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MEMORANDUM

SUBJECT: Phorate - Review of Pesticide Poisoning Incident Data

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TO: Registration and Special Review Section
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The following data bases have been consulted for the poisoning incident data on the active ingredient phorate (PC Code: 057201):

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.

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 which obtains data from 70 centers at hospitals or 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

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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 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 humans, animals, calls, incidents and others.

PHORATE REVIEW

IDS

There were 18 separate incidents reported to the IDS as of December 12, 1995. The vast majority of these involved wildlife and ecological adverse effects which will be reviewed by the Environmental Fate and Effects Division. One report of agricultural exposure involved a Brazilian worker who spooned phorate granules from a container for application around coffee trees. He did not wear safety equipment and after 10 days at work, developed nausea and headache. He recovered with hospitalization and treatment.

Poison Control Center Data

Phorate was one of the 28 chemicals for which poison control center data were requested. The following statistics are taken from an analysis of these data; see December 5, 1994 memo from Jerome Blondell to Joshua First.

Occupational and Non-occupational Exposure

There were a total of 109 cases of occupational exposure to phorate reported to the Poison Control Centers; 85 (78%) involved exposure to phorate alone and 24 (22%) involved exposure to multiple chemicals, including phorate. There were a total of 82 non-occupational exposures; 74 (90%) involved this chemical alone and 8 (10%) were attributed to multiple chemicals.¹ (Phorate is registered mainly for agricultural uses.)

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

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

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 phorate alone or in combination with other chemicals was evaluated for each of these categories, giving a total of 8 measures.

The following table presents the analyses for occupational and non-occupational exposures. The number in parenthesis is the median score for that category.

	Occupational Exposure	Non-occupational Exposure
Percent Seen in HCF		
Single chemical exposure	68.2 (68.2)	66.2* (44.0)
Multiple chemical exposure	66.1 (69.8)	64.6* (46.1)
Percent Hospitalized		
Single chemical exposure	15.5 (12.2)	16.3 (9.9)
Multiple chemical exposure	15.3 (14.3)	15.1 (12.6)
Percent with Symptoms		
Single chemical exposure	94.3* (85.8)	74.5 (74.0)
Multiple chemical exposure	95.3* (85.8)	76.9 (75.2)
Percent with Life-threatening Symptoms		
Single chemical exposure	3.8* (0.0)	0.0 (0.0)
Multiple chemical exposure	3.1* (0.5)	0.0 (0.05)

* Included in the top 25% of insecticides.

A ranking of the 28 chemicals was done based on the above eight measures, with the lowest number being the most frequently

implicated in adverse effects. Phorate ranked number 6 for occupational exposure and number 7 for non-occupational exposure (in spite of being registered for mostly agricultural uses). Phorate was one of eight chemicals in the top 10 rankings for both occupational and non-occupational exposure.

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 phorate, there were a total of 26 reports; 25 involved exposure to this chemical alone while 1 was attributed to multiple chemicals. Further analysis showed that 36.0% with exposure to phorate alone were seen at a health care facility². The percentage was 38.5% when phorate was used in combination with other chemicals³. Of these cases, the percentage hospitalized was 11.1% and 10.0% with single and multiple chemical exposures, respectively.

Ratios of Poisoning Per Reported Use - California Data

California data on the number of systemic poisonings (1982 through 1989) and number of applications per year were used to calculate a ratio of the poisonings/1,000 applications. The data on phorate are presented below. The median for 29 insecticides is presented for comparison.

Number of Applications	Systemic Poisonings/1,000 Applications (Number) Primary Pesticide Only		
	Handlers	Field Workers	Total
12,984	.46 (6)	.31 (4)	.77 (10)
Median	.21	.20	.41

Ratios of Poisonings - U.S. Poison Control Center Data

The poison control center data for those pesticides used almost exclusively in agriculture and data on 15 insecticides used in U.S. crop production⁴ were used to calculate the following ratios: exposure per use, poisonings per use, health care referral per use and hospital admitted cases per use. The ratios for phorate are presented in the table below.

² This percentage was the second highest of the 17 chemicals with 25 or more incident reports. Only carbofuran exposure resulted in a higher percentage of referrals to a HCF.

³ This percentage was the third highest of the 17 chemicals with 25 or more incident reports. Only carbofuran and aldicarb were higher.

⁴ Gianessi. L.P., Puffer, C.A. 1992. Insecticide Use in U.S. Crop Production. Resource for the Future, Washington, D.C.

	Exposure per Use	Poisonings per Use	Health Care Referral per Use	Hospital Admitted Cases per Use
Phorate	.023	.013	.015	.002
Median	.033	.013	.027	.004

California Detail Data - 1982-1993 - Circumstances of Poisoning

There were 22 case reports of adverse reactions received by the California Pesticide Illness Surveillance Program from 1982 to 1993; 20 involved use of phorate alone while in 2 cases other chemicals were also used. The following table presents the categories of illness by year⁵.

	Systemic	Skin	Eye	Respiratory
1982	6			
1983	2			
1984	1			
1985	1			
1987	1			
1988	1		1	
1989	3	1		1
1990	1			
1991	1			
1992	1	1		
Total	18	2	1	1

One incident reported both systemic and skin illnesses; another systemic and respiratory illness (not used until 1989).

Phorate application (5 cases) and mixing/loading (4 cases) were the most frequently cited activity classifications. Many of the reports did not list crop treated; sugar beets (4 cases) was the most frequently listed.

One fatality was reported in 1982 in a 22-month old child who was playing in his grandparent's yard where a can of Thimet was in a coffee can. The child became nauseated and collapsed. He was rushed to the hospital but died four days later. Symptoms listed on the report are nausea, coma, pneumonia, cerebral edema and death. Three

⁵ There were no reports for 1986.

emergency response personnel were exposed to the pesticide under similar conditions in 1982. They inhaled the chemical while assisting a patient with a coffee can of Thimet. Symptoms included headache, blurred vision and nausea.

Seven incidents involved accidents or failure to use protective equipment. In one case, a student who was barechested entered a field which had been treated with Thimet a day earlier to set up irrigation and check flow. He experienced headache, muscle aches, nausea, diarrhea, mild rash and dizziness. Two workers were exposed on two separate occasions while carrying bags of phorate with holes. A mixer/loader did not wear a respirator and developed headache, nausea and heartburn. A fifth worker was not wearing goggles when pesticide dust blew into his eye. Two UPS drivers were exposed to the fumes of phorate from a spill during a delivery. It is also interesting to note from the comments section of the reports that several workers did not feel ill until working with the pesticide for multiple days.

NPTN

A total of 116 calls on phorate were handled by NPTN from 1984 to 1991, inclusively. A total of 39 incidents, involving 29 humans and 5 animals, were reported.

CONCLUSIONS

The following conclusions can be drawn from the above analyses of the Poison Control Center data from 1985 through 1992.

1. The percent of occupational exposures to phorate alone or in combination with other chemicals which resulted in both symptoms and life-threatening symptoms exceeded the median score for the 28 chemicals analyzed. Four of the four calculations were in the top 25% of chemicals most frequently associated with adverse effects that had symptomatic or life-threatening outcomes. (See page 3.)
2. Non-occupational exposure to phorate, whether alone or in combination with other chemicals, exceeded the median score for the number of cases referred to a health care facility (HCF). (The Poison Control Centers classified workers indirectly exposed, i.e., non-handlers, as non-occupational exposures.) (See page 3.)
3. Of the 28 chemicals, phorate ranked 6 for occupational exposure and 7 for non-occupational exposure, with number 1 being most frequently associated with adverse effects. This suggests that phorate is above average in its ability to cause adverse effects. Therefore, regulatory restrictions to prevent acute poisoning should be in accordance with other organophosphates that are above average.
4. When using the California data and calculating ratios for the number of systemic poisonings per 1,000 applications, the

calculations are for phorate are higher than the median score for the 28 chemicals. Note, however, that California calculations were based on a relatively small number of cases. (See page 4, Ratios of Poisonings per Reported Use - California.) When using U.S. data, the ratios for exposure per use, poisonings per use, health care referral per use and hospital admitted cases per use were below the median scores. (See page 4, Ratios of Poisonings - U.S. Poison Control Center Data.) However, it should be remembered that these 28 chemicals were selected for a Data-Call-In because of concerns about the incidence of poisonings in California agricultural workers.

5. Approximately one-third of children exposed to phorate, whether alone or in combination with other chemicals, were referred to a HCF.

The following conclusions can be drawn from the detailed California Incident Data from 1982-1993.

1. Symptoms of a systemic illness are more likely reported after phorate exposure as compared to ocular and dermal effects.

2. Applicators and mixer/loaders are the most frequently affected activity categories.

3. Phorate is currently only used in granular formulations. Some of the above average ratios or measures of hazard (described above) suggest that handlers may not fully observe precautions because of the perception that poisoning is much less likely with a granular than liquid formulation. A similar pattern, with even greater hazard measures, has been found for granular aldicarb. Label requirements for these products need to be as stringent as for liquids. A prominent label warning that failure to follow precautions may be expected to result in serious or even life-threatening poisoning requiring immediate medical care should be considered. Also, the following may be added, "This granular formulation is soluble and is readily absorbed across skin to cause poisoning."