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PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

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SUBJECT: Review of Methyl Parathion Incident Reports
DP Barcode D242333, Chemical #053501, Reregistration Case#0153

FROM: Jerome Blondell, Ph.D., Health Statistician
Chemistry and Exposure Branch 2
Health Effects Division (7509C) Jerome Blondell

Monica F. Spann, MPH, Environmental Health Scientist
Chemistry and Exposure Branch 2 Monica F. Spann
Health Effects Division (7509C)

THRU: Susan V. Hummel, Senior Scientist Susan V. Hummel
Chemistry and Exposure Branch 2
Health Effects Division (7509C)

TO: Jonathan Becker, Environmental Health Specialist
Reregistration Branch 2
Health Effects Division (7509C)

BACKGROUND

The following data bases have been consulted for the poisoning incident data on the active ingredient Methyl Parathion (PC Code: 053501):

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

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.

METHYL PARATHION 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# 000578 001

A pesticide incident occurred in 1993, when nineteen workers were exposed to methyl parathion and two other pesticides when entering an apple orchard two or three days after application to thin the fruit. The other two pesticides, calcium chloride and Systhane/Mycloburanil, are not cholinesterase inhibitors. They all reported experiencing some combination of headaches, diarrhea, nausea, and one worker had a bloody nose. In another incident in the same field, sixteen workers (perhaps of the original 19) re-entered the area 49 hours after methyl parathion (Penncap M) was sprayed and a few complained of illness. The next day all sixteen workers were complaining of illness (headache, nausea, diarrhea) and left the field. No one sought medical treatment, so blood cholinesterase was not measured. No further information on the disposition of the case was reported.

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Incident# 000894 004

A pesticide incident occurred in 1992, when several inspectors found more than 200 gallons of methyl parathion in a basin and experienced burning throats, sore eyes, and fatigue. No further information on the disposition of the case was reported.

Incident# 001280 004

A pesticide incident occurred in 1994, when a veterinarian smelled a container with methyl parathion and became ill. No further information on the disposition of the case was reported.

Incident# 001769 001

A pesticide incident occurred in 1994, when a woman was sprayed with methyl parathion by an aerial applicator and experienced blurred vision, disorientation, weakening in the legs, and memory lapses. She reported that the symptoms persisted for eleven months.

Incident# 002225 001

A pesticide incident occurred in 1995, when an individual was packaging containers of methyl parathion and experienced nausea. No further information on the disposition of the case was reported.

Incident# 002431 001

A pesticide incident occurred in 1995, when a three year old boy was exposed to methyl parathion after a pig rooted out a hole in the ground which had previously been an old farm surrounded by a fence. The boy played in this same area and experienced vomiting. No further information on the disposition of the case was reported.

Incident# 002479 001

A pesticide incident occurred in 1995, when a man was sprayed with methyl parathion that was applied aerially and two weeks later experienced convulsions and seizures. Symptoms during the two week period were not reported. No further information on the disposition of the case was reported.

Incident# 002922 001

A pesticide incident occurred in 1995, when a man was accidentally sprayed with methyl parathion that was applied aerially to a cotton field. Specific symptoms were not mentioned. No further information on the disposition of the case was reported.

Incident# 003599 001

The Minnesota Department of Agriculture surveyed state enforcement agencies to determine what pesticides were involved in spray drift. Among the thirty-two states responding to the survey, there was a total of 2,681 cases of drift complaints related to specific pesticides. Methyl parathion was responsible for 7 complaints or less than one percent of the total.

Incident# 003976 001

A pesticide incident occurred in 1996, when a crop advisor, who was scouting corn fields 48 hours after spraying with methyl parathion. He experienced nausea, blurred vision, and excessive salivation. He did not see a doctor but remained in bed several days. No further information on the disposition of the case was reported.

Incident# 004420 001

A pesticide incident occurred in 1996, when a woman and her son were sitting on their back porch and were sprayed with methyl parathion. The woman experienced nausea, chest tightness, soreness over her entire body, and body tremors. The son experienced diarrhea, skin irritation, and headaches. No further information on the disposition of the case was reported.

Incident# 004439 142

A pesticide incident occurred in 1996, when an individual was drenched with methyl parathion and died. Despite repeated follow-up no information could be obtained to verify this incident.

II. Poison Control Center Data

Methyl Parathion 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 274 methyl parathion cases in the PCC data base. Of these, 102 cases were occupational exposure; 91 (89%) involved exposure to methyl parathion alone and 11 (11%) involved exposure to multiple chemicals, including methyl parathion. There were a total of 146 adult non-occupational exposures; 113 (77%) involved this chemical alone and 33 (23%) were attributed to multiple chemicals.[1]

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

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 methyl parathion 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.

Table 1: Measures of Risk From Occupational and Non-occupational Exposure to Methyl Parathion Using Poison Control Center Data from 1985-1992[a]

	Occupational Exposure	Non-occupational Exposure
Percent Seen in HCF		
Single chemical exposure	81.3[5] (68.2)	58.4* (44.0)
Multiple chemical exposure	82.4[5] (69.8)	63.7*[6] (46.1)
Percent Hospitalized		
Single chemical exposure	9.5* (12.2)	9.1* (9.9)
Multiple chemical exposure	13.1* (14.3)	14.0* (12.6)
Percent with Symptoms		
Single chemical exposure	72.7* (85.8)	80.0* (74.0)
Multiple chemical exposure	75.0* (85.8)	81.3*[7] (75.2)
Percent with Life-threatening Symptoms		
Single chemical exposure	0.0 (0.0)	0.0* (0.0)
Multiple chemical exposure	1.2 (0.5)	0.0* (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
* Top 25% of chemicals are ranked with a superscript of 1 to 7

Including exposure to multiple chemicals, methyl parathion had the fifth highest percent of occupational cases seen in a health care facility (Table 1). On other measures of hazard (percent hospitalized, percent with symptoms or life-threatening symptoms), methyl parathion had percents similar to the median for other cholinesterase-inhibitors, sometimes higher and sometimes lower.

B. Ratios of poisoning - California Data

The incidence of **systemic poisoning cases** in agricultural workers reported to the California was compared to the number of applications of methyl parathion. Those calculations, along with the median score for a total of 29 pesticides, are presented in the Table 2 below.

Table 2: Systemic Poisonings/1,000 Applications in Selected Agricultural Workers Exposed to Methyl Parathion in California, 1982-1989[a]

Pesticide	Number of Appl.	Poisonings/1,000 Appl. (N) Primary Pesticide Only			Poisonings/1,000 Appl. (N) Multiple Pesticide Exposure		
		Handlers	Field Workers	Total	Handlers	Field Workers	Total
Methyl Parathion	45,597	.04 (2)	.00 (0)	.04 (2)	.09 (4)	.04 (2)	.13 (6)
Median		.21	.20	.41	.44	.50	1.02

a Extracted from Table A5 in December 5, 1994 memo from Jerome Blondell to Joshua First; number in parentheses is the observed number of poisoned cases.

Methyl Parathion had much lower ratios of handler poisonings and field worker poisonings per 1,000 applications in California, regardless of whether exposures to mixtures were included or not. For total poisoning per 1,000 applications where methyl parathion was deemed the primary cause of the incident, only two other pesticides (bacillus thuringiensis and permethrin) had lower ratios. This is an unusually good record for an organophosphate insecticide, suggesting that worker practices in place in California from 1982 through 1989 were both safe and effective.

C. Ratios of Poisoning - U.S. Poison Control Data

Active registrations of methyl parathion are for agricultural use exclusively. Ratios of the number of occupational Poison Control Center exposures to the reported pounds of the chemical used[2] were calculated. The results for methyl parathion and the median for the 15 agricultural chemicals included in the analysis are presented in the Table 3 below.

Table 3: Ratios of Methyl Parathion Poisonings (PCC Data, 1985-1992) to Reported Use[a]

Pesticide	Exposure Per Use	Poisonings Per Use	Health Care Referral Per Use	Hospital Admitted Cases Per Use
Methyl Parathion	.013*	.008*	.010*	.001*
Median	.033	.013	.027	.004

a Extracted from Table 9 in the December 5, 1994 memo from Jerome Blondell to Joshua First

* Top 33% of chemicals are ranked with a superscript of 1 to 5

[2] Gianessi, L.P., Puffer, C.A. Insecticide Use in U.S. Crop Production. Resources for the Future, Washington, D.C., 1992.

Among pesticides used exclusively in agriculture, methyl parathion had the third lowest ratio of exposures, poisonings, and treatment to estimated pounds active ingredient reported in use (Table 3). Methyl parathion had second lowest ratio of hospitalized cases per estimated pounds used. Based on these measures, methyl parathion appears to be much less likely to be involved in potential poisonings than other organophosphate and carbamate insecticides.

D. 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 methyl parathion, there were 26 incidents; 23 involved exposure to methyl parathion alone and 3 involved other pesticides as well. Because of the relatively small number of cases, no statistical comparisons were made with other organophosphates and carbamates.

E. Environmental and Misuse accidents

The American Association of Poison Control Centers (AAPCC) provided data on over 100,000 exposures from 1985 through 1992 for 28 pesticides. A search was performed on this data for those pesticides with no significant home use, but large agricultural use (n = 15). Only exposures where the residence was the site of the exposure and the pesticide product was the sole product involved in the exposure were included in the analysis. The table below shows the results where reason was environmental or misuse. AAPCC defines these terms as follows:

Environmental: any passive exposure that results from man-made contamination of the environment, e.g. exposures to contaminated water resulting from improper disposal of chemicals, passive inhalation of toxic fumes or gases as a result of discharge at a plant or a "HazMat" incident.

Misuse: An accidental exposure which results from the improper or incorrect use of a substance where therapeutic or beneficial results were intended.

The other commonly used "reason" categories are general, occupational, unknown, and intentional (includes suicide and abuse). General is defined as: all unintended poisonings or exposures that are not specifically defined by other categories, including most accidental exposures to children, bites, stings, plant exposures and unintentional food poisoning.

Obviously there is considerable 'gray area' between these categories and many scenarios can be imagined where different poison specialists would assign different categories. For example, spray drift could be counted as environmental or misuse and

probably accounts for the majority of cases recorded. The purpose of this analysis was to find out if it might be used to identify agricultural pesticides illegally applied in the home environment.

The other key problem with AAPCC data, particularly severe in this case, is the lack of representation in certain states. Thirteen states had little or no coverage by AAPCC during the time period of interest. They were Nevada, Oklahoma, Texas, Arkansas, Mississippi, Illinois, Iowa, North Carolina, South Carolina, Delaware, Connecticut, Vermont and Maine. In particular, the absence of data from Mississippi, the Carolina, Arkansas, Texas and Oklahoma is likely to miss a substantial portion of misuse problems due to methyl parathion.

Table 4. AAPCC exposures for agricultural pesticides reported in residences due to environmental exposure or misuse, 1985-1992 (ratio = environmental + misuse/ pounds active ingredient).

Pesticide	Environ-mental	Misuse	Env. + Misuse	Pounds ai 1989-91	E+M/P ratio
aldicarb	30	6	36	5000	7.2
azinphosmethyl	16	3	19	3000	6.3
carbofuran	12	19	31	1500	20.7
dicrotophos	2	2	4		
ethoprop	2	0	2	750	2.7
fenamiphos	0	0	0	800	0.0
fonophos	12	1	13		
methamidophos	15	0	15	1230	12.2
methidathion	1	1	2	520	3.8
methyl parathion	29	5	34	8180	4.2
mevinphos	3	0	3	420	7.1
phorate	3	5	8	2902	2.8
profenofos	0	0	0	900	0.0
sulfotepp	7	0	7		
terbufos	4	4	8		

The conclusion from examining Table 4 is that the categories for environment and misuse can not be used to identify agricultural pesticides, like methyl parathion, that may be applied indoors.

III. California Data - 1982 through 1995

Detailed descriptions of 18 cases submitted to the California Pesticide Illness Surveillance Program (1982-1995) were reviewed. In 7 of these cases, methyl parathion was used alone and was judged to be responsible for the health effects. Only cases with a definite, probable or possible relationship were reviewed. Methyl parathion ranked 90th as a cause of systemic poisoning in California (1982-1994). Table 5 presents the types of illnesses reported by year. Table 6 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 5. Cases Due to Methyl Parathion Exposure in California Reported by Type of Illness and Year, 1982-1995

Year	Illness Type				
	Systemic[a]	Eye	Skin	Respiratory	Total
1982	1	1	-	-	2
1983	1	-	-	-	1
1984	-	-	-	-	-
1985	-	-	-	-	-
1986	-	-	-	-	-
1987	1	-	-	-	1
1988	-	-	-	-	-
1989	-	-	-	-	-
1990	2	-	-	-	2
1991	-	-	-	-	-
1992	1	-	-	-	1
1993	-	-	-	-	-
1994	-	-	-	-	-
1995	-	-	-	-	-
Total	6	1	-	-	7

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

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A total of 6 persons had systemic illnesses or 86% of 7 cases. Five of these workers took between two and five days off work as a result of their illness as shown in Table 6 below. One worker was hospitalized for four days after spraying the insecticide inside a greenhouse. A variety of worker activities were associated with exposure to methyl parathion as illustrated in Table 7 below.

Table 6. Number of Persons Disabled (taking time off work) or Hospitalized for Indicated Number of Days After Methyl Parathion Exposure in California, 1986-1995.

	Number of Persons Disabled	Number of Persons Hospitalized
One day	-	-
Two days	2	-
3-5 days	3	1
6-10 days	-	-
more than 10 days	-	-
Unknown	-	-

Table 7. Illnesses by Activity Categories for Methyl Parathion Exposure in California, 1986-1995

Activity Category[a]	Illness Category				
	Systemic[b]	Eye	Skin	Respiratory	Total
Applicator	2	1	-	-	3
Driftexp	2	-	-	-	2
Other	2	-	-	-	2
Total	6	-	-	-	7

[a] Driftexp= exposure to pesticide that has drifted from intended targets; Other= other occupational exposure
[b] Category includes cases where skin, eye, or respiratory effects were also reported

According to the above activity categories, applicators (two by hand and one by spray rig) were associated with three illnesses. The most serious case experienced muscle spasms, vomiting,

diarrhea, and abdominal pain and was hospitalized for four days. One of the cases classified as other was a person downwind from a spill, similar to the two drift exposure cases. These cases reported symptoms of headaches, difficulty breathing, nausea, diarrhea, vomiting, weakness, sweating, and itching around the mouth.

IV. NPTN

On the list of the top 200 chemicals for which NPTN received calls from 1984-1991 inclusively, methyl parathion was not reported to be involved in human incidents.

V. Literature Review

Two incidents involving deaths have been reported in Mississippi from misuse of methyl parathion inside homes. The first incident reported in 1977 involved seven of 13 members in one family who developed weakness, abdominal pain, nausea, vomiting, difficulty seeing, excessive sweating and salivation. The father of the rural farm family had taken some concentrated methyl parathion from a discarded drum and placed it in a nebulizer and then sprayed his home for cockroaches. A 26 year old died as a result of organophosphate poisoning confirmed by cholinesterase testing.

In the second incident, the male live-in companion sprayed the house to control spiders. He had obtained a nearly empty container of methyl parathion from the farm he worked on and added water to it. He used a hand sprayer to spray the solution on the inside upper walls of three of the four rooms (excluding the kitchen) in the house. The concentration in the hand sprayer was found to be three times that used for outdoor agricultural application. It was suspected that methyl parathion got into the food and drinking water, as well as being present in the air and on surfaces. All seven children in the home became ill and were hospitalized with confirmed cholinesterase inhibition. Two of the five children, a four year old and an eleven year old, died.

Numerous cases of exposure inside homes have been documented in Ohio, Michigan, Mississippi, Louisiana and elsewhere. These exposures have occurred due to illegal application by PCOs going door to door. Total number of people exposed from these applications number in the thousands and over 1,000 people have had to be relocated while their home were decontaminated. The estimated cost of clean up exceeds $70 million. There have been reports of symptomatic human cases and pets that have been adversely affected or died. However, these cases have not been confirmed by cholinesterase testing and the reported cases have not been published in the scientific literature.

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VI. Conclusions

Exposure to methyl parathion can lead to systemic illness. In outdoor agricultural situations, the primary activities associated with poisoning are application and spray drift. Compared to other organophosphate and carbamate insecticides, methyl parathion is associated with less poisoning when adjusted for amount of use. To some extent the similarity between the methyl parathion and the far more toxic ethyl parathion (in terms of poisonings and deaths even after adjusting for use), may have resulted in workers handling any product with the 'parathion' name with greater care.

Interior home use of methyl parathion has resulted in deaths in two separate incidents in Mississippi. Food or water contamination and an unusually high concentration used in the application probably contributed to these deaths which occurred in the 1970s and early 1980s. The more recent cases exposed primarily in Ohio, Mississippi, and Louisiana have not been well documented or confirmed with cholinesterase testing.

VII. Recommendations

Numerous actions have already been taken to prevent use of methyl parathion in homes. For outdoor use, protective measures required for other organophosphate and carbamate insecticides should be considered. Special attention should be given to protecting pesticide handlers and preventing spray drift.

cc: Correspondence
Methyl parathion file (chemical no. 053501)
SRRD - Emily Mitchell (7508W)

RDI: BRSrSci:SHummel:

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