be seen in a health care facility or require hospitalization. Symptoms, however, occurred just as often for dichlorvos and there were four life-threatening cases reported in children under age six.

III. California Data - 1982 through 1995

Detailed descriptions of 227 cases submitted to the California Pesticide Illness Surveillance Program (1982-1995) were reviewed. In 62 of these cases, dichlorvos alone was judged to be responsible for the health effects. Only cases with a definite, probable or possible relationship were reviewed. Dichlorvos ranked 27th as a cause of systemic poisoning in California. One individual was hospitalized between 1982 and 1995. Table 1 presents the types of illnesses reported by year. Table 2 gives the total number of workers that took time off work as a result of their illness and how many were hospitalized and for how long.

Table 1: Cases Due to Dichlorvos Exposure in California Reported by Type of Illness and Year, 1982-1995.

Year	Illness Type					Total
	Systemic ^a	Eye	Skin	Resp	Combina tion ^b	
1982	8	1	2	-	-	11
1983	6	1	2	-	-	9
1984	2	-	-	-	-	2
1985	6	1	-	-	-	7
1986	2	-	-	-	-	2
1987	-	-	-	-	-	-
1988	2	-	-	-	-	2
1989	1	-	-	-	-	1
1990	2	-	-	1	-	3
1991	1	-	-	-	-	1
1992	5	-	-	-	-	5
1993	4	-	-	-	-	4
1994	11	-	-	2	1	14
1995	1	-	-	-	-	1
Total	51	3	4	3	1	62

^a Category includes cases where skin, eye, or respiratory effects were also reported

^b Category includes combined irritative effects to eye, skin, and respiratory system

Table 2: Number of Persons Disabled (taking time off work) or Hospitalized for Indicated Number of Days After Dichlorvos Exposure in California, 1982-1995.

	Number of Persons Disabled	Number of Persons Hospitalized
One day	5	-
Two days	2	1

3-5 days	4	-
6-10 days	-	-
more than 10 days	2	-
Unknown	4	2

A total of 51 persons had systemic illnesses or 82.3% of 62 persons. A variety of worker activities were associated with exposure to dichlorvos as illustrated in Table 3 below.

Table 3: Illnesses by Activity Categories for Dichlorvos Exposure in California, 1982-1995

Activity Category ^a	Illness Category					Total
	Systemic ^b	Eye	Skin	Resp.	Combination ^c	
Applicator	6	1	1	-	-	8
Mixload	1	-	-	-	-	1
Clean/Fix	-	-	-	1	-	1
Coincidental	2	-	-	-	-	2
Driftexp	3	-	-	-	1	4

Activity Category ^a	Illness Category					
	Systemic ^b	Eye	Skin	Resp.	Combination ^c	Total
Expotoco	9	-	-	-	-	9
Fumicham	1	-	-	-	-	1
Manuform	1	-	-	-	-	1
Resifield	2	-	1	-	-	3
Resistru	15	-	-	2	-	17
Othernon	11	2	2	-	-	15
Total	40	3	4	3	1	62

^a Clean/Fix= clean and/or repairing pesticide contaminated equipment; Coincidental= coincidental; Driftexp= exposure to pesticide that has drifted from intended targets; Expotoco= persons handling pesticide products between packaging and end-use; Fumicham= chamber fumigation; Manuform= manufacturing/formulation plant workers; Mixload= mixing and/or loader of pesticide concentrates and dilute pesticides; Othernon= non-occupational miscellaneous exposure; Resifield= field worker exposed to residue in the field; Resistru= worker exposed to residue of structural treatment

^b Category includes cases where skin, eye, or respiratory effects were also reported

^c Category includes combined irritative effects to eye, skin, and respiratory system

According to the above activity categories, resistru (worker exposed to residue of structural treatment) and nonoccb (non-occupational exposure) were associated with the majority of the exposures. Most such cases involve indoor workers exposed to residues from a fogger or spray-type application. A number of cases resulted due to faulty equipment. The resistru category caused illnesses that included symptoms of shortness of breath, difficulty breathing, chest tightness and pain, loss of concentration, headaches, dizziness, and several other symptoms. The nonoccb category caused illnesses that included symptoms of difficulty breathing, contact dermatitis on the face and nose, chemical conjunctivitis of the eyes, headaches, nausea, and several other symptoms.

IV. NPTN

On the list of the top 200 chemicals for which NPTN received calls from 1984-1991 inclusively, dichlorvos was ranked

18th with 188 incidents in humans reported and 32 incidents in animals (mostly pets).

V. Conclusions

Dichlorvos has widespread use patterns in the home and agricultural environments. Many of these uses (e.g., poultry houses) are atypical of most organophosphates; which makes it difficult to compare the risk. According to California data, it appears that a majority of cases involved illnesses to workers indoors that entered a previously dichlorvos fumigated facility. Often exposure results from lack of proper protective equipment and inadequate ventilation before persons are allowed in or near the treated area.

VI. Recommendations

Dichlorvos is capable of causing systemic illness including respiratory effects after fumigation. Labels for dichlorvos sprays and foggers should advise that the area to be treated be well-ventilated before people are allowed to return. For workers who reenter a fumigated facility, proper respiratory protection should be mandatory. Measures to reduce risk to applicators and handlers of dichlorvos should be consistent with other organophosphate and carbamates.

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