

**ENVIRONMENTAL MONITORING OF
MALATHION AERIAL APPLICATIONS USED TO
ERADICATE MEDITERRANEAN FRUIT FLIES
IN SOUTHERN CALIFORNIA, 1990**

March 1991

Environmental Hazards Assessment Program



STATE OF CALIFORNIA
Department of Food and Agriculture
Division of Pest Management, Environmental Protection and Worker Safety
Environmental Monitoring and Pest Management Branch
1220 N Street, Sacramento, California 95814

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DEPARTMENT OF FOOD AND AGRICULTURE



EXECUTIVE SUMMARY
Of Report EH 91-3 Entitled
"Environmental Monitoring of Malathion Aerial Applications
Used to Eradicate Mediterranean Fruit Flies
in Southern California, 1990"

Environmental Monitoring and Pest Management Branch
Division of Pest Management, Environmental
Protection and Worker Safety
Department of Food and Agriculture

PURPOSE:

Staff of the California Department of Food and Agriculture measured levels of malathion and malaoxon (an oxidation product of malathion) on the ground, in water and in air resulting from aerial applications of a malathion bait mixture to eradicate the Mediterranean fruit fly (Medfly).

BACKGROUND:

A Medfly infestation was discovered in Los Angeles County in July of 1989. Since the Medfly is one of the most destructive fruit pests, eradication measures were initiated as soon as the infestation was detected. One measure used was multiple aerial applications of malathion bait over 1,504 square kilometers (371,645 acres) of urban areas within Los Angeles, Orange, Riverside, and San Bernardino Counties.¹

Extensive monitoring by the Environmental Hazards Assessment Program (EHAP) of a similar aerial treatment program in 1981 did not reveal any unusual exposure to the public or to the environment, except to aquatic biota during storm runoff periods (Oshima, et al., 1982).² Therefore, only representative monitoring was conducted for the 1989-90 aerial treatment program to determine if mass deposition (amount reaching the ground), droplet sizes, and water and air concentrations of malathion and malaoxon were similar to those measured in 1981.

1. The material sprayed was a mixture which contained the pesticide malathion and an insect bait which attracts the flies. The insect bait, Nu-Lure, is a plant-based liquid which contains primarily water, amino acids and sugars. The malathion bait mixture was applied at a rate of 12.4 fluid ounces per acre. Malathion accounted for approximately 22 percent of this mixture.

2. Oshima, R.J., L.A. Neher, T.M. Mischke, D.J. Weaver and O.S. Leifson. 1982. A Characterization of Sequential Aerial Malathion Applications in the Santa Clara Valley of California, 1981. California Department of Food and Agriculture.

STUDY METHODS:

Most of the monitoring occurred between February 12 and April 25, 1990. The EHAP staff monitored one application in each of the following six areas which were treated with malathion bait: Brea/La Habra Heights; Garden Grove; Sylmar, North Hollywood, Panorama City (San Fernando Valley); and Rosemead/Monrovia. Three additional applications were monitored in the Rosemead/Monrovia area. This monitoring covered 419 square kilometers (103,537 acres) of treated area. Within each of these treated areas, the EHAP collected samples to provide information about the mass and droplet sizes of malathion on the ground, indoor and outdoor air concentrations, and water concentrations. The amount of malathion and malaaxon, and the size and number of spray droplets reaching the ground after an application were measured at more than 200 sites in all treated areas which were monitored. Water concentrations were measured before and after an application in two freshwater ponds and 12 swimming pools in the six treated areas. Water samples were also taken before and immediately after an application from three sites (a drinking water reservoir and two fishing areas) which, in order to protect public health or fish and game, were not to be sprayed although they were located within the six treated areas. Indoor and outdoor air was sampled before, during, and up to 48 hours after an application at 34 sites which included schools, hospitals, convalescent hospitals, private residences, and a daycare facility in the six treated areas.

Outside treated areas, additional water samples were collected from all major waterways which carried surface runoff from the sprayed areas. This runoff monitoring continued through June of 1990.

MAJOR FINDINGS:

A. Mass Deposition

Deposits of malathion following a single aerial spray averaged 2,028 micrograms per square foot (values ranged from 141 to 4,991 micrograms per square foot). Malaaxon deposits averaged 11.7 micrograms per square foot (values ranged from none detected to 43.9 micrograms per square foot). The expected application rate of 2.8 fluid ounces of Malathion ULV product per acre is equivalent to 2,212 micrograms malathion plus malaaxon per square foot. At this expected application rate, an average city lot measuring 60 by 100 feet would receive slightly over two teaspoonfuls of malathion distributed over the entire area.

B. Droplet Size

The average deposit from all monitoring of the six treated sites was 711 droplets per square foot.

C. Water

1. Inside Treated Areas

a. Sites Which Were Sprayed Directly

Malathion concentrations were measured in 12 swimming pools and 2 freshwater ponds: an average of 49.4 parts per billion malathion was measured in the ponds, and 9.38 parts per billion in the pools immediately after each application. The average level of malaaxon was 0.80 parts per billion in the ponds and 16.5 parts per billion in the pools.

b. Sites Which Were Not Sprayed Directly

Water concentrations were also measured at three sites which were in or near the treatment areas, but which were not to receive malathion bait applications in order to protect public health and fish and game: a drinking water reservoir, a fishing pond and a recreational area.

Malathion was detected in the two drinking water reservoir samples (0.15 and 0.11 parts per billion), well below the California Department of Health Services Advisory Level of 160 parts per billion for malathion.

Concentrations of malathion (average 6.22 parts per billion) and malaaxon (average 2.26 parts per billion) were detected in the fishing area. Effects in trout would not be expected at these concentrations. However, at least two fish kills (trout) occurred in this pond during the treatment period. The fish kills occurred immediately following fish planting when fish are already under stress. According to the California Department of Fish and Game (CDFG), although the malathion concentrations may have placed further stress on the hatchery fish, the fish kills were probably caused by a combination of high temperature and low dissolved oxygen content of the water which are factors not related to bait application.

None of the samples collected from the recreational area contained detectable levels of malathion or malaaxon.

2. Outside Treated Areas

Between May 1 and June 25, 1990, water runoff samples were collected from five sites (two rivers, two runoff channels, and a marsh) in three areas near the coast where drainage impacts on aquatic biota might occur due to the discharge of drainage water. Samples collected during both rain and non-rain periods generally showed low concentrations. The CDFG has developed a criterion to serve as a guideline for evaluating potential risks to the aquatic environment resulting from malathion aerial applications. This acute (24-hour exposure) water quality criterion of 3.54 parts per billion malathion was exceeded on three of eight sampling dates. No adverse

impacts could be attributed to these levels since no specific monitoring for invertebrates or fish was conducted.

D. Air

Air concentrations of malathion and malaaxon were measured in 266 samples collected at all 34 sites in the six treated areas. Of these 266 samples, 63 had no detectable amount of malathion or malaaxon. In almost all cases malathion concentrations were greater than malaaxon concentrations. The highest concentrations detected were 19.3 parts per trillion malathion (detected during the application), and 13.6 parts per trillion malaaxon (detected 48 hours after the application). The work place standard for daily employee exposure to air concentrations of malathion is 745,000 parts per trillion. In virtually all samples, outdoor air concentrations were higher than those indoor, and the first 24-hour post spray period was higher than the other sampling intervals.

CONCLUSIONS:

Results from the 1990 monitoring program for air, water, mass deposition and droplet size samples differed significantly from those of 1981: in 1990, droplet size was larger, mass deposition and deposition efficiency were higher, water concentrations were generally higher, and air concentrations were lower than in 1981. The larger droplet size of 1990 probably contributed to the higher deposition efficiency; higher deposition efficiency may have contributed, in part, to higher water concentrations observed in 1990. The differences between 1990 and 1981 monitoring may also be related to changes in application techniques and weather. In 1990, the application rate was higher and larger nozzles were used than in 1981. Temperatures during the winter and spring of 1990 were lower than average temperatures during the 1981 monitoring which may account for the lower air concentrations observed in 1990.

The presence of malathion in water bodies, from direct application, drift, or runoff, may cause the most environmental impacts. Of particular concern are high concentrations of malathion in rain runoff which may occur during winter malathion applications when rainfall is heaviest. Several fish losses due to malathion were reported during the 1981 eradication program. Runoff monitoring, conducted by the Los Angeles County Agriculture Department during 1989-90, showed maximum concentrations in the parts per million range, many times higher than the water quality criterion for freshwater. This report recommends that extensive monitoring of both water quality and invertebrate and fish losses be conducted to determine if malathion spraying causes unacceptable aquatic impacts during the winter rainfall period.



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3/22/91

ENVIRONMENTAL MONITORING OF MALATHION AERIAL APPLICATIONS
USED TO ERADICATE MEDITERRANEAN FRUIT FLIES
IN SOUTHERN CALIFORNIA, 1990

BY

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ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM

ABSTRACT

Multiple aerial applications of malathion bait over urban areas were used to eradicate a Mediterranean fruit fly (Medfly) infestation in Southern California during 1989 and 1990. Extensive monitoring of a similar aerial treatment program in 1981 did not reveal any unusual risks to public health or the environment. Therefore, less intensive monitoring was conducted by the Environmental Hazards Assessment Program of the California Department of Food and Agriculture to determine if the values for certain parameters for the 1989-1990 aerial treatment program were similar to the values in 1981. These parameters included mass deposition (amount reaching the ground), air and water concentrations of malathion and malaoxon (malathion oxidation product), and droplet sizes.

Mass deposition and droplet size were measured at more than 200 sites by capturing the spray on plastic-backed paper sheets and Kromekote® paper cards. The paper sheets were chemically analyzed for malathion and malaoxon, and the Kromekote® cards were scanned with a microscope to determine droplet sizes. Even though the aircraft were flying at a high altitude (153 m), the efficiency of deposition was very high, with 92% (2041 $\mu\text{g}/\text{ft}^2$) of the theoretical amount released accounted for on the ground surface. The application efficiency and absolute amount of malathion found are significantly higher than the values found during the 1981 program (75%, 1385 $\mu\text{g}/\text{ft}^2$). The differences in efficiencies are due, in part, to differences in the numbers and sizes of droplets deposited. The mean droplet diameter was 252 μm in 1981 and 308 μm in 1990. Less than 5% of the 1990 droplets were in sizes which might drift (<100 μm).

Malathion and malaoxon water concentrations were measured in freshwater ponds, swimming pools, storm drains, and a marsh area. Residues were highly variable (from none detected to 91 ppb) due in part to the wide variety of sites and time periods sampled. The concentrations found were below the Health Advisory Level for drinking water. However, the California Department of Fish and Game's (CDFG) recommended water quality criterion for the protection of freshwater aquatic species was exceeded on several occasions and two fish kills were investigated. The CDFG determined that the fish kills were probably not due to malathion poisoning and no adverse impacts were observed when the criterion was exceeded. However, no specific biota monitoring was conducted. The winter rain season may be especially problematic. Malathion concentrations in runoff channels reached the parts per million range as documented by the Los Angeles County Agriculture Department. It is recommended that extensive monitoring of both water quality and biota losses be conducted if malathion applications occur during the winter rain season.

Air concentrations were determined at 34 sites by collecting four consecutive samples: background (24-hr period), spray (duration of application), first post spray (24-hr period), and second post spray (24-hr period). Samplers trapped malathion and malaoxon by drawing air across a bed of XAD-2® resin. The maximum concentrations measured (0.259 and 0.174 $\mu\text{g}/\text{m}^3$ for malathion and malaoxon, respectively) were lower than those detected during the 1981 program. However, the exact proportions of malathion and malaoxon could not be determined because of the artificially high malaoxon levels created by the sampling technique. Generally, concentrations were higher outdoors than

indoors and higher during the first post spray interval than the other sampling periods. This is the same pattern found during the 1981 program, with 1981 concentrations somewhat higher than the 1990 concentrations.

Significant differences between the 1981 and 1990 programs were found in all media sampled. To some extent, these differences are interrelated. For example, the larger droplets found during 1990 probably contributed to the higher deposition efficiency. These differences may also be related to changes in application techniques and weather.

Differences in application techniques and weather during the 1989-1990 treatment period also preclude using these data to characterize the environmental fate of malathion during the entire 1989-1990 program. The data were collected in a three month time frame, while applications occurred during an entire year. How the different environmental conditions and application techniques during the unmonitored periods interact to influence the environmental fate of malathion generally cannot be predicted.

PREFACE

This report discusses the monitoring conducted by the Environmental Hazards Assessment Program of the California Department of Food and Agriculture. Other groups and agencies have also conducted monitoring of this Medfly eradication project, but their results are not reported here. A list of the other groups is given at the end of this report.

All of the data presented here are accurate to two or three significant digits. In several cases more digits are shown so that readers may use the data in their own calculations, to avoid confusion due to rounding-off, and for clarity in presentation.

Several unusual units are used in this report because key users of the data requested them and for ease of comparison with previous work.

Some of the data presented here do not agree with results given in the monitoring summary dated March 14, 1990. The earlier report contained minor errors which have been corrected.

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Invaluable information was provided by the Medfly Eradication Project personnel and Pest Management Division staff.

DISCLAIMER

The mention of commercial products, their source or use in connection with material reported herein is not to be construed as an actual or implied endorsement of such product.

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INTRODUCTION

Background

The Mediterranean fruit fly (Medfly), Ceratitidis capitata, is one of the most destructive agricultural pests (Christenson, 1960). Therefore, the California Department of Food and Agriculture (CDFA) maintains a program to prevent the Medfly from becoming established. As part of this program eradication measures are initiated as soon as infestations are detected.

In July, 1989 a Medfly infestation was detected in the Elysian Park area of Los Angeles County. With the discovery of the infestation the Cooperative Mediterranean Fruit Fly Eradication Project was established. This project, a joint program of the United States Department of Agriculture (USDA), the CDFA, and the affected county Agriculture Departments, conducted all eradication activities. In California, the normal eradication procedure consists of one or two aerial applications of baited malathion followed by the release of sterile Medflies (CDFA, 1989a). However, this infestation continued to expand until the number of sterile Medflies needed for eradication was greater than the production capacity of rearing facilities in Hawaii and Mexico. Eventually, multiple aerial applications of baited malathion over urban areas of Los Angeles, Orange, Riverside, and San Bernardino Counties became necessary to achieve eradication. Eradication of this infestation was declared in November, 1990.

A similar malathion aerial spray program to eradicate a Medfly infestation was conducted in the San Francisco bay area in 1981. Extensive monitoring of that program did not reveal any unusual malathion exposure to the public or environment, except to aquatic biota during storm runoff periods (Discher, 1982; Finlayson, 1982; Grether, 1987; Oshima, 1982). To compare the 1981 and 1990 environmental levels, the CDFA conducted representative monitoring of the current infestation between February and June, 1990. These pesticide monitoring results are presented in this report.

Aerial Treatment Program

The material sprayed was a mixture of a pesticide and an insect bait. The pesticide used in this program, malathion, is an organophosphate insecticide that is widely used throughout the world. The specific product used was Clean Crop Malathion ULV formulated by the Platte Chemical Company. This product is a technical formulation of malathion which contains 95% active ingredient (by weight) with the following characteristics (Hartley, 1987):

Chemical Name: S-1,2-bis(ethoxycarbonyl)ethyl O,O-dimethyl phosphorodithioate

Molecular Formula: $C_{10}H_{19}O_6PS_2$

Molecular Weight: 330.36

Chemical Abstracts Number: 121-75-5

Melting Point: 2.85°C

Boiling Point: 156-157°C

Vapor Pressure: 5.3 mPa at 30°C

Specific Gravity: 1.23 at 25°C

Water Solubility: 145 mg/L at 25°C

Acute LD50: 2800 mg/kg, rat, oral (technical product)

According to the product label the other 5% of the formulation is made up of inert ingredients. These inert ingredients are actually impurities or co-products from the manufacturing process. The co-products consist of the following 16 chemicals (Voss, 1990):

1. Diethyl fumarate [DEF]	0.90%
2. Diethylhydroxysuccinate	0.05%
3. O,O-dimethyl phosphorothioite	0.05%
4. O,O,O-trimethyl phosphorothioate [TMTP]	0.45%
5. O,O,S-trimethyl phosphorodithioate [TME]	1.20%
6. Ethyl nitrite	0.03%
7. Diethyl-bis(ethoxycarbonyl) mercaptosuccinate	0.15%
8. S-1,2-ethyl-O,S-dimethyl phosphorodithioate [isomalathion]	0.20%
9. S-(1-methoxycarbonyl-2-ethoxycarbonyl) ethyl-O,O-dimethyl phosphorodithioate	0.60%

10. Bis-(0,0-dimethyl thionophosphoryl) sulfide	[PSP]	0.30%
11. Diethyl methylthiosuccinate	[DEMMS]	1.00%
12. S-ethyl-0,0-dimethyl phosphorodithioate		0.10%
13. S-1,2-bis(ethoxycarbonyl) ethyl-0,0-dimethyl phosphorothioate	[malaixon]	0.10%
14. Diethyl ethylthiosuccinate		0.10%
15. Water		0.07%
16. Acidity as sulfuric acid		0.05%

The insect bait, Nu-Lure, is a plant-based, viscous liquid containing amino acids and carbohydrates (sugars) as the attractants. The bait is not a precise mixture, but contains chemicals with approximately the following amounts and properties:

Water	52%
Amino Acids	22%
Carbohydrates	14%
Inorganics (salts and ash)	10%
Fat	2%
pH	3.5 - 4.5
Specific Gravity	1.22 - 1.28

The application rate for malathion has been a source of confusion because of the material and units referred to. Application rates are generally expressed in two manners: as a volume of formulated product per unit area, or as a weight of active ingredient per unit area. Further confusion arises because fluid ounces is a unit of volume, while ounces is a unit of weight. Moreover, the registrations used to make these applications state: "Apply 2.8 ounces a.i. of malathion ..." (CDFA, 1989b), and "Use a maximum of 2.8 oz. active ingredient malathion ..." (CDFA, 1989c). Medfly Project personnel interpreted these statements to mean a volume of product, or 2.8 fluid ounces of Malathion ULV product.

The Malathion ULV product and Nu-Lure bait were combined and the resulting mixture was applied at a rate (volume basis) of 906 milliliters per hectare (ml/ha) or 12.4 fluid ounces per acre (fl oz/ac). Of the 12.4 fl oz/ac of malathion/bait mixture applied, 2.80 fl oz/ac was the Malathion ULV product.

If the Malathion ULV/Nu-Lure bait is mixed as stated above it should contain 21.1% malathion (active ingredient by weight, assuming bait specific gravity = 1.25). This equates to an application rate for the active ingredient (weight basis) of 238 g/ha or 3.40 oz/ac or 2210 micrograms per square foot ($\mu\text{g}/\text{ft}^2$). If the amount of malaoxon in the technical product is included, the application rate becomes 2212 $\mu\text{g}/\text{ft}^2$.

The malathion/bait mixture was applied by four to six Bell 204 helicopters flying abreast at 130 km/hr or 70 knots at an altitude of 153 meters (m) or 500 feet (ft) above ground level. Each helicopter discharged the mixture through six Tee Jet 8010 flat fan nozzles resulting in a nominal swath width of 61 m or 200 ft. The spray operations occurred at night beginning at 9:00 PM and ending between 1:00 and 4:00 AM the next morning depending on the size of area treated.

In contrast, the 1981 spray program used a malathion product containing 91% active ingredient applied at a rate of 1836 $\mu\text{g}/\text{ft}^2$ or 17% lower than the 1989-1990 application rate. In 1981, the material was applied by helicopters equipped with smaller 8003 nozzles and flying at an altitude of 92 m. The different materials and methods created the potential for causing different environmental levels.

Medfly aerial applications were initiated in August, 1989, and continued through July, 1990. During this period 882,397 liters (L) of malathion/bait mixture or 231,629 kilograms (kg) of malathion active ingredient were aerially applied to 22 spray areas or corridors, encompassing approximately 1504 square kilometers (km^2) or 581 mi^2 in Los Angeles, Orange, San Bernardino, and Riverside Counties (Figure 1). Individual areas received 1 to 12 applications of malathion (Table 1). Generally, one to two weeks were required to spray all corridors once, or complete one application cycle. The time interval between applications for individual corridors was one to three weeks.

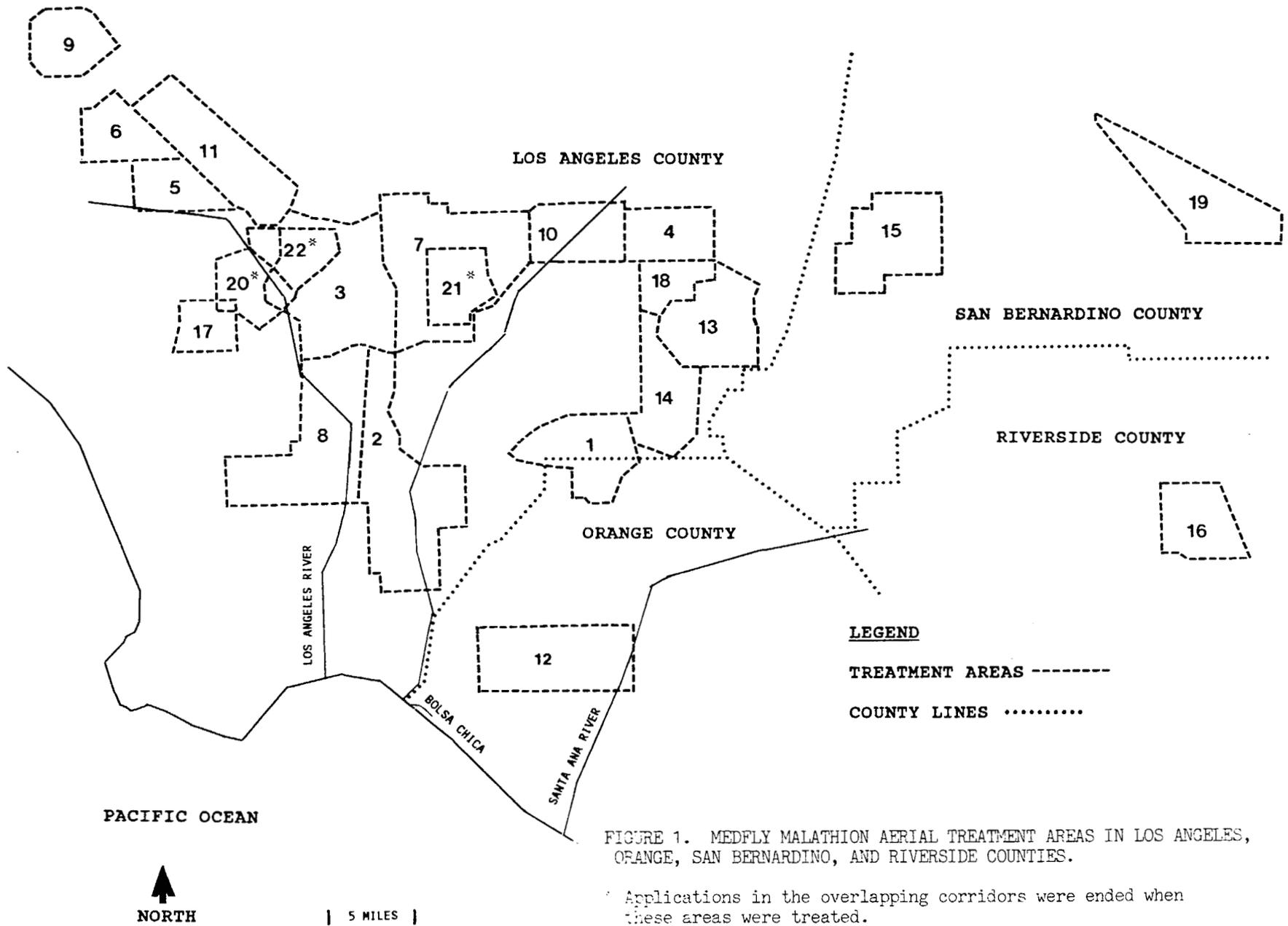


FIGURE 1. MEDFLY MALATHION AERIAL TREATMENT AREAS IN LOS ANGELES, ORANGE, SAN BERNARDINO, AND RIVERSIDE COUNTIES.

* Applications in the overlapping corridors were ended when these areas were treated.

Table 1. List of Medfly aerial treatment areas (corridors).^a

Corridor	Name	Area (km ²)	Number of Applications
1	Brea/La Habra Hts	67	9
2	Downey/Norwalk	148	10
3	Eagle Rock/So Pasadena	122	10
4	Glendora	47	7
5	North Hollywood	36	8
6	Panorama City	41	9
7	Rosemead/Monrovia ^b	137	10
8	South Gate	124	10
9	Sylmar	44	6
10	Irwindale	54	6
11	Verdugo Hills	78	5
12	Garden Grove	93	9
13	Pomona	67	6
14	Diamond Bar	62	3
15	Upland	78	3
16	Woodcrest	49	9
17	Hancock Park	26	2
18	San Dimas	26	2
19	San Bernardino	88	7
20	Echo Park ^c	36	2
21	Rosemead ^{b,c}	41	2
22	Glassell Park ^c	39	2

^a Additional areas in Los Angeles, Valinda, Baldwin Park and Whittier were sprayed once. An area around Compton was also sprayed three times for a Mexican fruit fly infestation.

^b A portion of Corridor 7 made up corridor 21 (Figure 1). Therefore, the area within Corridor 21 was sprayed 12 times.

^c Applications in the overlapping corridors were ended when these areas were treated.

Environmental Monitoring Program

Monitoring was conducted by the Environmental Hazards Assessment Program (EHAP) of the CDFA with the objective of determining if the following parameters for the 1989-1990 aerial treatment program were similar to the 1981 program: mass deposition (amount reaching the ground), air and water concentrations of malathion and malaoxon (malathion oxidation product), and droplet sizes.

Most of the monitoring occurred between February 12 and April 25, 1990. During this period, four application cycles were completed for 16 treatment corridors encompassing approximately 992 km². The time interval between applications to individual corridors during this period was approximately three weeks.

During the first application cycle the EHAP monitored six treatment corridors, encompassing approximately 419 km²: Brea/La Habra Heights, Garden Grove, San Fernando Valley (Sylmar, North Hollywood, Panorama City), and Rosemead/Monrovia (Figure 2). During the next three applications, the EHAP monitored the Rosemead/Monrovia corridor only. Within each of these treatment corridors the EHAP collected samples to provide information about the mass and droplet sizes of malathion reaching the ground, indoor and outdoor air concentrations, and water concentrations. Outside treatment corridors, additional water samples were collected from major waterways which carried surface runoff from the sprayed areas. Runoff monitoring continued through June, 1990.

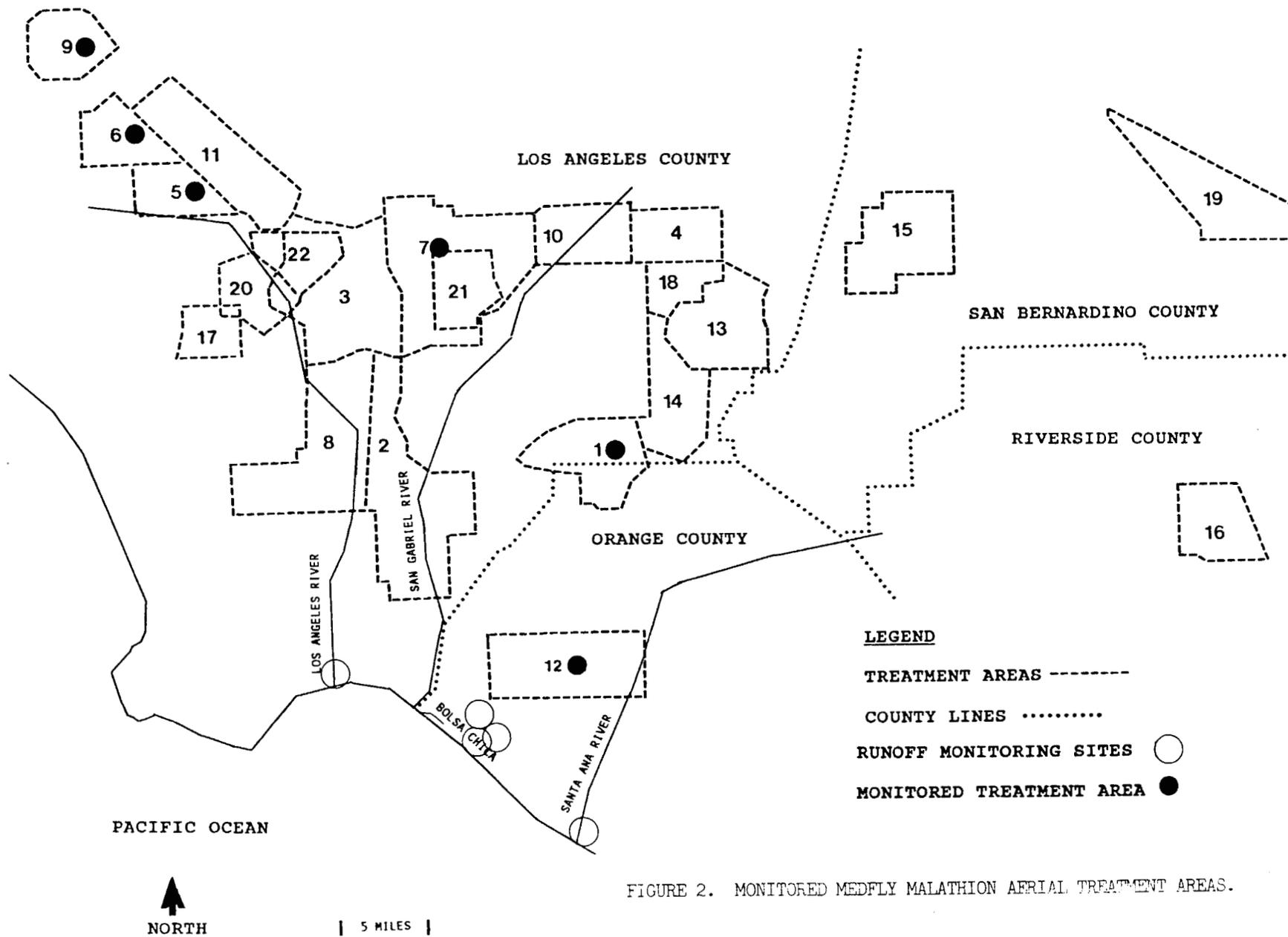


FIGURE 2. MONITORED MEDFLY MALATHION AERIAL TREATMENT AREAS.

MATERIALS AND METHODS

A summary of the sampling, analytical and mathematical methods is presented in this section. A detailed description of these methods is given in Appendix A.

Site Selection

Sampling sites were selected for each monitored application based on several criteria. Sites for mass deposition samples, droplet size samples, and water samples were generally located so that no tree cover or other obstructions could intercept the deposition of the malathion spray. Sites for rain runoff sampling were selected based on drainage patterns and sampling accessibility. Air sites were chosen which had sampling areas accessible both indoors and outdoors, and electrical power to run the samplers. Sites were located at least 300 meters apart and 400 meters inside the perimeter of the treated areas. Prior to sampling, permission was obtained from the property owner, unless the site was located on public property.

Mass Deposition

Approximately 30 mass deposition sampling sites were selected in each area for each monitored application (Table 2). At each mass deposition site an absorbent paper towel with plastic backing (0.093 m^2 , 9 x 16 inch = 1 ft²) was attached to a plastic covered cardboard sampling platform with push-pins. The sampling platform was placed horizontally at various heights, from ground level to five feet above ground level, depending on the site characteristics. The mass deposition samples were deployed several hours before the spray and were collected approximately 15 to 30 minutes after the helicopters had sprayed the area. The absorbent towels were folded with the plastic side out, and wrapped in aluminum foil. The samples were kept frozen from the time they were collected until analysis.

Additional sampling to determine the deposition variability within a site and levels of co-products was conducted at the request of the California Department of Health Services (CDHS). The spatial variability of malathion deposition was determined by collecting nine samples from each of two sites

Table 2. Number and type of sampling sites for the Medfly aerial applications.

Study Area	Application Date	Number of Sites			
		Mass Deposition	Droplet Size	Water	Air
Brea/La Habra	2/13/90	31	30	1 Pool 1 Pond	3 Residences 1 Hospital 1 Daycare
Garden Grove	2/15/90	29	28	1 Pool 1 Pond	3 Residences 1 Hospital 1 School
San Fernando	2/19/90	29	29	2 Pools	2 Residences 1 Hospital 1 School
Rosemead/Monrovia	2/21/90	29	28	2 Pools	3 Residences 1 School 1 Hospital
	3/14/90	30	30	2 Pools	2 Residences 1 Convalescent Hospital 1 Hospital 1 School
	4/04/90	30	30	2 Pools	2 Residences 1 Convalescent Hospital 1 Hospital 1 School
	4/25/90	25	29	2 Pools	2 Residences 1 Convalescent Hospital 1 Hospital 1 School

during the fourth Rosemead/Monrovia application (April 25). The nine samples were arranged in a 3 by 3 grid of approximately 3.35 m² (36 ft²). The samples were collected as described previously.

Also in cooperation with the CDHS, six additional mass deposition samples were collected at Site D005 to determine if certain co-products and breakdown products could be detected. These chemicals included: malaoxon; isomalathion; O,O,O-trimethyl phosphorothioate (TMTP); O,O,S-trimethyl phosphorothioate (iso-TMTP); O,O,S-trimethyl phosphorodithioate (TME); and diethyl fumarate (DEF). Two different types of mass deposition samples were collected, the normal plastic-backed paper and teflon[®] sheets. Three paper and three teflon[®] sheets were placed a few hours before application. One paper and one teflon[®] sheet were collected at three intervals: 1, 30, and 52 hours after application.

The laboratory analyzed each mass deposition towel by first extracting the residue with ethyl acetate. An aliquot of the extract was diluted and analyzed for malathion using a gas chromatograph with a thermionic specific detector. The remainder of the extract was concentrated and analyzed for malaoxon using a gas chromatograph with a flame photometric detector. The results were reported in micrograms (µg) of malathion and malaoxon per sample which equals µg per ft². The minimum detectable level was 1.0 µg.

Because the molecular weight changes when malathion is oxidized to malaoxon, total (malathion + malaoxon) concentrations are expressed as malathion "equivalents" to account for all of the mass. Malaoxon values are converted to malathion equivalents by multiplying by 1.051 to adjust for the molecular weight difference.

Since only malathion was detected on mass deposition samples in 1981, the statistical comparison between 1981 and 1990 used only the malathion data. A comparison between the amounts deposited as well as the deposition efficiency was made using chi-square tests. Details of these tests are given in Appendix E.

Droplet Size

The sites selected for mass deposition were also used for droplet size sampling. The droplet cards were placed and collected at the same time as the accompanying mass deposition samples. A droplet card, consisting of a sheet of Kromekote® cover 65 lb glossy paper (approximately 9 cm x 13 cm) in a cardboard holder, was also attached to the cardboard sampling platform with push-pins. When the sample was collected, the cardboard holder was folded over the glossy paper to prevent smearing of the droplets. The samples were stored at room temperature until they were analyzed.

The droplet samples were analyzed by scanning with a microscope. The diameter of each drop observed within random areas across the droplet card (total area examined per card $\approx 38 \text{ cm}^2$) was compared to a graticule (sizing grid) and counted into one of 12 size categories. By counting the number of drops in each size category, the percentage of drops in each size range and droplet density (number of droplets/ft²) was determined. A calculation was made to convert the 2-dimensional diameter measured on the card to a 3-dimensional spherical diameter. This spread factor was determined by comparing droplet sizes on the Kromekote® card with droplets on magnesium oxide coated slides (which represent 86% of true diameter), and computing a regression line to describe the relationship. The spread factor for the 1990 data is described by the following equation:

$$\begin{aligned} \text{true diameter } (\mu\text{m}) = & 12.4055 + 0.58462(\text{observed diameter}) \\ & - (1.7558 \times 10^{-5})(\text{observed diameter})^2 \end{aligned}$$

A mean diameter and relative frequency distribution were computed from the data. The mean droplet diameter was calculated by multiplying the arithmetic mean of each size category by the proportion of droplets in the category, then adding the values calculated for each category. Droplet size distributions were created by plotting the arithmetic mean of each size category versus the percentage of drops in each category (divided by the difference between the largest and smallest value of the category to adjust for the unequal sizes of the categories). No statistical analysis of the distributions was conducted because the individual drops measured are not independent; there are dependencies among droplet counts obtained from the same cards.

Water

Two water sites, either swimming pools or small ponds, were selected within each sampling area for each monitored application (Table 2). Three additional "sensitive sites" were also monitored: Van Norman Complex (drinking water reservoir), Peck Pond (fishing area), and Santa Fe Recreation Area (fishing and recreation area). Two replicate samples were collected at all sites and for all sampling periods. Background samples were obtained several hours before the spray, while post spray samples were usually obtained within 15 to 45 minutes. All water samples were collected in 1 liter amber glass bottles with teflon®-lined lids. Each sample bottle was submerged approximately 0.5 m and the cap was removed. The bottle was allowed to fill, then the cap was replaced while the bottle was still under the surface. The pH of all water samples was recorded.

Each water sample was analyzed by first extracting with methylene chloride. The extract was filtered, the solvent was exchanged to acetone, and analyzed for malathion and malaoxon using a gas chromatograph with a flame photometric detector. The results were reported in parts per billion (ppb). The minimum detectable level was 0.1 ppb.

Statistical analysis of the data was not appropriate because of the varying surface area, depth, and types of water bodies sampled.

Air

Within each spray area, if possible, 3 residences, 1 hospital, and 1 school (Table 2) were used as air sampling sites. Indoor and outdoor samples were collected at each air site. General Metal Works® high volume air samplers equipped with Kurz® model 310 flow controllers, calibrated at 1.0 cubic meters per minute (m^3/min) were used to obtain samples in the schools and hospitals. A high volume air sample consisted of a glass jar containing 125 ml of XAD-2® resin. The air is drawn through the resin and the pesticide is trapped on its surface. High volume samplers could not be used at private residences because of the high noise of the pumps. Instead, Gast® carbon-vaned pumps or Anderson® model 114 low volume air samplers running at approximately 0.015

m³/min were used for private residences. A low volume air sample consisted of a glass tube containing 15 ml of XAD-2[®] resin. The air flow was measured with a rotameter before and after sampling.

Air samples were collected over four consecutive periods during each monitored application event: one 24-hour background sample, one spray sample of variable duration (as long as the spray lasted plus 1/2 hour), one 24-hour immediate post spray sample, and another sequential 24-hour final post spray sample. After collection, the sample jars and tubes were sealed in plastic bags and kept frozen until they were analyzed by the laboratory.

The XAD-2[®] resin from each sample was extracted with acetone, concentrated, and analyzed for malathion and malaaxon using a gas chromatograph with a flame photometric detector. The analytical results were reported in µg per sample. The minimum detectable limit was 0.1 µg for both high and low volume air samples.

To obtain a value which took into account the amount of air sampled, the following calculation was performed on reported results: the amount of pesticide in the sample (µg) was divided by the flow rate of the sampler (m³/min) X the length of time that the sampler ran (in minutes), to yield a concentration in µg/m³. As with the mass deposition samples total malathion and malaaxon is calculated by converting malaaxon concentrations to malathion equivalents. The sampling methods employed can produce artificially high values of malaaxon because malathion is converted to malaaxon within the sampler. A series of tests conducted to determine the rate of artificial oxidation is described in Appendix D.

Statistical analysis of the data involved the creation of relative frequency distributions for the 1981 and 1990 data. The data were then compared using chi-square goodness-of-fit tests. For both these tests as well as the summary statistics, samples which had no detectable amount of malathion and/or malaaxon were assumed to contain one-half the detection limit for calculation purposes.

Sample Integrity

All personnel who came in contact with samples wore disposable gloves which were changed between samples. Contaminated equipment was immediately sealed in plastic garbage bags. The contaminated materials were promptly removed from the sampling vehicles, and either cleaned or safely discarded. The reusable materials were washed with a soap solution, and then rinsed with water, deionized water, and isopropyl alcohol.

Each sample had a dedicated chain of custody record on which all sampling information was recorded. This document accompanied the sample from the time the sample was prepared until the sample was analyzed. Each time the sample changed hands the chain of custody was signed by the person relinquishing the sample and by the person receiving the sample. The samples were secured in locked vehicles during transport, and in locked refrigerator or freezer units while in storage.

Quality Control

The quality control program was designed to assess the accuracy and precision of the analyzing laboratory (CDFA-Chemistry Laboratory Services Branch), and to detect sample contamination which occurred in the field or during transport. The terms "blank" and "blank matrix sample" describe a sample which consisted of uncontaminated sample medium (deionized water, clean XAD-2 resin or clean mass deposition towels). The terms "spike" and "blank matrix spike sample" describe a blank sample with a known amount of chemical (malathion or malaoxon analytical standard) added.

Method validation spikes were prepared by the laboratory, extracted and analyzed to determine the accuracy and precision of the proposed method of analysis. Laboratory spikes were used to determine the ongoing accuracy and precision of analysis. Blind spikes (spikes disguised as actual samples) were periodically submitted to the analyzing laboratory.

Laboratory blanks were included to determine if sample contamination was occurring in the laboratory. Field blanks, prepared in the field, were submitted to determine if sample contamination occurred during sampling, transport, or storage.

Inter-laboratory splits were actual samples which were divided in the field. One portion was submitted to the primary laboratory (CDFA), and the other portion was submitted to a second laboratory (Enseco, Inc.). Water was the only medium homogeneous enough to split precisely.

Storage stability tests were conducted to determine if any dissipation occurred between the time the samples were collected and the time they were analyzed.

RESULTS AND DISCUSSION

The data presented here summarize the results of the monitoring. Results of individual samples, both actual field samples and quality control samples, are shown in Appendices B and C.

All of the data presented here are accurate to two or three significant digits. In several cases more digits are shown so that readers may use the data in their own calculations, to avoid confusion due to rounding-off, and for clarity in presentation.

Several unusual units, such as $\mu\text{g}/\text{ft}^2$ are used in this report because key users of the data requested them and for ease of comparison with previous work.

Mass Deposition

The laboratory quality control results indicated good precision and accuracy of the chemical analyses (Table 3). One of the field blanks and none of the laboratory blanks were positive. The storage stability test showed no dissipation while the samples were held (100% recovered after 7 days).

Table 3. Mass deposition quality control results for the Medfly aerial applications.

Sample Type	Number of Samples	Percent Recovery			
		Malathion		Malaoxon	
		Mean	Std Dev	Mean	Std Dev
Validation Spikes	8	97	12	99	10
Continuing QC Spikes	12	102	11	96	12
Blind Spikes	2	90	1	97	1
Lab Blanks	11 ^a	---	----	--	----
Field Blanks	4 ^b	---	----	--	----

^a None of the 11 lab blank samples contained a detectable amount of malathion or malaoxon, detection limit 1.0 µg/ft²

^b One of the 4 field blank samples contained a detectable amount of malathion (16 µg/ft²). No malaoxon was detected, detection limit 1.0 µg/ft²

The amount of malathion and malaoxon deposited on ground surfaces, or mass deposition, was estimated by collecting and analyzing samples from 203 sites. The average amount of malathion detected was 2028 µg/ft² and 11.7 µg/ft² for malaoxon, with a sum (as malathion) of 2041 µg/ft² and a standard error of the mean of 70 µg/ft² (Table 4). Therefore, 92±3% of the 2212 µg/ft² of malathion and malaoxon theoretically released was accounted for on the ground surface target. The sum of malathion and malaoxon deposited ranged from 141 to 5010 µg/ft².

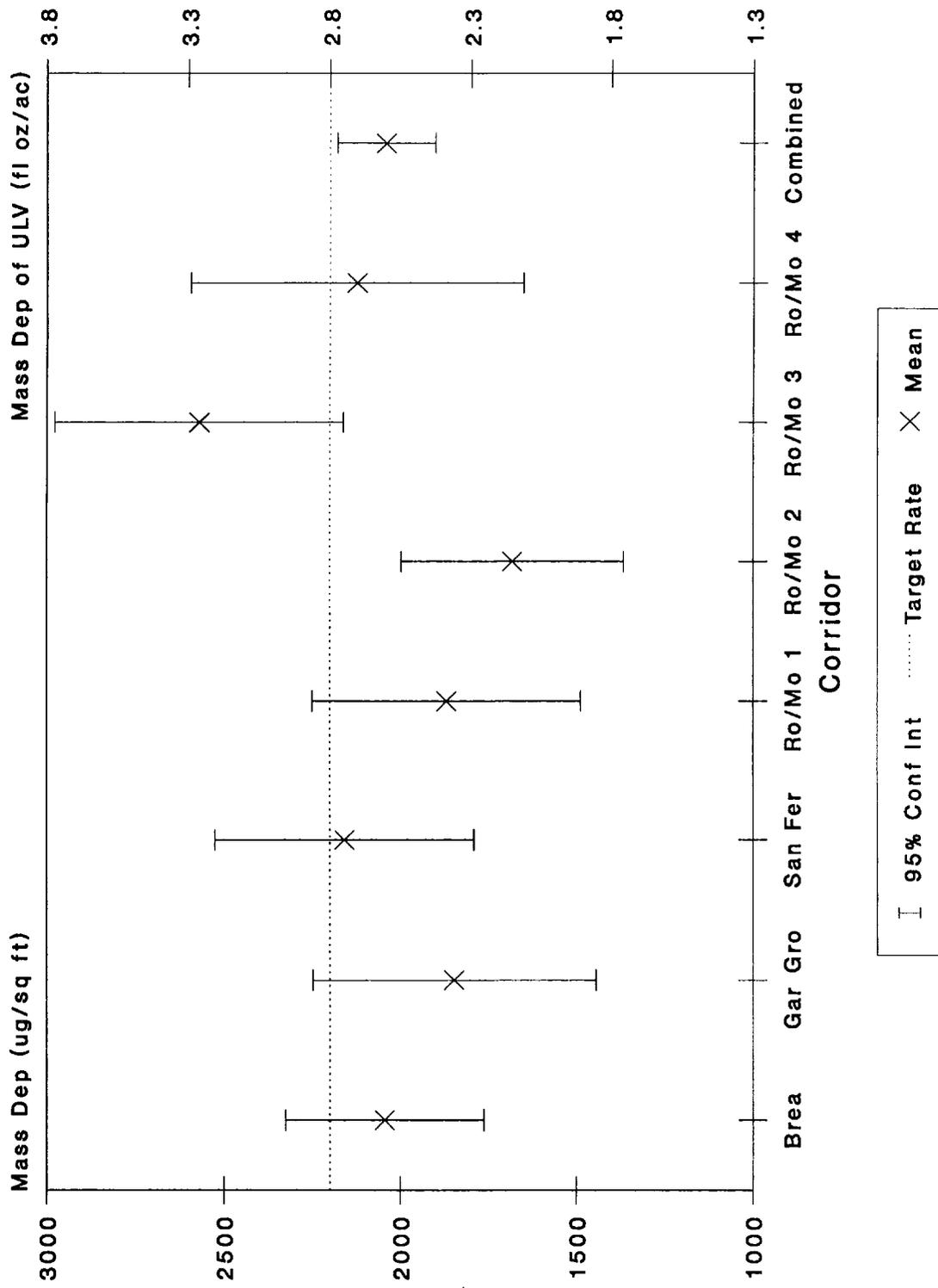
The Rosemead/Monrovia Corridor was monitored during four consecutive application cycles and the average deposition was 1869, 1682, 2569, and 2123 µg/ft² for applications one through four, respectively (Figure 3). No increasing or decreasing trend was observed over the four applications cycles sampled. While the third Rosemead application showed an average amount that was 116% of the label rate, the difference between the amount found and the label rate is not statistically significant and may be due to normal sample variation. Also, the total amount of malathion/bait used for this application was the same as the other Rosemead/Monrovia applications.

Table 4. Malathion and malaoxon mass deposition for the Medfly aerial applications. To convert values to mg/m² multiply concentrations in µg/ft² by 0.01076.

	Mass Deposition (µg/ft ²)		
	Malathion	Malaoxon	Total (as malathion)
# of Samples	203	203	203
Mean	2028	11.7	2041
Std. Deviation	1002	7.5	1007
Std. Error	70	0.5	70
Minimum	141	ND ^a	141
Maximum	4991	43.9	5010

^a None Detected, detection limit 1.0 µg/ft²

Figure 3. Medfly total (malathion/malaoxon) mass deposition



The 1990 average malathion mass deposition ($2028 \mu\text{g}/\text{ft}^2$) was higher than the deposition measured during the 1981 program ($1385 \mu\text{g}/\text{ft}^2$). This was expected since the 1990 application rate was higher than the 1981 rate. Additionally, differences were found in deposition efficiency (92% in 1990 vs 75% in 1981) and deposition distribution (Figure 4). Chi-square tests of the 1990 versus 1981 mass deposition data found significant differences between the averages, efficiencies and distributions at the 0.05 level. Details of the statistical analysis is given in Appendix E.

The amount of malaoxon found on ground surfaces averaged $11.7 \mu\text{g}/\text{ft}^2$ or 0.58% of the malathion found. However, the $11.7 \mu\text{g}/\text{ft}^2$ is 503% of the $2.33 \mu\text{g}/\text{ft}^2$ of malaoxon theoretically released. The high proportion of malaoxon found (relative to the theoretical amount) is mainly due to the relatively high proportion of malaoxon found in the malathion/bait mixture. Early analyses of the malathion concentrate (CDFA, 1990) and malathion/bait mixture (Solina, 1990) showed 443% proportionally more malaoxon in the mixture than the concentrate. Oxidation of malathion to malaoxon may have occurred during storage, transport, or mixing of the malathion concentrate.

Mass deposition was also measured at sites which were intentionally avoided (flagged) by the spray aircraft. These sites included: the Van Norman Complex (drinking water reservoir) in the Sylmar Corridor, and Peck Pond and the Los Angeles Arboretum in the Rosemead/Monrovia Corridor. The sample concentrations at these sites ranged from no detectable amount (detection limit $1.0 \mu\text{g}/\text{ft}^2$) to $101 \mu\text{g}/\text{ft}^2$ (Table 5). The data indicate that the helicopters were somewhat, but not entirely successful in avoiding these flagged areas.

Two sites with nine samples arranged in a 3 by 3 grid were used to estimate spatial variability within a site. Average deposition at site D002 was $2564 \mu\text{g}/\text{ft}^2$, with a standard deviation of $154 \mu\text{g}/\text{ft}^2$ (Table 6). Average deposition at site D005 was $2774 \mu\text{g}/\text{ft}^2$, with a standard deviation of $257 \mu\text{g}/\text{ft}^2$ (Table 6). As indicated by the standard deviations, variability was extremely low, especially when analytical variation is taken into account.

Figure 4. Comparison of 1981 and 1990 Medfly malathion mass deposition

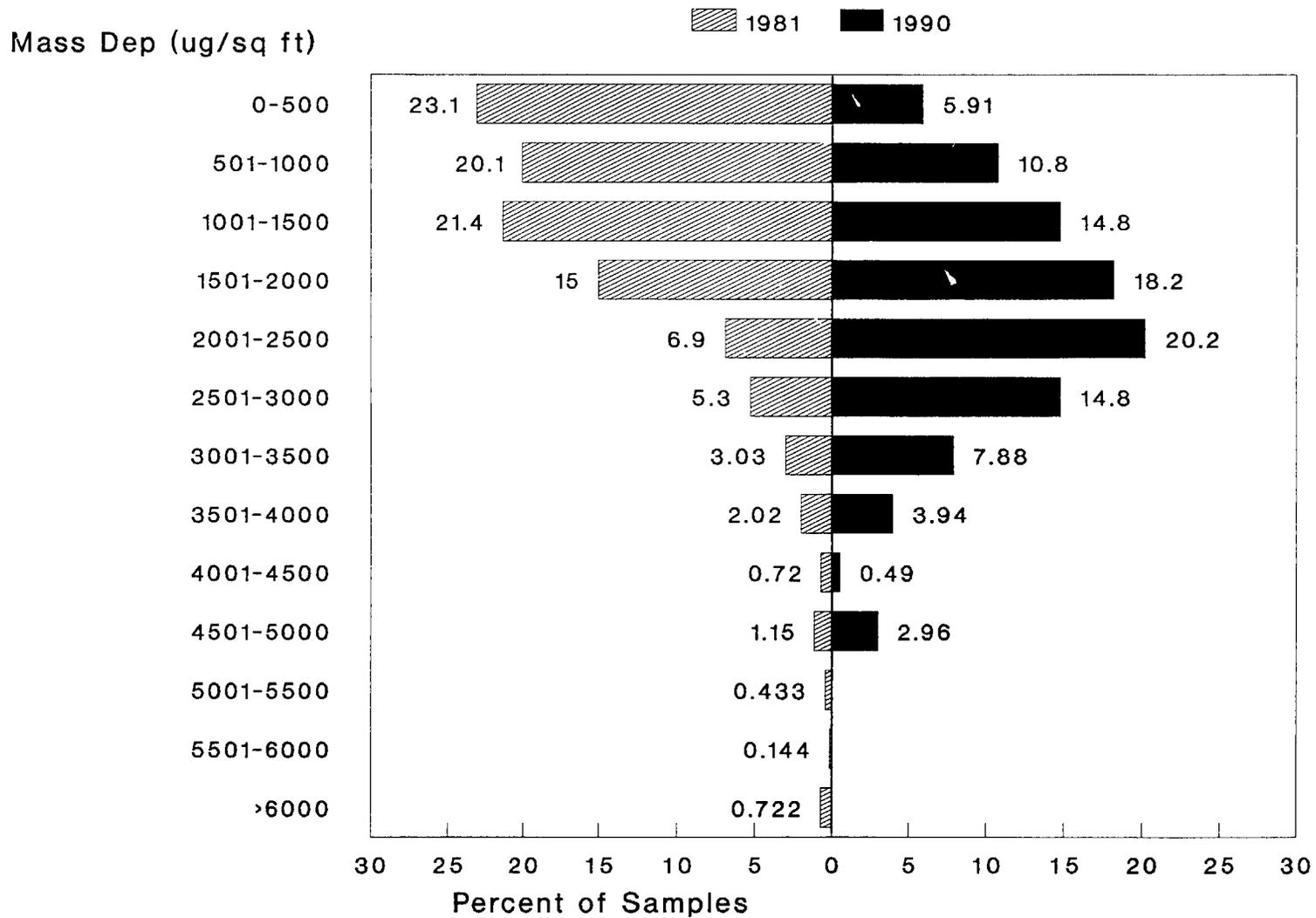


Table 5. Malathion mass deposition at flagged sites for the Medfly aerial applications. To convert values to mg/m² multiply concentrations in µg/ft² by 0.01076.

Application Sequence	Malathion Mass Deposition (µg/ft ²)		
	Van Norman Complex	Peck Pond	LA Arboretum
1	1.25	1.75	56.1 ^a
2	not sampled	ND ^b	not sampled
3	----- ^c	19.1	11.8
4	-----	7.26	101

^a This sample contained 0.87 µg/ft² of malaoxon, all others had no detectable amount

^b None Detected, detection limit 1.0 µg/ft².

^c The corridor containing this site was not treated during applications 3-4.

Table 6. Malathion and malaoxon mass deposition within site variability^a for the Medfly aerial applications. To convert values to mg/m² multiply concentrations in µg/ft² by 0.01076.

Sample #	Mass Deposition (µg/ft ²)	
	Malathion	Malaoxon
Site D002		
4970	2527	10.21
4971	2551	8.88
4972	2639	9.24
4973	2551	9.44
4974	2886	10.11
4975	2479	9.74
4976	2359	2.94
4977	2407	4.46
4978	2604	10.17
Site D005		
1345	2610	8.80
1346	3057	8.39
1347	3034	7.81
1349	2640	7.35
1350	2628	9.17
1351	2594	12.04
1352	3042	9.72
1353	2933	9.60
4992	2343	8.67

^a Nine samples were arranged in a 3 X 3 grid at each site.

Six additional mass deposition samples were collected at Site D005 to determine if certain co-products and breakdown products could be detected. Only the malaoxon and iso-TMTP were detected at an amount greater than the concentration extrapolated from the formulation (Table 7). Malaoxon is formed environmentally by the oxidation of malathion. Iso-TMTP may be formed by the photolysis of malathion (Chukwudebe, 1989), by the oxidation of TME, or it may be part of the formulation (Oshima, 1990). Since these samples were unreplicated, any time trend conclusions are problematic. The data should only be used in a qualitative manner.

Table 7. Malathion co-products and breakdown products mass deposition from the Medfly Rosemead/Monrovia application of April 25, 1990. To convert values to mg/m² multiply concentrations in µg/ft² by 0.01076.

Chemical (theoretical amt, µg/ft ²) ^a	Time After Application (Hours)	Mass Deposition (µg/ft ²)	
		Paper	Teflon
Malathion (2210)	1	2500	2680
	30	2050	2020
	52	1790	2160
Malaaxon (2.33)	1	8.8	7.1
	30	82.3	3.0
	52	80.5	10.6
Isomalathion (4.65)	1	3.68	3.6
	30	3.15	2.0
	52	2.3	7.5
TMTP (10.5)	1	ND (0.04) ^b	ND (0.04)
	30	ND (0.04)	ND (0.04)
	52	ND (0.04)	Not Analyzed
iso-TMTP (0)	1	0.66	1.04
	30	0.76	ND (0.04)
	52	0.56	Not Analyzed
TME (27.9)	1	2.3	4.52
	30	0.10	0.45
	52	0.13	Not Analyzed
DEF (20.9)	1	2.1	2.39
	30	3.06	0.80
	52	3.8	Not Analyzed

^a Theoretical amounts based on percentages given on pages 2-3.

^b None Detected with the detection limit shown in parentheses.

Droplet Size

Two hundred and four samples were collected to estimate the spray droplet size distribution. An average of 711 drops/ft² were found, with a range of 0 to 2244 drops/ft². For the 5822 droplets counted, the diameters ranged from 46 to 1422 μm , with a mean of 308 μm (Table 8, Figure 5). An additional 24 droplets were observed (0.41% of all droplets observed) which were larger than 1422 μm . These droplets could not be measured with the instrumentation employed, but were between 1500 and 4000 μm . Additionally, droplets smaller than 46 μm could not be seen with the instrumentation.

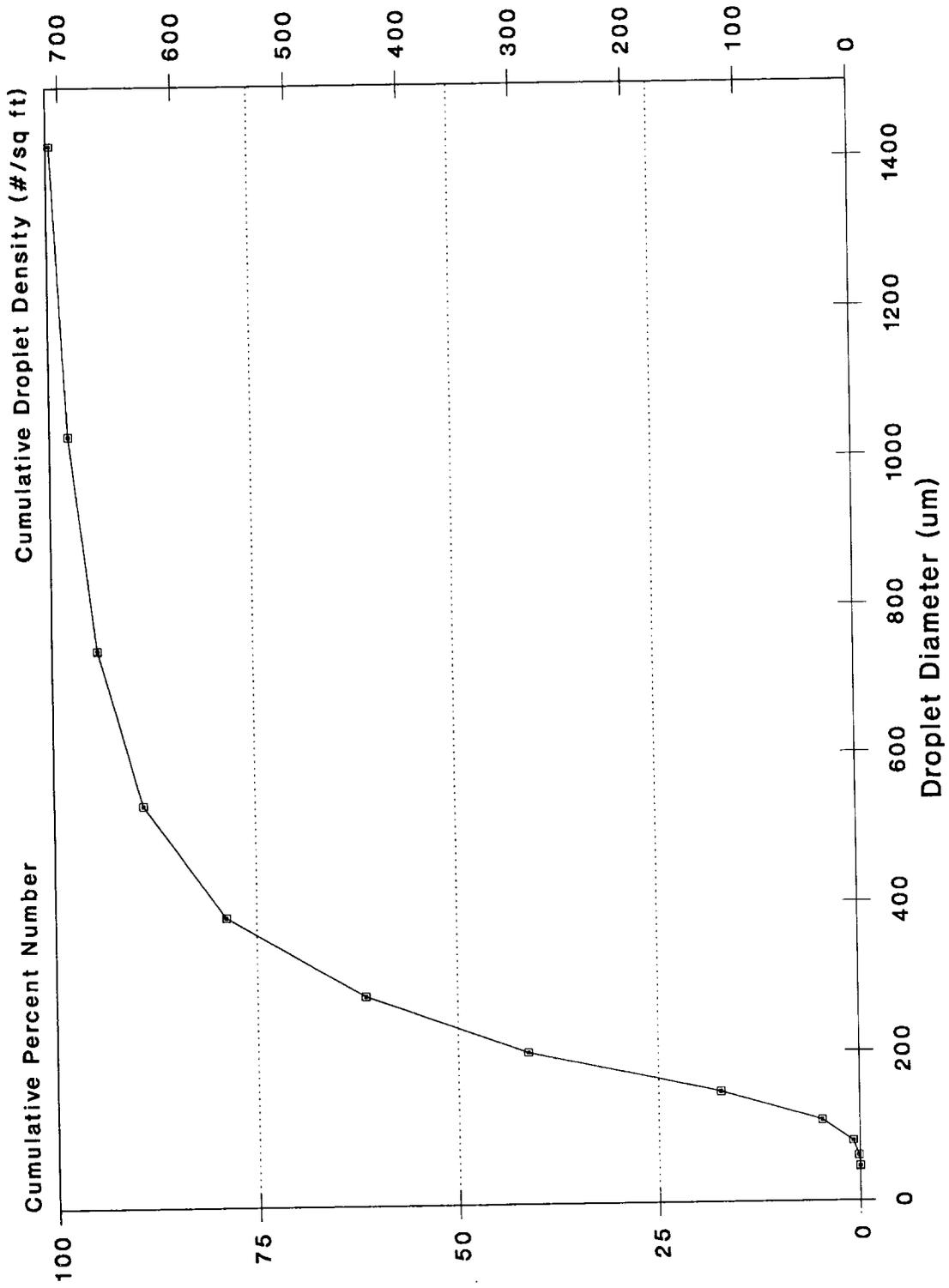
In comparison, smaller droplets were found during the 1981 program (Figure 6). The relative frequency distributions shown in Figure 6 were created by plotting the arithmetic midpoint of each size category versus the percentage of drops in each category (divided by the difference between the largest and smallest value of the category to adjust for the unequal sizes of the categories). Thus, the relative frequency axis can be interpreted as the percent of droplets at each discrete whole micrometer diameter. The 1981 mean droplet diameter was 252 μm , with 99% of the droplets smaller than 872 μm . The 1990 mean diameter was 308 μm , and 99% of the droplets are not accounted for until the size reaches 1422 μm . No statistical comparison has been done on the distributions because the individual drops measured are not independent; there are dependencies among droplet counts obtained from the same cards.

The spread factor (correction to convert the 2-dimensional measured diameter to a 3-dimensional spherical diameter) determined in 1990 was similar to the one determined in 1981. Since essentially the same formulation was used for both programs, the difference may only be normal variation. If the 1981 spread factor is applied to the 1990 data, the droplet sizes are even larger and the difference between 1981 and 1990 is more pronounced (Appendix E).

Table 8. Malathion bait droplet size distribution for the Medfly aerial applications.

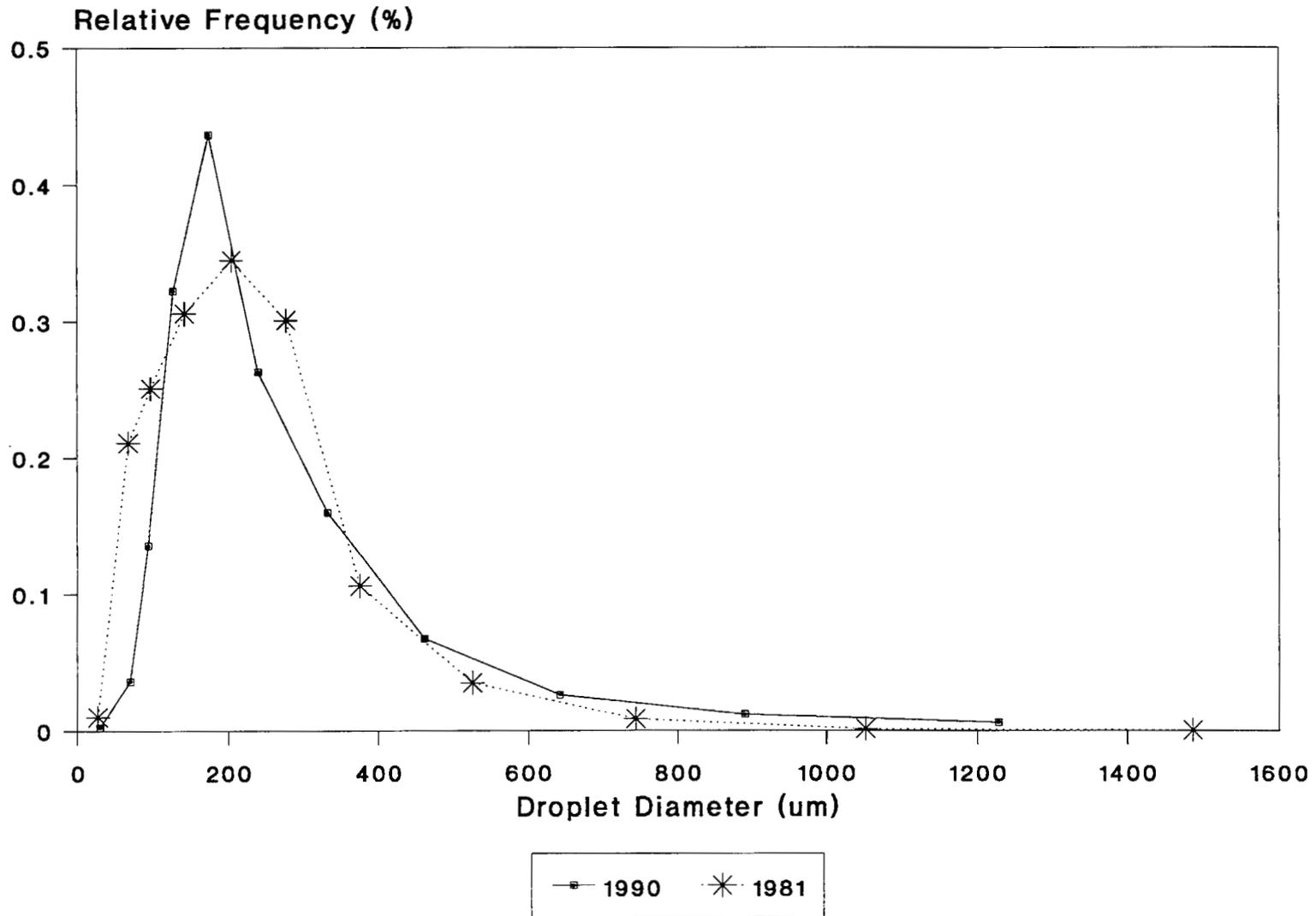
Diameter Range (μm)	Arithmetic Mean Diameter (μm)	Total Number Droplets	Droplet Density ($\#/ft^2$)	Percent Number
46 - 60	53	8	0.97	0.14
60 - 80	70	42	5.11	0.72
80 - 108	94	222	27.0	3.80
108 - 147	128	735	89.4	12.57
147 - 202	175	1404	170.8	24.02
202 - 279	241	1184	144.0	20.25
279 - 387	333	1008	122.6	17.24
387 - 538	463	594	72.3	10.16
538 - 747	643	318	38.7	5.44
747 - 1034	891	197	24.0	3.37
1034 - 1422	1228	110	13.4	1.88
1422+		24	2.92	0.41
Total		5846	711.20	100.0

Figure 5. Medfly malathion bait droplet sizes



Drops >1422 um are not plotted

Figure 6. Comparison of 1981 and 1990 Medfly malathion bait droplet size distribution



Water

The laboratory quality control results indicated good precision and accuracy of the chemical analyses (Table 9). The relative percent difference between replicate samples averaged 30% for malathion and 22% for malaoxon. None of the laboratory blank samples were positive; however, some of the field blank samples were positive, indicating a contamination problem. The investigation into this problem revealed that the source of the contamination was probably cross-contamination between samples in the lab. This problem did not appear to be serious because the 18 samples split between two laboratories agreed on all positives and negatives (14 of 18 samples negative for malathion and 6 of 18 samples negative for malaoxon). For positive samples, the quality control laboratory consistently found concentrations lower than the CDFA laboratory. The average relative percent difference between the laboratories for positive samples was 52 and 39% for malathion and malaoxon, respectively.

The storage stability test showed that dissipation may have occurred during the 3-day holding period, depending on the pH (63% recovered after 3 days, pH 8). As expected, the higher the pH, the faster the dissipation (Appendix C). Subsequent tests have shown that adjusting the water samples to pH 3 and refrigerating just after collection will preserve malathion for at least 28 days. Some of the concentrations may have been underestimated, since the sample pH's varied between 7.2 and 9.9.

Twelve swimming pools and two artificial ponds were monitored to estimate the concentration levels immediately after application (Table 10). Residues were highly variable with concentrations from no detectable amount (detection limit 0.10 ppb) to 89.7 ppb of malathion and 0.57 to 46.1 ppb for malaoxon. Background levels of malathion and/or malaoxon were detected before several applications, probably due to carryover from the previous spray. However, no increasing or decreasing trend was observed in swimming pools over the four application cycles monitored (Figure 7). Malathion concentrations were much higher than malaoxon in freshwater ponds, while malaoxon predominated in swimming pools. The difference is probably due to oxidizers such as chlorine used in swimming pools.

Table 9. Water quality control results for the Medfly aerial applications.

Sample Type	Number of Samples	Percent Recovery			
		Malathion		Malaoxon	
		Mean	Std Dev	Mean	Std Dev
Validation Spikes	8	104	3.2	115	19
Continuing QC Spikes	21	95	8.0	100	7.4
Blind Spikes	3	133	25	119	42
Lab Blanks	24 ^a	---	---	--	---
Field Blanks	44 ^b	---	---	--	---

^a None of the 24 lab blank samples contained a detectable amount of malathion or malaoxon, detection limit 0.1 ppb.

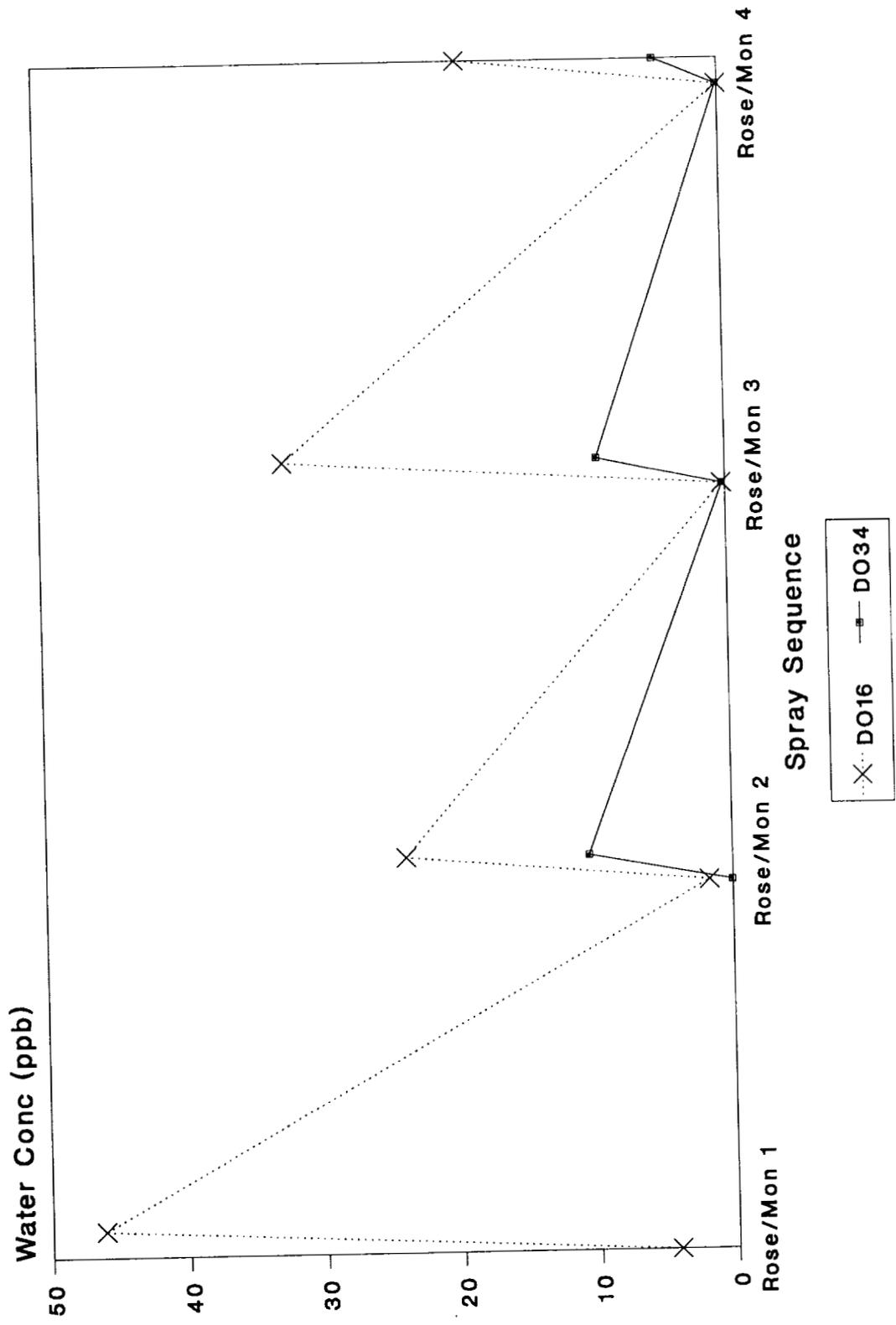
^b Seven of the 44 field blank samples contained a detectable amount of malathion (mean 0.28 ppb). No malaoxon was detected, detection limit 0.1 ppb.

Table 10. Average malathion and malaoxon water concentrations for the Medfly aerial applications.

Location	Sampling Interval	Number of Sites	Average Water Concentration (ppb)	
			Malathion	Malaoxon
Pools	Background	12	0.33	1.40
	Spray	12	9.38	16.5
Ponds	Background	2	0.80	ND ^a
	Spray	2	49.4	0.80

^a ND - None Detected, detection limit 0.1 ppb.

Figure 7. Medfly Rosemead/Monrovia malaoxon sequential water concentrations in pools



Strict comparison to the 1981 monitoring would not be appropriate because of the different surface areas and depths of the water bodies. However, it appears that pond concentrations were similar for both years, while pool concentrations in 1990 may have been higher than 1981.

At the request of the CDHS, the dissipation rate in two swimming pools was also determined. Only malaoxon was detected, with a half-life (time to reduce the concentration by one-half) of 37 hours (Table 11, Figure 8). In contrast, dissipation to no detectable amount occurred within a few hours during the 1981 program (Oshima, 1982). The discrepancy may be due to pH and/or temperature differences (Freed et. al, 1979; Guerrant, 1970).

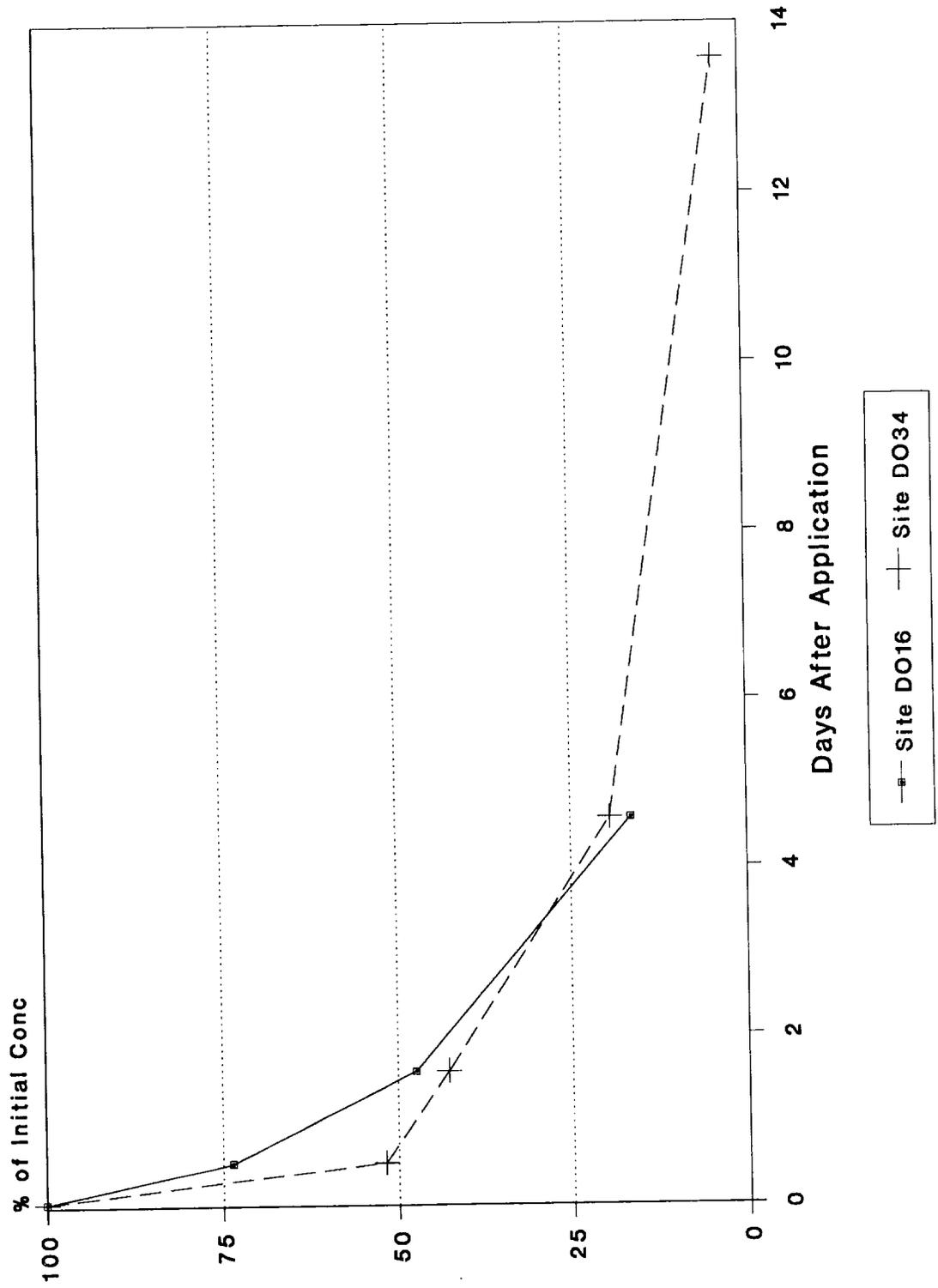
Water concentrations were also measured at three sites which were flagged: Van Norman Complex (drinking water reservoir), Peck Pond, and the Santa Fe Recreation Area. The Van Norman Complex, located in the Sylmar Corridor was sampled only once before spraying in this corridor was completed. Replicate water samples collected approximately 12 hours after treatment contained an average of 0.13 ppb malathion and no malaoxon (detection limit 0.1 ppb), well below the CDHS Health Advisory Level of 160 ppb for malathion.

Peck Pond, a flagged fishing area, is located in the Rosemead Corridor. This pond was sampled during the second, third, and fourth applications. Water entering this pond comes from other treated areas which probably accounts for the positive background concentrations. Background concentrations for the three applications averaged 4.99 ppb and 1.93 ppb for malathion and malaoxon, respectively. In comparison, samples collected just after the applications averaged 6.22 ppb and 2.26 ppb for malathion and malaoxon, respectively. These water concentrations confirm the mass deposition results which showed small amounts of malathion deposited just after application. This pond is stocked with hatchery reared fish on a regular basis by the California Department of Fish and Game (CDFG). Two fish kills (50-100 fish) occurred in this pond during the treatment period, immediately following the planting of trout. According to the CDFG, while these malathion concentrations may have further stressed the already stressed hatchery fish (trout malathion LC50 = 100-150 ppb), the fish kills were probably the result of the high temperature and low dissolved oxygen content of Peck Pond water (Harrington, 1990).

Table 11. Malaoxon water dissipation in swimming pools for the Medfly aerial applications. No malathion was detected, detection limit 0.1 ppb.

Time After Application	Malaoxon (ppb)	
	Site D016	Site D034
1 hr	19.2	4.71
12 hrs	14.1	2.44
1 day, 14 hrs (38 hrs)	9.08	2.01
4 days, 14 hrs (110 hrs)	3.15	0.915
13 days, 14 hrs (326 hrs)	No Water	0.175

Figure 8. Medfly malaoxon swimming pool water dissipation



After the Peck Pond fish kills, CDFG recommended monitoring the Santa Fe Recreation Area. This area is another water body that is used for fishing as well as other recreation. It is not located within any treatment corridor, but is approximately 1000 m south of the Irwindale Corridor (#10). Samples were collected on four dates, two before and two after application. None of the samples contained a detectable amount of malathion or malaoxon.

Results of the 1981 monitoring showed that high concentrations can occur in rain runoff from treated areas; this was again demonstrated in 1990. Initial rain runoff samples were collected by the CDFG. These samples showed concentrations as high as 91.1 and 12.2 ppb for malathion and malaoxon, respectively. However, most of the initial samples were obtained from collector drains within the treated areas. After discussions with CDFG it was decided to sample sites closer to coastal areas where impacts might occur. Five monitoring sites were established, one at the Los Angeles River, one at the Santa Ana River and three in the Bolsa Chica area (Bolsa Chica Channel, Wintersberg Channel, and Bolsa Chica itself) where a wildlife refuge is located (Figure 2). The Bolsa Chica Site is a marsh area, the other four are runoff channels. Samples collected during both rain and non-rain periods generally showed low concentrations (Tables 12 and 13). However, the CDFG recommended acute water criterion of 3.54 ppb (Finlayson, 1982) for freshwater was exceeded on three occasions. The acute saltwater criterion of 10 ppb was not exceeded at the Bolsa Chica Site. These criteria were based on 96-hr LC50 values (concentrations required to kill one-half of the test population in 96 hr). They are not protective of long-term conditions and sublethal effects, and should only be used as indicators in identifying situations which may result in fish kills. Homeowner and other normal pesticide uses may have contributed to malathion residues detected in runoff water.

D. Air

The laboratory quality control results indicated good precision and accuracy of the chemical analyses (Table 14). None of the laboratory and field blank samples had a detectable amount of malathion or malaoxon. The storage stability test showed no dissipation during the time the samples were held (111% recovered after 7 days).

Table 12. Malathion and malaoxon runoff concentrations for the Los Angeles and Santa Ana Rivers.

Sampling Date	Water Concentration (ppb)			
	Los Angeles River		Santa Ana River	
	Malathion	Malaoxon	Malathion	Malaoxon
5/1/90-Rain	44.1	41.0	0.53	ND ^a
5/23/90	ND	ND	No Water	
5/30/90-Rain	0.66	0.30	ND	ND
6/1/90	ND	ND	No Water	
6/6/90	ND	ND	ND	ND
6/15/90	ND	ND	No Water	
6/20/90	ND	ND	No Water	
6/28/90	ND	ND	No Water	

^a None Detected, detection limit 0.1 ppb

Table 13. Malathion and malaoxon runoff concentrations for the Bolsa Chica area.

Sampling Date	Water Concentration (ppb)					
	Bolsa Chica Channel		Wintersberg Channel		Bolsa Chica	
	Malathion	Malaoxon	Malathion	Malaoxon	Malathion	Malaoxon
5/1/90-Rain	Not Sampled		Not Sampled		ND ^a	ND
5/23/90	0.20	ND	ND	ND	ND	ND
5/30/90-Rain	3.44	1.78	4.21	2.09	1.64	0.79
6/1/90	1.27	0.14	ND	0.13	0.16	ND
6/6/90	0.74	0.66	ND	ND	ND	ND
6/15/90	0.13	ND	ND	ND	ND	ND
6/20/90	ND	ND	ND	ND	ND	ND
6/28/90	0.30	0.30	ND	ND	ND	ND

^a None Detected, detection limit 0.1 ppb

Table 14. Air quality control results for the Medfly aerial applications.

Sample Type	Number of Samples	Percent Recovery			
		Malathion		Malaaxon	
		Mean	Std Dev	Mean	Std Dev
Validation Spikes	6	109	1.6	118	9.3
Continuing QC Spikes	31 ^a	98	8.7	100	9.5
Lab Blanks	31 ^b	---	----	--	----
Field Blanks	3	---	----	--	----

^a None of the 31 lab blank samples contained a detectable amount of malathion or malaaxon, detection limit 0.1 µg/sample

^b None of the 3 field blank samples contained a detectable amount of malathion or malaaxon, detection limit 0.1 µg/sample.

A series of four air samples was collected inside and outside at each of 34 sites: a background sample before application (24-hour duration), a spray sample (duration of the application + 1/2 hr), a post-spray sample immediately after application (24-hour duration), and a second post-spray sample immediately following the first post-spray sample (24-hour duration). Of the 266 samples collected, 63 had no detectable amount of malathion or malaoxon, including 27 of 67 background samples. The results were calculated assuming the samples below the detection limit have the value of one-half of the detection limit. In almost all instances malathion concentrations were greater than malaoxon concentrations. The highest concentrations detected were $0.259 \mu\text{g}/\text{m}^3$ (19.3 ppt, v/v) and $0.174 \mu\text{g}/\text{m}^3$ (13.6 ppt, v/v) for malathion and malaoxon, respectively (Table 15). In general, outdoor air concentrations were higher than indoor and the first 24-hr post spray period was higher than the other sampling intervals (Figure 9). No increasing or decreasing trends were noted over the four applications monitored for the Rosemead/Monrovia Corridor (Figure 10).

The reported malaoxon values are probably an overestimate, because artificial oxidation of malathion to malaoxon occurs with the sampling technique employed. An estimate of the amount of artificial oxidation was determined (Appendix D). However, this estimate differs significantly from the 1981 estimate and there are substantial differences between samples collected at night and samples collected during the day. In addition, the oxidation test was conducted during a summer period of high temperature and ozone concentrations, and may not be indicative of winter and spring conditions when the Medfly samples were collected. Therefore, these data have not been adjusted for artificial oxidation.

Comparable air concentration patterns were found during the 1981 and 1990 programs, with higher concentrations outdoors than indoors and the first post spray period higher than the other sampling periods. Absolute concentrations were compared using three sets of data: total (malathion + malaoxon, as malathion), adjusted for artificial oxidation, and unadjusted for artificial oxidation. Since the amount of artificial oxidation cannot be estimated accurately, more confidence is placed in the total (malathion + malaoxon) data set. Using these data, average air concentrations during the 1981 program

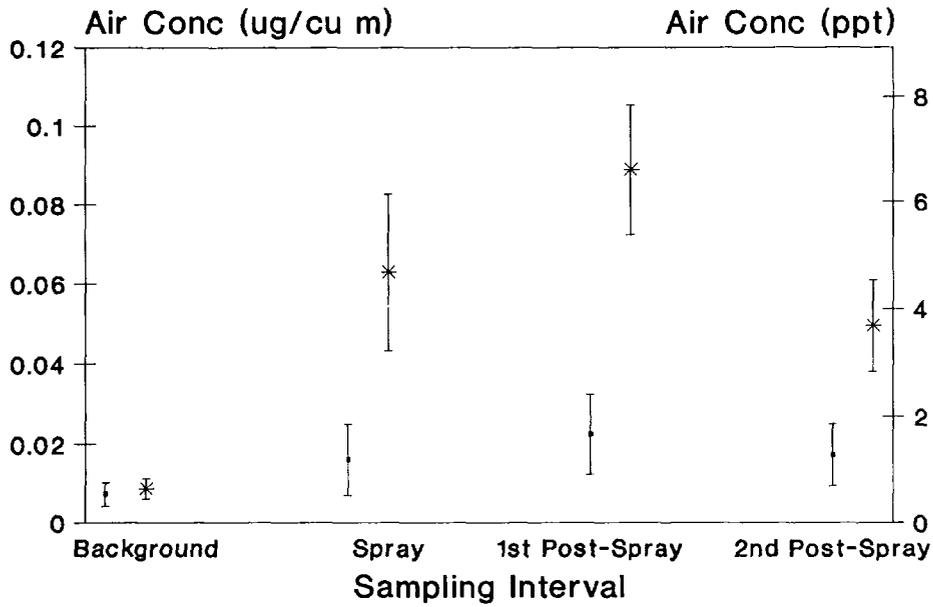
Table 15. Malathion and malaoxon air concentrations for the Medfly aerial applications. Background samples were collected prior to application (24-hr duration). Spray samples were collected during application (application duration). Post-spray samples were collected immediately after application (24-hr duration each). These values have not been corrected for oxidation due to sampling technique. To convert malathion values to ppt, multiply concentration in $\mu\text{g}/\text{m}^3$ by 74.5, for malaoxon multiply by 78.3.

		Air Concentration ($\mu\text{g}/\text{m}^3$)			
		Background	Spray	1st Post-Spray	2nd Post-Spray
Malathion Indoor	# Samples	33	33	33	32
	Average	0.0072	0.0160	0.0223	0.0171
	Std. Error	0.0015	0.0045	0.0050	0.0039
	Minimum	ND ^a	ND	ND	ND
	Maximum	0.0312	0.1535	0.1066	0.0931
Malathion Outdoor	# Samples	34	34	33	34
	Average	0.0087	0.0629	0.0888	0.0496
	Std. Error	0.0013	0.0098	0.0083	0.0057
	Minimum	ND	ND	0.0268	ND
	Maximum	0.0336	0.2592	0.2491	0.1455
Malaoxon Indoor	# Samples	33	33	33	32
	Average	0.0049	0.0115	0.0083	0.0079
	Std. Error	0.0016	0.0037	0.0020	0.0022
	Minimum	ND	ND	ND	ND
	Maximum	0.0557	0.1260	0.0576	0.0634
Malaoxon Outdoor	# Samples	34	34	33	34
	Average	0.0072	0.0074	0.0470	0.0366
	Std. Error	0.0009	0.0005	0.0062	0.0062
	Minimum	ND	ND	ND	ND
	Maximum	0.0213	0.0154	0.1455	0.1741

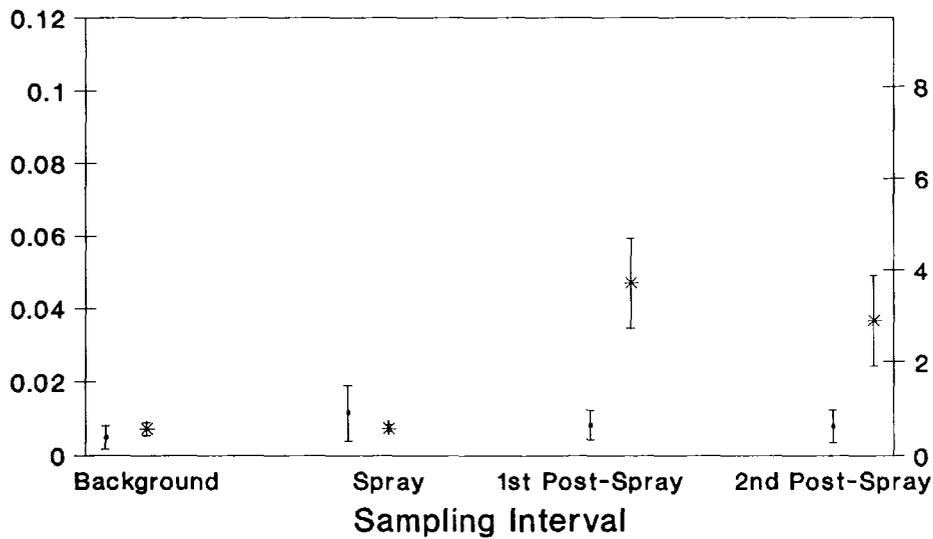
^a None Detected, these samples are assumed to have concentrations of one-half the detection limit.

Figure 9. Medfly malathion and malaoxon air concentrations

Malathion



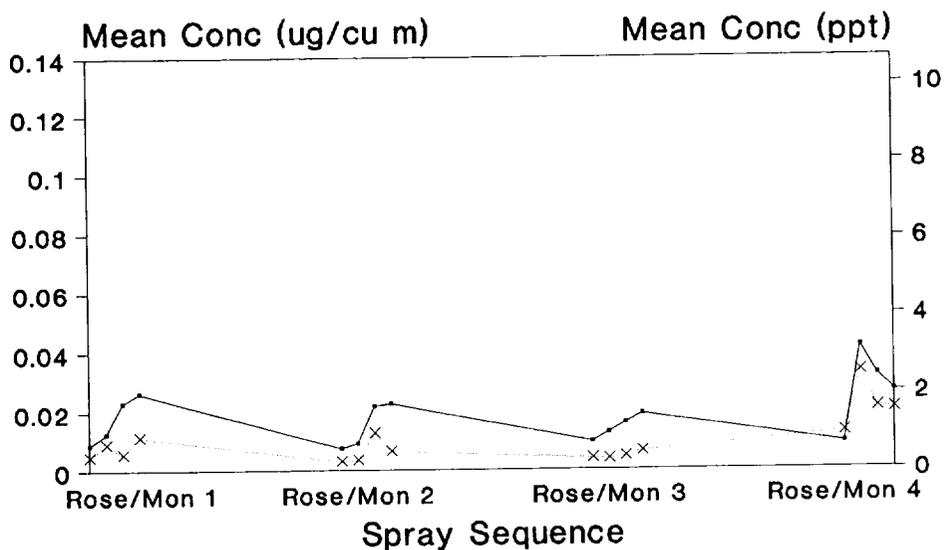
Malaoxon



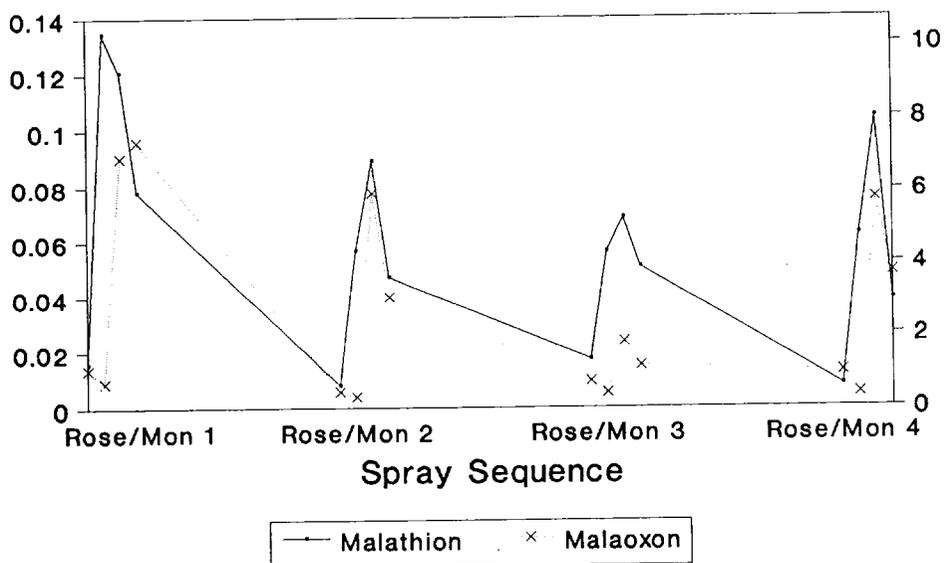
95% Conf Int
 Indoor Mean
 * Outdoor Mean

Figure 10. Medfly Rosemead/Monrovia malathion and malaoxon sequential air concentrations

Indoor



Outdoor



were consistently higher than the 1990 program (Figure 11). However, only the outdoor background and spray periods are significantly different ($p < 0.01$). The other two data sets also show higher or similar concentrations in 1981 when compared to 1990, with one exception. Higher malaoxon concentrations were detected during the 1990 spray period, both indoors and outdoors. More detailed comparisons of the 1981 and 1990 air data are discussed in Appendix E.

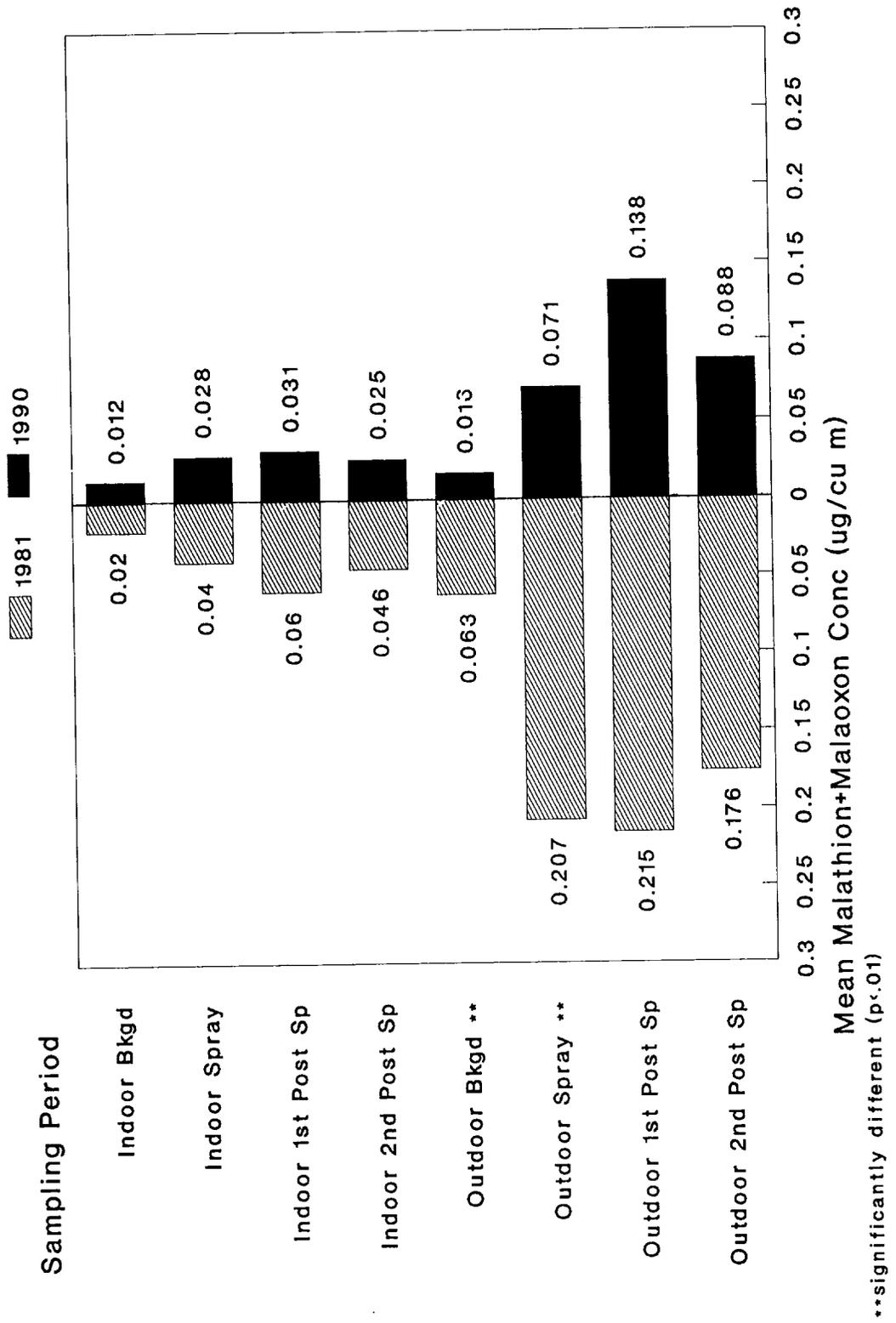
Since the amount of artificial oxidation cannot be determined with accuracy, the true concentration of malaoxon cannot be determined. While it seems plausible that the amount of malathion converted to malaoxon is correlated with ozone concentrations, as suggested by the South Coast Air Quality Management District (SCAQMD, 1990), this cannot be demonstrated with the available data.

CONCLUSIONS AND RECOMMENDATIONS

Even though the aircraft were flying at a high altitude (153 m), the efficiency of deposition measured was very high, with 92% of the amount of malathion released accounted for on the ground surface. Normal agricultural applications generally deposit 5 - 85% on the ground while flying at an altitude of 10 m or less (Miller, 1980). The high efficiency is in part due to the large droplet sizes deposited. Less than 5% of the droplets measured were small enough to drift ($< 100 \mu\text{m}$; Akesson, 1982), and the mass associated with droplets less than $100 \mu\text{m}$ would be much less than 5% of the mass deposited. The 8% unaccounted for either degraded before hitting the ground, volatilized before sample collection, or drifted outside the target area. Some drift did occur as indicated by samples taken from flagged areas. The amount of drift could be reduced by flying at a lower altitude, but lower altitude flying may not be feasible in urban areas.

The presence of malathion in water bodies, resulting from direct application, drift, or runoff, may cause the most environmental impacts. Two fish kills were recorded in a pond that contained malathion. However, they could not be directly attributed to the malathion. The freshwater water quality criterion recommended by the CDFG was also exceeded on several occasions; but, again no adverse impacts could be attributed to these levels.

Figure 11. Comparison of 1981 and 1990 Medfly total (malathion/malaoxon) air concentrations



Winter malathion applications, when rainfall is heaviest, may be especially problematic. Several fish losses due to malathion were documented during the 1981 program, particularly between September and November when there was moderate rainfall (Finlayson, 1982). The 1989-1990 treatment program is the first which involved aerial applications during the winter. Runoff monitoring conducted by the Los Angeles County Agriculture Department during this period showed concentrations within some storm drains in the parts per million range (Donley, 1990). However, no monitoring of aquatic biota was done. It is recommended that extensive monitoring of both water quality and biota losses be conducted to determine if malathion spraying causes unacceptable aquatic impacts during the winter rainfall period.

Air concentrations measured were low in comparison to the 1981 concentrations. However, the exact proportions of malathion and malaaxon could not be determined because of artificially high malaaxon levels created by the sampling technique. Environmental factors such as ozone levels apparently influence the artificial oxidation as well as true oxidation of malathion to malaaxon. In order to determine the relative proportions of malathion and malaaxon, oxidation tests would have to be done at the same time and place as the actual monitoring.

The breakdown products and co-products analyzed for, with the exception of malaaxon, appear to represent a very small proportion of the total material found. In several cases, such as swimming pools, the amount of malaaxon was greater than the amount of malathion. The presence of chlorine, ozone, or other oxidizers may accelerate the conversion of malathion to malaaxon.

Significant differences between the 1981 and 1990 programs were found in all media sampled. To some extent, these differences are interrelated. For example, the larger droplets found during the 1990 program probably contributed to the higher deposition efficiency. In turn, the higher deposition efficiency may have contributed to higher water concentrations. These differences may also be related to changes in application techniques and weather. The higher application rate and larger nozzles undoubtedly contributed to the higher mass deposition and larger droplets found. Lower

temperatures during the winter and spring of 1990 in comparison to the summer of 1981, may have been a factor in the lower air concentrations found.

Differences in application techniques and weather during the 1989-1990 treatment period also preclude using these data to characterize the environmental fate of malathion during the entire 1989-1990 program. The data were collected in a three month time frame, while applications occurred during an entire year. How the different environmental conditions and application techniques during the unmonitored periods interact to influence the environmental fate of malathion generally cannot be predicted.

Specifically, most of the monitoring was conducted during February, 1990, with some monitoring during March and April, while aerial applications occurred between August, 1989 and July, 1990. Environmental conditions, such as temperature, light intensity, and oxidant levels during the monitored periods were very different from those periods which were not monitored. These different conditions could increase or decrease the environmental concentrations of malathion. For example, higher temperatures and inversion layers during the summer could decrease the mass deposition and increase the volatilization of malathion. Whether these changes would increase or decrease malathion air concentrations cannot be predicted.

Application techniques also change with seasons. Primarily, time intervals between applications decrease as the temperature increases. Most dissipation mechanisms are more rapid with increasing temperature, but whether this would offset the increased amount of malathion applied is unknown.

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OTHER MONITORING PROGRAMS

Several other CDFA units and agencies have conducted environmental monitoring of this eradication program. Listed below are the groups that the authors are aware of that have done monitoring. In most cases the data have not been published yet and may not be readily accessible. This list does not include organizations which have done or are planning to do health monitoring.

CDFA - Pest Detection/Emergency Projects Branch

1220 N Street Rm A-350
Sacramento, CA 95814

This unit has primary responsibility for most eradication activities, including aerial treatments. As part of their quality control program, droplet sizes are estimated. Samples are collected for every application at locations where Medflies have been trapped.

CDFA - Pesticide Use Enforcement Branch

1220 N Street Rm A-170
Sacramento, CA 95814

This unit has collected some samples of commodities. This group also measures the malathion concentration in each lot of technical material used.

CDHS - Hazardous Materials Laboratory

2151 Berkeley Way, Rm 234
Berkeley, CA 94704

This unit is investigating malathion co-products more closely. They have collected samples of mass deposition and air over time. They have also been working with the CDFA laboratory on co-products and contaminants in the malathion and bait.

Los Angeles County Agriculture Department

3400 La Madera Avenue
El Monte, CA 91732

This agency has a small-scale ongoing monitoring program. Samples of mass deposition and water are collected. Some vegetation and soil samples have also been collected. They check the malathion/bait concentration before each application.

Orange County Health Care Agency - Environmental Health

PO Box 355
1725 West 17th Street
Santa Ana, CA 92702

This agency has collected some water samples at drinking water facilities.

South Coast Air Quality Management District

9150 Flair Drive
El Monte, CA 91731

This agency has collected some mass deposition samples.

APPENDIX A
SAMPLING AND ANALYTICAL METHODS

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Droplet Size.....	A-21
Water.....	A-25
Air.....	A-31

MASS DEPOSITION AND DROPLET SIZE SAMPLING METHODS

SCOPE:

This method is for the collection of mass deposition and droplet size samples for malathion and malaoxon.

SUMMARY:

The mass deposition sample (an absorbent paper towel with plastic backing) and the droplet size sample (a sheet of Kromekote® cover 65 lb glossy paper) were attached to a plastic covered cardboard sampling platform with push-pins. The sampling platform was placed horizontally at various heights. The samples were deployed several hours before the spray and were collected approximately 15 to 30 minutes after the helicopters had sprayed the area. The absorbent towels were folded with the plastic side out, and wrapped in aluminum foil, and the droplet card cardboard holder (which has a spacer to prevent it from touching the sample) was folded over the glossy paper to prevent smearing of the droplets.

EQUIPMENT:

Sampling Equipment

Cardboard Sampling Platform - 18" x 18".
Plastic Bag to cover Sampling Platform - 18" x 24"
Cinder Block
Bungi Cord
Clean push-pins
Gloves

Samples

Mass Deposition Sample and Chain of Custody
Droplet Size Sample and Chain of Custody

Equipment Cleanup

Jar for dirty push-pins
Trash bag
Paper towels
Soap
Water
Deionized Water
Alcohol

Sample Storage

Dry Ice
Icechest

SAMPLING:

All personnel must wear disposable gloves when handling samples, and change to clean gloves if contamination is suspected.

- 1) Cover the cardboard sampling platform with a clean plastic bag (18"x24").

- 2) Using the bungi cord, attach the sampling platform to the cinder block. If it is more convenient, the sampling platform may be attached to low benches or walls. The sampling platform must be horizontal.
- 3) Attach the mass deposition sample to the sampling platform by inserting push-pins through the corners of the sample into the cardboard platform.
- 4) Open the cardboard cover on the droplet size sample, and attach the sample to the platform with push-pins.
- 5) Place the sampling platform in a location free of overhead obstructions, and wait for the spraying helicopters to pass over.
- 6) Fifteen minutes after the area has been sprayed the samples can be collected.
- 7) With clean gloves, remove the push-pins from the mass deposition sample and fold the sample, keeping the plastic backing outward. Place the folded sample in the center of a large piece of aluminum foil, and fold the foil to seal the sample inside. Place the sample in a manilla envelope and store on dry ice until analyzed. Record the site and sampling information on the chain of custody record.
- 8) Remove the push-pins from the droplet sample holder, fold the cover over, place in a manilla envelope, and store at room temperature. Record the site and sampling information on the chain of custody record.
- 9) Remove and discard contaminated plastic bag covering the sampling platform. Wash all push-pins, bungi cords, and cinder blocks thoroughly (soap and water wash, water rinse, deionized water rinse, and alcohol rinse).

DISCUSSION:

There are several advantages and disadvantages to using these types of sheets for sampling. The advantages are that they are easy to use and prepare, they withstand adverse conditions well, such as wind and dew, and they are inexpensive. The disadvantages include some difficulty with the chemical analysis due to the plastic backing, and the mass deposition sheets absorb gas phase pesticides.

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Original Date: 06/09/89
Supercedes: New
Current Date: 07/30/90
Method #:

MALATHION AND MALAOXON ON MASS DEPOSITION SAMPLES

SCOPE:

This method is for the determination of malathion and malaaxon on Kimbie[®] or Teflon[®] cards.

PRINCIPLE:

Residues of malathion and malaaxon were extracted from Kimbies[®] (asbordant towel with a plastic backing) by shaking them with ethyl acetate. The extract was then concentrated for malaaxon and analyzed by gas chromatograph using a flame photometric detector (FPD). Since the levels of malathion were in milligram amounts an aliquot was taken and diluted. It was then analyzed by gas chromatography using a Thermionic Specific Detector[®] (TSD).

REAGENTS AND EQUIPMENT:

Ethyl acetate; (pesticide residue grade).
Wide-mouth mason jars (quart size).
Mechanical shaker (G10 Gyrotory Shaker).
Boiling flasks, flat bottom with ground glass joint 24/40 (300 mL).
Rotary evaporator (Büchi/Brinkmann, R110).
Graduate test tubes (15 mL).
Nitrogen evaporator (Organomation Model # 12)
Vibrating mixer for test tubes
Graduated cylinder (1 L).
Kimbie[®] (Kimberly-Clark Corp.)

ANALYSIS:

Place the Kimbie[®] in a quart mason jar. Add 500 mL of ethyl acetate and shake on a mechanical shaker for 30 min. at a setting of ~ 165 RPM.

Malaaxon

- 1) Take 100 mL of extract to be analyzed for malaxon and concentrate down just to dryness on a rotary evaporator. Rinse sides of flask with a few milliliters of ethyl acetate.
- 2) Transfer extract to a graduated test tube. Rinse flask 3 times each with 2 mL of ethyl acetate. Transfer each wash to the same graduated test tube.

- 3) Place extract on a nitrogen evaporator with waterbath set at 35°C and evaporate to a final volume of 1 mL under a gentle stream of nitrogen.
- 4) Stopper the graduated test tube and mix contents by placing on a vibrating mixer for about 15 seconds. Submit sample for gas chromatographic analysis.

Malathion

- 1) Take 1 mL aliquot of the initial ethyl acetate extract and dilute 1:2 with ethyl acetate. Submit sample for gas chromatographic analysis.

EQUIPMENT CONDITIONS:

MALAOXON

VARIAN 3700 GC with FPD

Column: DB-1701 (7% cyanopropyl & 7% phenol polysiloxane) 30 m x 0.552 mm x 1.0 um

Carrier gas: Helium, flow rate: 15 psi.

Injector: 200°C.

Detector: 250°C.

Temperature: 195°C isothermal.

Injection volume: 2 uL.

Retention times: Malathion 8.82 ± 0.1 min. Malaoxon 7.86 ± 0.1 min.

Linearity checked: 0.2 ng - 20 ng.

MALATHION

VARIAN 6000 GC WITH TSD

Column: DB-1301 (6% cyanopropylphenyl & 94% methyl) 30 m x 0.55 mm x 1.0 um

Carrier gas: Helium, flow rate: 20 psi.

Injector: 220°C.

Detector: 300°C.

Temperature: 185°C isothermal.

Injection volume: 2 uL.

Retention times: Malathion 6.24 ± 0.05 Malaoxon 5.17 ± 0.05

Linearity checked: 0.2 ng - 10 ng.

CALCULATIONS:

Micrograms (UG) MALAOXON

$$\text{ug in sample} = \frac{(\text{peak height sample})(\text{ng/uL std})(\text{uL injected std})(500 \text{ mL})(\text{final volume mL})}{(\text{peak height std})(\text{uL injected sample})(100 \text{ mL})}$$

Micrograms (UG) MALATHION

$$\text{ug in sample} = \frac{(\text{peak height sample})(\text{ng/uL std})(\text{uL injected std})(\text{final volume mLs})}{(\text{peak height std})(\text{uL injected sample})(100 \text{ mL})}$$

FORTIFICATION:

Malathion and malaaxon were spiked onto separate Kimbie[®] sheet at the levels listed below. The Kimbies[®] were allowed to dry before extracting them.

RECOVERIES:

% Recoveries of malathion and malaaxon

Levels	Malathion(mean)	Malaaxon(mean)
10 ug (n=2)	96	110
100 ug (n=2)	83	92
1000 ug (n=2)	108	98
5000 ug (n=2)	103	98

Recovery validation was done prior to the samples.

MINIMUM DETECTABLE LEVEL:

1.0 ug (1 kimbie per sample) S/N=4

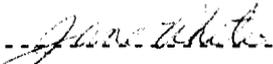
DISCUSSION:

Each run contained stds of .1 ng/uL, 1 ng/uL, 2.5 ng/uL, 5 ng/uL and 10 ng/uL at the begin and end. A 1 ng/uL, 2.5 ng/uL and 5 ng/uL were run after every 10-12 samples. A separate spike for malathion and malaaxon at a 1000 ug level was done for each set of sample.

REFERENCE:

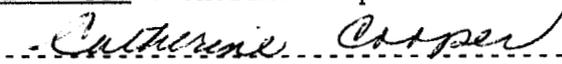
- 1) White, Jane., *Parathion on Kimbies*, 1989 Environmental Monitoring Methods, California Department of Food and Agriculture.

WRITTEN BY: Jane White



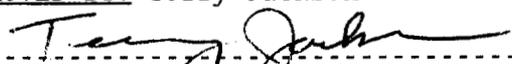
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REVIEWED BY: Catherine Cooper



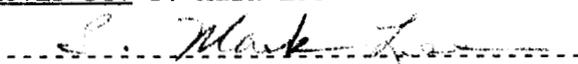
TITLE: Agricultural Chemist III

APPROVED BY: Terry Jackson



TITLE: Quality Assurance Officer

APPROVED BY: S. Mark Lee



TITLE: Research Agricultural Chemist

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(916)+427-4410

Original Date: July 19, 1990
Supercedes: none
Current Date: July 19, 1990
Method #: Mala Co-products 90-1

Analysis of Six Malathion Co-Products

SCOPE:

This is a method for the analysis of Malathion technical concentrates, tank mixes, and mass depositon samples for the following six Malathion co-products: Malaoxon, Isomalathion, O,O,S-Trimethyl phosphorodithioate (TME), O,O,S-Trimethyl phosphorothioate (iso-TMTP), O,O,O-Trimethyl phophorothioate (TMTP), and Diethyl Fumarate (DEF). Malaoxon and Isomalathion are analyzed by a Gas Chromatograph (GC) equipped with a Flame Photometric Detector (FPD) or a GC / Mass Selective Detector (MSD) after Preparatory High Performance Liquid Chromatography (Prep HPLC) cleanup. TMTP, iso-TMTP, and TME are analyzed without cleanup by either a GC/FPD or a GC/MSD. DEF is analyzed without cleanup by a GC/MSD.

PRINCIPLE:

TMTP, iso-TMTP, TME, Malaoxon, and Isomalathion are determined with either a GC equipped with a FPD in the phosphorous mode or a GC/MSD in the selected ion monitoring (SIM) mode. DEF is determined with a GC/MSD in the SIM mode. A sample is analyzed for TMTP, iso-TMTP, TME, and DEF after solvent extraction and appropriate adjustment of the extract concentration. Malaoxon and Isomalathion are determined after solvent extraction of the sample, followed by prep HPLC cleanup of the extract. Without cleanup the high level of Malathion in the sample makes it difficult to accurately quantify both compounds.

Malaoxon and Isomalathion are separated from Malathion on a reverse phase prep HPLC column. The fraction containing both Malaoxon and Isomalathion but no Malathion is collected then concentrated. Both of these co-products are then accurately determined by GC equipped with an FPD or a GC/MSD.

REAGENTS AND EQUIPMENT:

1. Hewlett Packard 5890 Series II gas chromatograph with a split/splitless capillary injector and a 7673A auto injector / 5970 mass selective detector.
2. Hewlett Packard 5890 gas chromatograph equipped with a flame photometric detector set in the phosphorous Mode.
3. Hewlett Packard 1090 liquid chromatograph and a 1040A diode array detector.
4. Reverse phase preparation HPLC column - Hibar Prep 10 10 mm x 250 mm.
5. Gas chromatographic columns - Hewlett Packard HP-1 0.2 mm I.D. x 25 m. and a HP-1 0.53 mm I.D. x 10 m.

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6. Rotary evaporator - Buchi RE 121 Rotavapor with a Buchi 461 Water Bath.
7. Round bottom evaporation flasks (250 mL).
8. Graduated centrifuge test tubes (15 mL) with glass stoppers.
9. Separatory funnels (125 mL).
10. Volumetric flasks (100 mL).
12. Pasteur pipets - Disposable - Kimble.
11. Wheaton autosampler Vials (1 mL).
12. Acetonitrile (HPLC grade).
13. Water (purified).
14. Ethyl acetate (pesticide grade).
15. Acetone (pesticide grade).
16. Anhydrous sodium sulfate (Reagent Grade).
17. Sodium chloride (Reagent Grade).

ANALYSIS:

- A. **Extraction of Malathion and its co-products from technical concentrates, tank mixes and mass deposition cards (Kimbies or Teflon Sheets).**

(See attached methods).

- B. **Sample Preparation for Technical Concentrate.**

TMTP, iso-TMTP, TME, and DEF

1. Transfer an aliquot (1 mL) of the Acetonitrile solution (2 g/25 mL) to a volumetric flask (100 mL). Dilute to volume with ethyl acetate. The concentration of this solution is 0.8 mg of sample in one mL. This sample is ready for GC/MSD analysis of TMTP, iso-TMTP, TME and DEF or GC/FPD analysis of TMTP, iso-TMTP, or TME.

Malaoxon and Isomalathion

1. Inject a 50 uL volume of the acetonitrile solution (2 g/25 mL) onto the prep HPLC column. Collect the eluate from the detector for the first nine minutes of the HPLC run (36 mL) in a separatory funnel (125 mL) containing ethyl acetate (30 mL) and sodium chloride (ca. 2 g). The remainder of the HPLC run should go to waste.
2. Stopper the separatory funnel, then shake gently for 1 minute. Allow the phases to separate. Drain the aqueous layer into a beaker (100 mL). Decant the ethyl acetate solution through anhydrous sodium sulfate into a round bottom evaporation flask (250 mL). Return the aqueous layer to the separatory funnel, then extract it with an

Analysis of Six Malathion Co-Products

additional volume of ethyl acetate (20 mL). Drain and discard the aqueous layer. Decant the organic phase through the same sodium sulfate and combine it with the first ethyl acetate extract. Finally rinse the sodium sulfate with ethyl acetate (10 mL) and combine it with the ethyl acetate extract.

3. Evaporate the ethyl acetate in a water bath set at 50 degrees C with a rotary evaporator to a volume of approximately 1 mL. Quantitatively transfer the sample to a graduated test tube (15 mL) and adjust to a final volume of 5 mL. The concentration of the sample is 0.8 mg/mL. The sample is ready for GC/MSD or GC/FPD analysis for Malaoxon and Isomalathion.

C. Sample preparation for Tank Mix

TMTP, iso-TMTP, TME, DEF

1. Transfer an aliquot (1 mL) of the ethyl acetate solution (2 g/100 mL) to a graduated test tube (15 mL). Dilute with ethyl acetate to a final volume of 5 mL. Add anhydrous sodium sulfate (1 g) to the tube and shake well. The concentration of the solution is 4.0 mg of sample per mL. The sample is ready for GC/MSD analysis of TMTP, iso-TMTP, TME and DEF or GC/FPD analysis of TMTP, iso-TMTP, and TME.

Malaoxon and Isomalathion

1. Transfer an aliquot (40 mL) of the ethyl acetate solution (2 g/100 mL) to a beaker (100 mL). Evaporate the sample just to dryness on a steam bath with a gentle stream of nitrogen. Quantitatively transfer the sample with acetonitrile from the beaker to volumetric flask (10 mL) and adjust to volume with acetonitrile. The final concentration of the sample is 80.0 mg/mL.
2. Inject a 50 uL volume of the acetonitrile solution onto the prep HPLC column. Follow steps 2-4 in method B. above, then adjust to a final volume of 2 mL. The concentration of the sample is 2.0 mg/mL. The sample is ready for GC/MSD or GC/FPD analysis of Malaoxon and Isomalathion.

D. Sample Preparation for Mass Deposition samples.

TMTP, iso-TMTP, TME, DEF

1. Concentrate an aliquot (100 mL) of the ethyl acetate solution to approximately 5 mL at 50 degrees C with a rotary evaporator. Quantitatively transfer the sample to a graduate test tube (15 mL). Concentrate the sample to 2 mL in a water bath set at 40 degrees C with a gentle stream of nitrogen. Do not evaporate to dryness. The concentration in the test tube is 20 % of the sample in 2 mL. The sample is ready for GC/MSD analysis of TMTP, iso-TMTP, TME, and DEF or GC/FPD analysis of TMTP, iso-TMTP or TME.

Analysis of Six Malathion Co-Products

Malaoxon and Isomalathion

1. Evaporate an aliquot (100 mL) of the ethyl acetate solution to dryness at 50 degrees C on a rotary evaporator. Quantitatively transfer the sample to a graduated test tube (15 mL) with approximately 5 mL of ethyl acetate, then concentrate to 1 mL. Filter the sample with a 0.2 micron HPLC filter into a graduated test tube (15 mL). Rinse the filter with a volume (1 mL) of acetone and combine it with the ethyl acetate. Evaporate the sample to dryness in a water bath set at 40 degrees C with a gentle stream of nitrogen. Dissolve the sample in a volume (250 uL) of HPLC grade acetonitrile. The concentration in the tube is 20 % of the sample in 250 uL.
2. Inject a 200 uL volume of the Acetonitrile onto the prep HPLC column. Follow steps 2-4 in Method B. above, then adjust to a final volume of 2 mL. The concentration in the tube is 16 % of the sample in 2 mL. The sample is ready for GC/MSD or GC/FPD analysis of Malaoxon and Isomalathion.

EQUIPMENT CONDITIONS:

HP 1090 HPLC conditions:

Column: Hibar Prep 10 - 10 mm x 250 mm

Mobile Phase: Acetonitrile:Water (65:45, v:v)

Flow rate: 4 mL/min.

Detector wavelength: 224 nm.

Dimensions of tubing from detector: 0.8 mm I.D. x 2 ft.

HP 5890 GC equipped with FPD:

Column: HP-1 .53 mm x 10 m.

Column oven temperature program:

Initial Temp - 60 C.

Hold time initial temp - 1 min.

Temp. program rate - 20 C/min.

Final Temp - 240 C.

Hold time final temp - 10 min.

Injector temp. - 220 C.

Detector temp. - 230 C

Detector - FPD in phosphorous Mode

HP 5890 GC / 5970 MSD

Column: HP-1 .20 mm x 25 m, 0.33 um thickness

Analysis of Six Malathion Co-Products

Column oven temperature program:

Initial Temp - 60 C
Hold time initial temp - 1 min.
Temp. program rate - 10 C/min
Final Temperature - 250 C.
Hold time final temp - 25 min.
injector temp. - 175 C.
Detector temp. - 250 C.

Splitless injection:

<u>run time(min)</u>	<u>purge valve</u>
0.00	off
0.50	on

HP 5970 MSD conditions:

SIM mode

<u>Start time(min)</u>	<u>Ions monitored(m/z)</u>
4.00	93, 126, 156
7.50	110, 141, 156
9.00	93, 99, 125, 127, 143, 172
18.00	109, 127, 173, 299
21.00	127, 173, 283

CALCULATIONS:

1. All six co-products in technical concentrates-

$$\frac{\text{peak area sample}}{\text{peak area standard}} \times \frac{\text{Conc. of standard (ug/mL)}}{800 \text{ ug/mL}} \times 100 = \text{percent}$$

2. TMTP, iso-TMTP, TME, DEF in tank mixes-

$$\frac{\text{peak area sample}}{\text{peak area standard}} \times \frac{\text{Conc. of standard (ug/mL)}}{4000 \text{ ug/mL}} \times 100 = \text{percent}$$

3. Malaoxon and Isomalathion in tank Mixes-

$$\frac{\text{peak area sample}}{\text{peak area standard}} \times \frac{\text{Conc. of standard (ug/mL)}}{2000 \text{ ug/mL}} \times 100 = \text{percent}$$

4. TMTP, iso-TMTP, TME, DEF in mass deposition samples-

$$\frac{\text{peak area sample}}{\text{peak area standard}} \times \frac{\text{Conc. of standard (ug/mL)}}{0.2 \text{ of sample} / 2 \text{ mL}} = \text{ug per sample}$$

Analysis of Six Malathion Co-Products

5. Malaoxon and Isomalathion in mass deposition samples-

$$\frac{\text{peak area sample}}{\text{peak area standard}} \times \frac{\text{Conc. of standard (ug/mL)}}{0.16 \text{ of sample} / 2 \text{ mL}} = \text{ug per sample}$$

*Calculations assume identical injection volume of both sample and external std.

DISCUSSION:

The method was validated in all three matrices using a HP 5890 GC/FPD for five organophosphate co-products: Malaoxon, Isomalathion, TMTP, iso-TMTP, and TME. The method was not validated for DEF because it is not detected by an FPD.

A concentrate was over spiked in triplicate with all five organophosphate (OP) co-products. These spiked concentrates were analyzed along with the unspiked concentrate. The recoveries, average recovery and percent RSD for all five compounds are listed (Table 1). The higher than expected recoveries for Malaoxon and Isomalathion are observed but were not further pursued for possible explanation.

A tank mix was prepared by mixing the concentrate (20 g) with med-fly bait (Nu-Lure insect bait, 80 g). The tank mix was mixed four hours with a magnetic stirrer. Aliquots (2.2 g) of this tank mix were then analyzed. Since the concentrate was diluted 1 to 5 with bait, the amount (mg/g) of all 5 OP co-products added was 20 % of the amount (mg/g) in the concentrate. The recoveries, average recovery, and percent RSD are listed (Table 2). The recovery of Iso-TMTP is low, it is evidently not quantitatively extracted from this matrix with ethyl acetate.

Three blank Kimbies were spiked with the tank mix (2.3 g). The amount of each OP co-product added was determined by multiplying the concentration of each in the tank mix (mg/g) by 2.3 g. The recoveries, average recovery, and percent RSD are listed (Table 3). The percent recovery of Isomalathion is higher in this matrix than it was from the tank mix. A possible explanation for the high recovery is matrix enhancement.

The GC/MSD can also be used to analyze all three of these matrices for the five organophosphate co-products. If one set up as described in the Instrument Conditions section, the GC/MSD can be as sensitive and selective as the GC/FPD for the five OP co-products. A GC/FPD is used to perform the primary analyses of the samples. Because it is selective for phosphorous compounds and these instruments are available in the laboratory. The GC/MSD should be used to confirm the primary analyses. Conversely, the GC/MSD is required for the primary analysis of the sample for DEF which does not contain phosphorous.

Analysis of Six Malathion Co-Products

The minimum detection limits (S/N = 10) for the six compounds in each of the three matrices are estimated and listed (Table 4). Representative Chromatograms from the GC/MSD and the GC/FPD are attached.

- Figure 1: GC/MSD (SIM) Chromatogram of Malaoxon and Isomalathion Standards (3ng).
- Figure 2: GC/MSD (SIM) Chromatogram of Malathion Co-Products from Concentrate.
- Figure 3: GC/MSD (SIM) Chromatogram of Malathion Concentrate.
- Figure 4: GC (FPD) Chromatograms- Malathion Co-Products Standards and Concentrate.
- Figure 5: GC (FPD) Chromatograms: Comparison of Malathion Concentrate Before and After Preparative HPLC Cleanup.

Table 1.

CO-PRODUCT SPIKE OF MALATHION CONCENTRATE

COMPOUND	FOUND mg/gm	ADDED mg/gm	RECOV. 1 mg/gm	RECOV. 2 mg/gm	RECOV. 3 mg/gm	AVERAGE RECOVERY		% RSD %
						mg/gm	%recov.	
MALAOXON	3.600	.490	.700	.600	.600	.833	129.252	9.116
ISOMALATHION	1.600	.420	.600	.600	.500	.567	134.321	10.189
TMTP	.110	.375	.390	.390	.400	.393	104.389	1.468
ISO TMTP	.220	.460	.490	.520	.510	.507	110.145	3.015
TME	3.000	.480	.450	.390	.390	.410	88.130	8.449

CO-PRODUCT SPIKE OF TANK MIX.

Table 2.

COMPOUND	ADDED mg/gm	RECOV. 1 mg/gm	RECOV. 2 mg/gm	RECOV. 3 mg/gm	AVERAGE RECOVERY		% RSD %
					mg/gm	%recov.	
MALAOXON	.720	.750	.740	.730	.740	102.778	1.351
ISOMALATHION	.320	.360	.320	.320	.333	104.187	6.928
TMTP	.022	.021	.022	.021	.021	96.970	2.706
ISO TMTP	.044	.031	.030	.029	.030	68.182	3.333
TME	.600	.550	.560	.530	.547	91.111	2.794

CO-PRODUCT SPIKE OF KIMBIES (MASS DEPOSITION CARD).

Table 3.

COMPOUND	ADDED mg	RECOV. 1 mg	RECOV. 2 mg	RECOV. 3 mg	AVERAGE RECOVERY		% RSD %
					mg	%recov.	
MALAOXON	1.600	1.660	1.660	1.660	1.660	103.750	0
ISOMALATHION	.740	1.050	1.010	1.010	1.023	138.288	2.257
TMTP	.051	.046	.052	.044	.047	92.810	8.796
ISO TMTP	.102	.098	.110	.093	.100	98.366	8.708
TME	1.380	1.440	1.610	1.360	1.470	106.522	8.685

Analysis of Six Malathion Co-Products

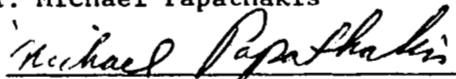
Minimum Detection Limits

<u>Compound</u>	<u>Concentrates</u>	<u>Tank Mixes</u>	<u>Mass Deposition Samples</u>
Malaoxon	0.005 %	0.005 %	0.5 ug
Isomalathion	0.010 %	0.010 %	1.0 ug
TMTD	0.0005 %	0.0005 %	0.04 ug
iso-TMTD	0.0005 %	0.0005 %	0.04 ug
TME	0.0005 %	0.0005 %	0.04 ug
DEF	0.0005 %	0.0005 %	0.04 ug

REFERENCES:

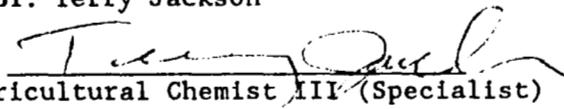
"High Resolution Gas Chromatographic Analysis for Impurities in Technical Butanedioic Acid-(O,O-dimethyldithiophosphoro, diethyl ester (CL 6,601)." American Cyanamid Company, Agricultural Research Division, P.O. Box 400, Princeton, NJ 08540.

WRITTEN BY: Michael Papathakis



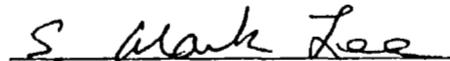
TITLE: Agricultural Chemist III (Specialist)

REVIEWED BY: Terry Jackson

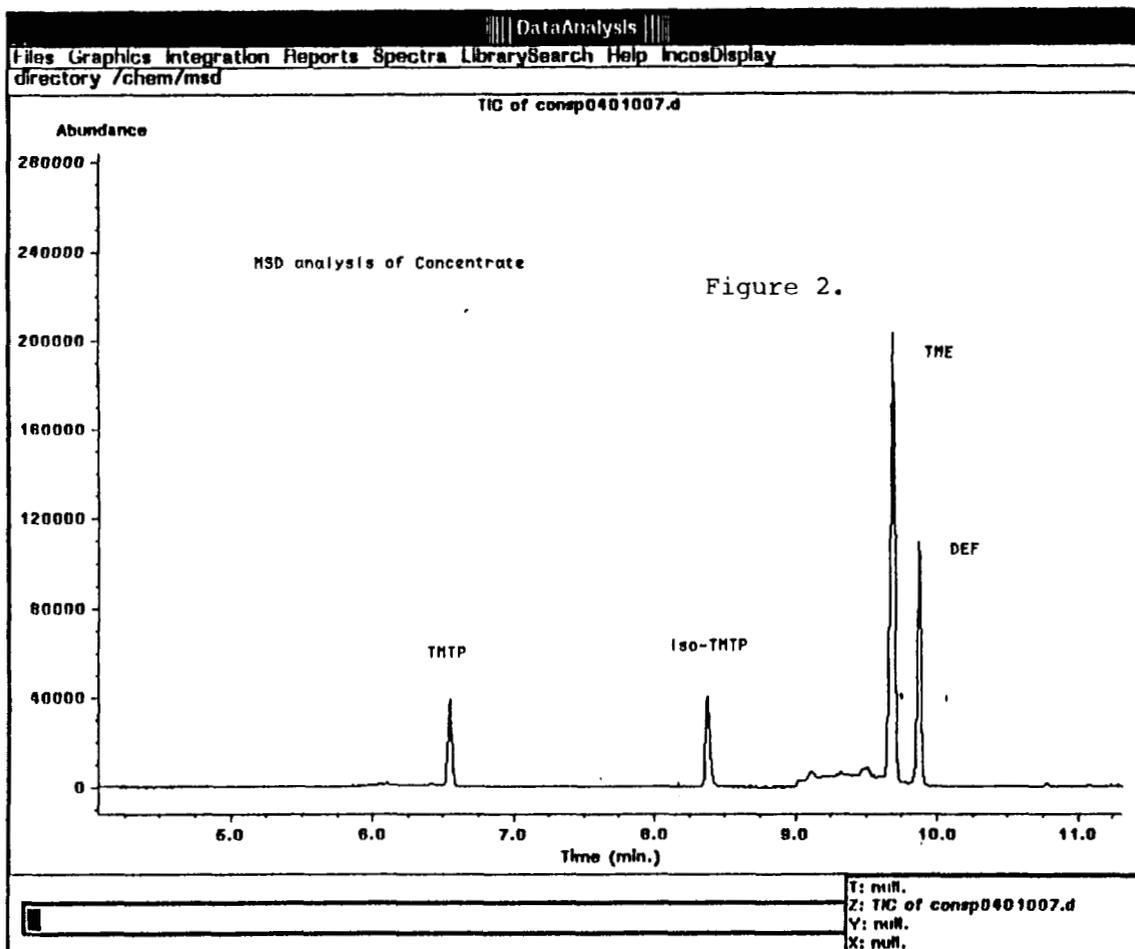
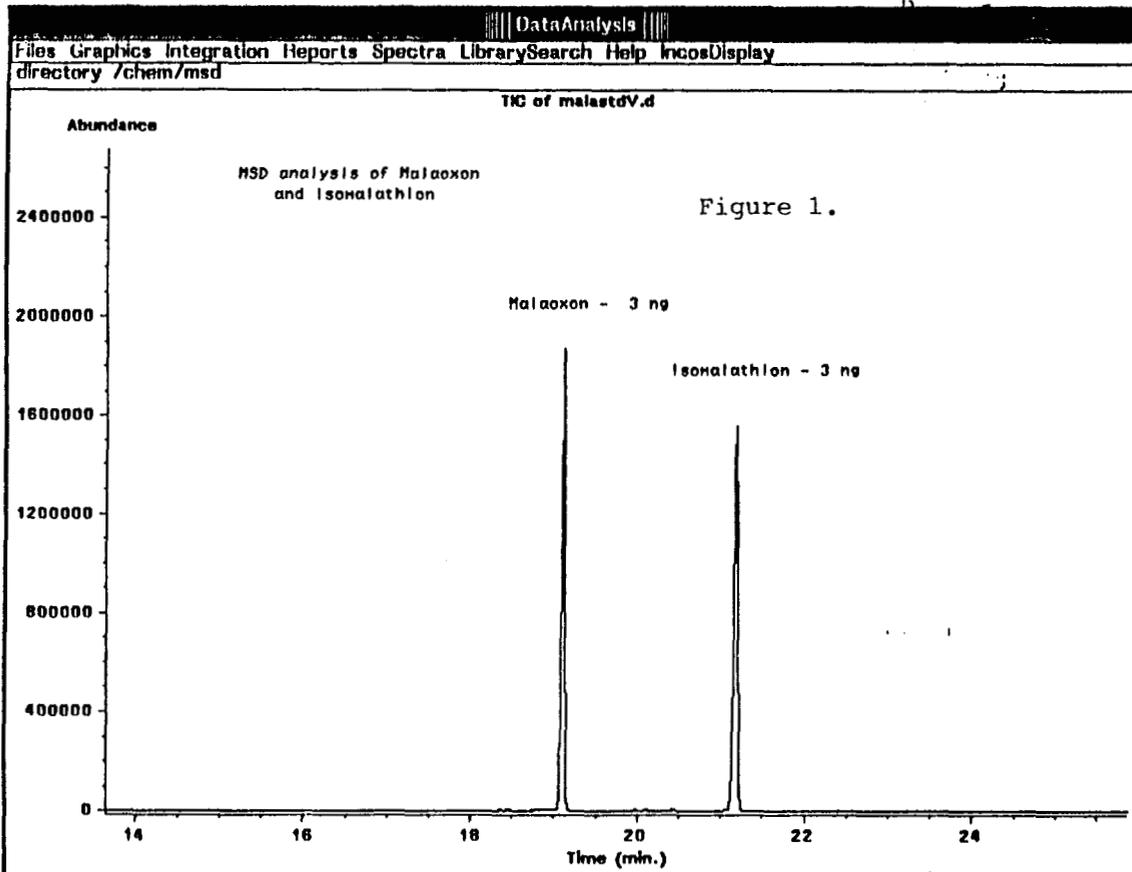


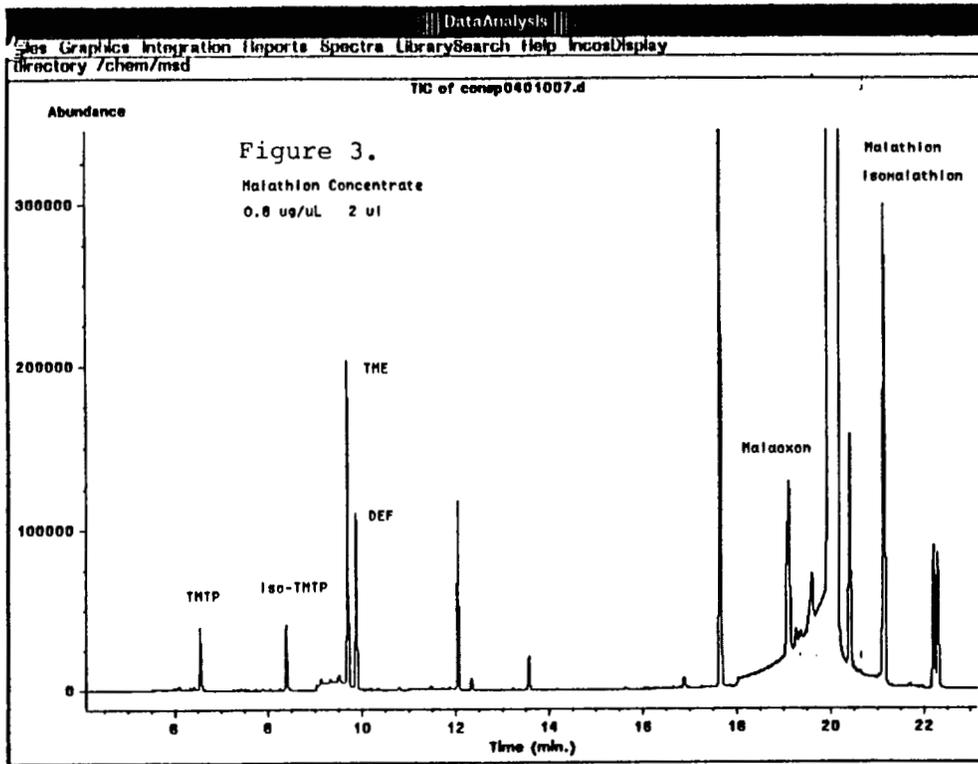
TITLE: Agricultural Chemist III (Specialist)

APPROVED BY: S. Mark Lee

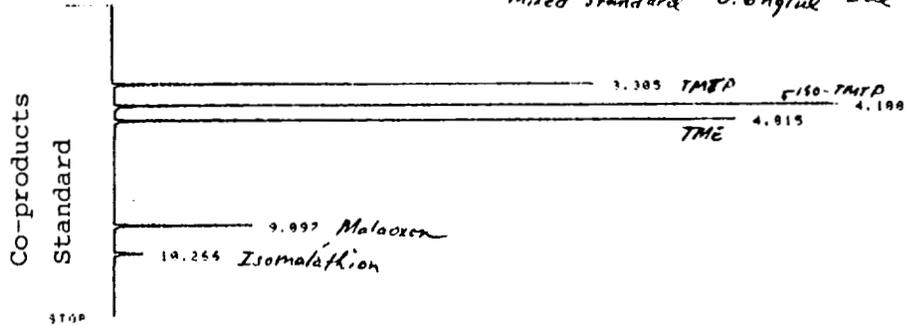


TITLE: Research Agricultural Chemist





* RUN # 254 JUN 13, 1990 09:23:48 HP 5870 with FPD
 START not ready Mixed standard 0.6 ng/uL 2ul



RUN# 254 JUN 13, 1990 09:23:48

AREA#

RT	AREA	TYPE	WIDTH	AREA%
3.305	1775921	PK	.043	24.46576
4.189	2454242	PK	.040	34.08809
4.815	2142991	BB	.041	29.76552
9.897	682049	PK	.051	8.36233
10.264	224445	BB	.003	3.11749

TOTAL AREA=7199536
 MUL FACTOR=1.0000E+00

Figure 4.

* RUN # 255 JUN 13, 1990 09:40:44
 START not ready

HP 5890 with FPD
 Concentrate analyzed with out cleanup
 0.8 mg/uL 2ul

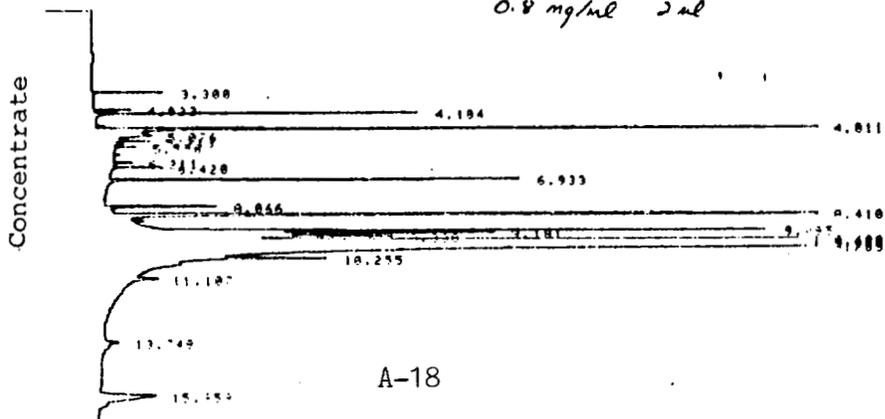


Figure 5.

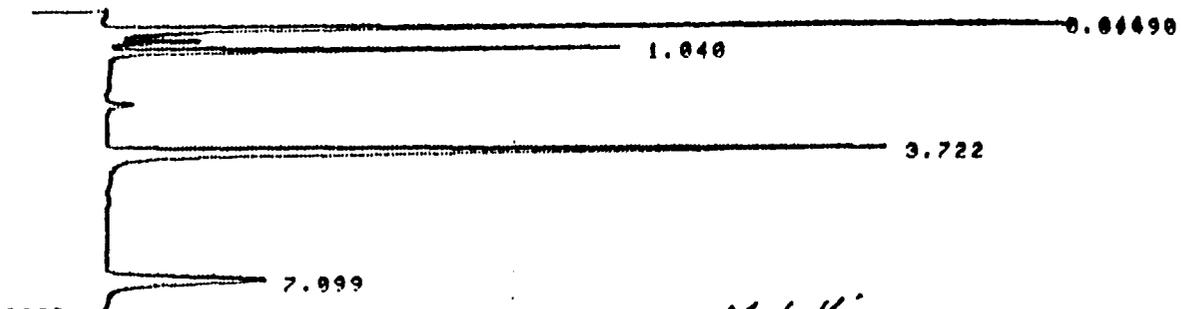
GC oven temp - 190°C isothermal

Malathion Concentrate after Cleanup
2 ul 0.8 ug/ul

+ PUN # 340 JUN 24, 1990 12109143

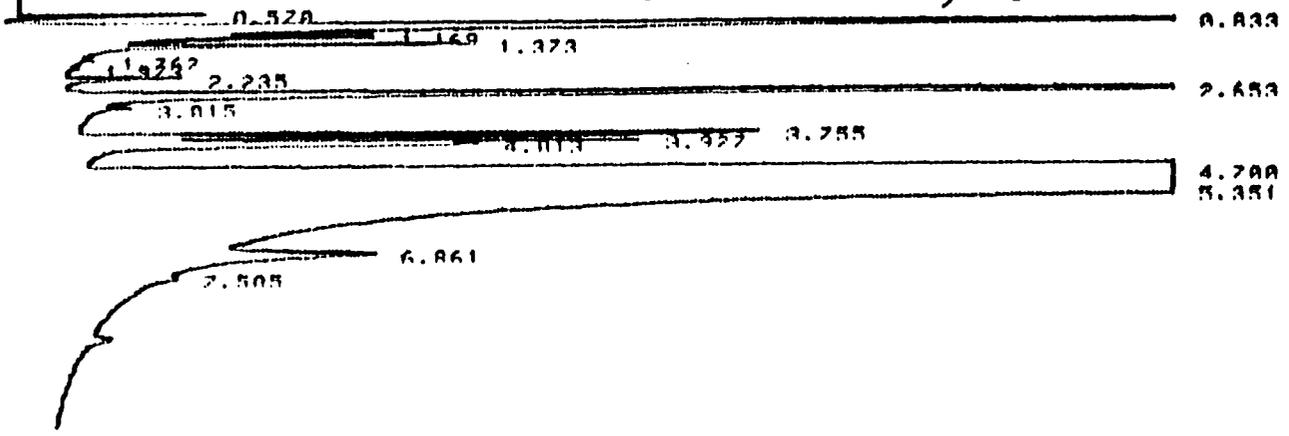
START

IP 5890
w/ FPD



Malathion Concentrate w/o Cleanup
2 ul 0.8 ug/ul

START



MASS DEPOSITION CALCULATIONS

The laboratory reported the results on a microgram per sample basis. Since the sheets were 1 ft² in area, no calculations are needed to express the concentrations as µg/ft².

When malathion is converted to malaaxon the weight of the molecule changes (malathion molecular weight = 330.36, malaaxon MW = 314.30). To get an accounting of the pesticide mass it is necessary to adjust for the change in molecular weight. Therefore, total malathion and malaaxon is expressed as "malathion equivalents", with the malaaxon values adjusted to a malathion equivalent value. Malaaxon values are converted by multiplying by 330.36 and dividing by 314.30.

DROPLET SIZE SAMPLING METHODS

See Mass Deposition Sampling Methods

DROPLET SIZE SAMPLE ANALYSIS

SCOPE:

This method is for the determination of malathion/bait droplet sizes on Kromekote® cards.

SUMMARY:

Three random areas on each card are scanned using a microscope. Each droplet observed is compared to an eyepiece graticule with 12 different size ranges. The number of droplets in each size category, total number of droplets counted, and the area scanned are used to calculate the percentage of droplets in each size range, droplet density (#/ft²), and frequency distribution.

EQUIPMENT:

Microscope equipped with an 18x eyepiece and 1x objective lens
Porton eyepiece graticule with 2^{0.5} increments (sizing grid)
Micrometer

ANALYSIS:

- 1) Calibrate the graticule daily with a micrometer.
- 2) Measure the length and width of the card and record on the data sheet.
- 3) Draw three randomly spaced parallel strips (1.0 cm wide) along the length of the card.
- 4) Scan the three random areas for drops. For each drop observed, compare the diameter to the graticule to determine which size range category it fits in.
- 5) Record the number of drops in each size category.

DISCUSSION:

This type of analysis has advantages and disadvantages. The advantages include simple instrumentation and rapid analysis. The disadvantages include the limited size range that can be measured (46 - 1422 µm) and the exact diameter of individual drops is not measured.

SPREAD FACTOR DETERMINATION

SCOPE:

This method determines correction needed to convert the 2-dimensional measured droplet diameter to a 3-dimensional spherical diameter.

SUMMARY:

Malathion/bait mixture is sprayed on Kromekote® cards and microscope slides coated with magnesium oxide. Since the magnesium oxide slides have a known spread factor, a regression line describing the relationship between the measured diameter and the volumetric diameter can be established.

EQUIPMENT:

Malathion ULV and Nu-Lure bait mixture
Magnesium oxide tape, 1/4 inch wide
Microscope slides
Kromekote® cards
Sprayer

ANALYSIS:

- 1) Prepare uniformly coated MgO slides. Burn MgO tape and let smoke coat microscope slide.
- 2) Place one MgO slide and one Kromekote® card side by side at four locations approximately 50 cm apart.
- 3) Spray all slides and cards with the malathion/bait mixture.
- 4) Collect and analyze Kromekote® cards normally.
- 5) Collect and analyze the MgO slides using same procedures, except multiply the MgO slide droplet measurements by 0.86 to convert from the measured diameter to the volumetric diameter.
- 6) Repeat entire procedure two more times.

CALCULATIONS:

The MgO coated slides represent the sizes of droplets with no spread (the "true" sizes), while the Kromekote® cards are the surface used to collect droplets for size determination during the actual malathion applications.

Percentiles of the slide and card droplet size distributions were equated by the following procedure. For each surface the total number of droplets in each size category in three combined replications was counted. The cumulative distribution function for each surface (i.e., the percent of droplets with diameters less than or equal to any given size) was expressed as log diameter vs. the logit ($\text{logit} = \log(p/(1-p))$, where p is the proportion of droplets less than or equal to each diameter). The purpose of expressing the cumulative distribution in this form is to linearize it so that it can be expressed easily as an equation. Once the linear equation describing the cumulative distribution function for each surface is found, one can solve for the two diameters (one for each surface) that correspond to any given percentile. The

last step is to find a least-squares curve relating slide diameter to the corresponding card diameter. This least-squares equation is used to calculate the "true", or slide, droplet diameter for any observed, or card, droplet diameter.

In the present case, the log-logit transformation failed to linearize the cumulative distribution functions and second-order polynomial equations were required. The final least-squares equation relating card droplet diameter (x) to true diameter (y) was:

$$y = 12.4055 + 0.58462*x - 0.000017558*x^2$$

which gave the following true diameters for each of the droplet size categories that were counted:

<u>µm observed diameter</u> <u>(upper limit of category)</u>	<u>µm true diameter</u>
41	36.35
58	46.25
82	60.23
116	79.99
164	107.81
231	146.52
327	201.70
462	278.75
654	387.24
925	538.16
1308	747.05
1850	1033.86
2616	1421.61

DROPLET SIZE CALCULATIONS

The percentage of droplets in each size category was calculated using the following equation:

$$\% \text{ drops in a category} = \frac{\# \text{ drops in category} \times 100}{\text{Total } \# \text{ drops}}$$

The droplet density (number of drops per unit area) was calculated using the following equation:

$$\text{Droplet Density} = \frac{\# \text{ drops}}{\text{area scanned (ft}^2\text{)}}$$

The mean droplet diameter was calculated by:

- 1) Determining the arithmetic mean for each size category.
- 2) Multiplying each size category mean by the proportion of droplets in the size category.
- 3) Obtaining the sum of all 11 weighted means calculated in 2).

The relative frequency distribution was calculated by:

- 1) Determining the arithmetic mean for each size category.
- 2) Obtain the percentage of droplets in each size category.
- 3) Compute the range of each category by subtracting the smallest value from the largest value.
- 4) Divide the value from 2) by the value from 3) for each category.
- 5) Plot the values from 1) versus the values from 4).

The relative frequency axis can then be interpreted as the percent of droplets at each discrete whole number diameter.

SURFACE WATER SAMPLING

SCOPE:

This method is for the collection of water samples for malathion and malaoxon.

SUMMARY:

All water samples were collected in 1 liter amber glass bottles with teflon lined lids. Each sample bottle was submerged and the cap was removed. The bottle was allowed to fill, then the cap was replaced while the bottle was still under the surface.

EQUIPMENT:

Sampling Equipment

Plastic bag - 18 x 24"
Stainless steel funnel
Stainless steel bucket
pH meter
Shoulder length gloves
Gloves
Deionized water for field blanks
Boots, Waders, and Rainsuits

Samples

1 L Amber Glass Bottles + teflon®-lined lids and Chain of Custody Records

Equipment Cleanup

Trash bag
Paper towels
Soap
Water
Deionized Water
Alcohol

Sample Storage

Wet Ice
Ice Chest

SAMPLING:

All personnel must wear disposable gloves when handling samples, and change to clean gloves if contamination is suspected.

- 1) Place the sample bottles near the body of water to be sampled, keeping all samples and sampling equipment on a large plastic bag (18"x24") to prevent contamination.
- 2) Fill two sample bottles by submerging them and removing the caps. Allow the bottles to fill, and replace the caps while the bottles are still under the surface. If necessary, the stainless steel bucket can be used to

obtain a sample which is then transferred into the bottle through the stainless steel funnel.

- 3) Fill one field blank sample bottle with deionized water and cap.
- 4) Place all samples in an ice chest with wet ice, and keep refrigerated until analyzed.
- 5) Measure the pH of the sampled water body. Record the site and sampling information on the chain of custody record.
- 6) Discard the plastic bag which was used as a dropcloth, and thoroughly clean all sampling equipment (soap and water wash, water rinse, deionized water rinse, and alcohol rinse).
- 7) Wait a minimum of 15 minutes after the area has been sprayed, and then collect the post spray samples (following steps 1 through 6).

DISCUSSION:

The storage dissipation test showed that at high pH, breakdown can occur even under refrigeration. Later tests showed that adjusting the pH to 3 with 3N hydrochloric acid will preserve malathion at least 28 days. The last few runoff samples were handled in this manner, but the earlier water samples were not.

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(916) 427-4649/4999

Original Date: 06/09/89
Supercedes: New
Current Date: 07/27/90
Method #:

MALATHION AND MALAOXON IN WATER

SCOPE:

This method is for the determination of malathion and malaoxon in water.

PRINCIPLE:

The samples of water were extracted by shaking in a separatory funnel with methylene chloride. The extract was filtered and evaporated to dryness. It was then transferred and brought up to final volume with acetone. The extract was analyzed by gas chromatography using a flame photometric detector (FPD).

REAGENTS AND EQUIPMENT:

Methylene chloride and acetone (pesticide residue grade)
Sodium sulfate (anhydrous)
Separatory funnels (2 L)
Boiling flasks, flat bottom with ground glass joint 24/40 (500 mL)
Glass stem funnels (65 mm/75 mm)
Rotary evaporator (Büchi/Brinkmann, R110)
Graduate test tubes (15 mL)
Nitrogen evaporator (Organomation Model # 12)
Vortex mixer for test tubes
Balance (Mettler PC 4400)
Filter paper (Whatman #4, 12.5 cm)

ANALYSIS:

- 1) Remove samples from refrigerated storage and allow them to come to room temperature. Samples consist of approximately 1 L and are stored in 1 L amber glass bottles to prevent any photodegradation from occurring.
- 2) Record weight of the sample by weighing sample bottle before and after transfer.
- 3) Extract sample by shaking with 100 mL of methylene chloride for 2 min.
- 4) Allow layers to separate and filter the organic layer through 25 g anhydrous sodium sulfate and filter paper. Collect extract in a 500 mL boiling flask.
- 5) Repeat steps 3 & 4 two more times using 80 mL of methylene chloride each time.

- 6) Rinse sodium sulfate with 20 mL additional methylene chloride and collect in the same 500 mL boiling flask.
- 7) Take extract just to dryness on a rotary evaporator. Add a 1-2 mL acetone to the flask to rinse down the sides.
- 8) Transfer extract to a graduated test tube. Rinse flask 3 times each with 2 mL of acetone. Transfer each wash to the same graduated test tube.
- 9) Place extract in a nitrogen evaporator with waterbath set at 35°C and evaporate to a final volume of 1 mL under a gentle stream of nitrogen.
- 10) Stopper the graduated test tube and mix contents by placing on a vibrating mixer for about 15 seconds. Submit sample for gas chromatographic analysis.

EQUIPMENT CONDITIONS:

PRIMARY ANALYSIS

Varian: 3700 GC with FPD

Column: DB-1701 (7% cyanopropyl & 7% phenol polysiloxane) 30 m x 0.552 mm
x 1.0 um

Carrier gas: Helium, Flow rate: 20 mL/min.

Injector: 200°C.

Detector: 250°C.

Temperature: 195°C isothermal

Injection volume: 2 uL

Retention times: Malathion 8.82 ± 0.1 min. Malaoxon 7.86 ± 0.1 min.

Linearity checked: 0.2 ng - 20 ng

CONFIRMATION ANALYSIS

Varian: 3700 GC WITH FPD

Column: DB-210 (50% tri-fluoropropyl methyl polysiloxane) 15 m x 0.537 mm
x 1.0 um

Carrier gas: Helium, Flow rate: 17 mL/min.

Injector: 220°C.

Detector: 260°C.

Temperature program: Initial Temp: 130°C held for 2 minutes.

Rate: 20°C/minute.

Final Temp: 180°C held for 3 minutes.

Injection volume: 2 uL

Retention times: Malathion 2.78 ± 0.1 min. Malaoxon 3.17 ± 0.1 min.

Linearity checked: 0.2 ng - 20 ng

CONFIRMATION ANALYSIS

Hewlett Packard 5880 A GC with FPD

Column: HP-1 (100% methyl polysiloxane) 10 m x 0.52 mm x 1.0 um

Carrier gas: Helium; Flow rate: 20 mL/min.

Injector: 220°C.

Detector: 250°.

Temperature: 170°C isothermal

Injection volume: 2 uL

Retention times: Malathion 5.21 ± 0.1 min. Malaoxon 3.85 ± 0.1 min

Linearity checked: 0.2 ng - 20 ng

CALCULATIONS:

PPB MALATHION AND MALAOXON

$$\text{ppb in sample} = \frac{(\text{peak height sample})(\text{ng/uL std})(\text{uL injected std})(\text{final volume mLs})(1000)}{(\text{peak height std})(\text{uL injected sample})(\text{weight of sample g})}$$

FORTIFICATION:

Malathion and malaoxon were spiked into separate 1 L volumes of water at the levels listed below.

RECOVERIES:

% Recoveries of malathion and malaoxon

Levels	Malathion(mean)	Malaoxon(mean)
0.5 ppb (n=2)	99	138
5.0 ppb (n=2)	106	124
50.0 ppb (n=2)	106	101
500 ppb (n=2)	103	96

Recovery validation was done prior to samples.

MINIMUM DETECTABLE LEVEL:

The minimum detectable level was 0.1 ppb (1 liter volume of sample used.)
S/N=4

DISCUSSION:

At the beginning and end of each run standards were run consisting of 0.1, 1, 2.5, 5 and 10 ng/uL. A 1, 2.5 and 5 ng/uL standards were run after every 10-12 samples. A separate 5 ppb spike for malathion and malaoxon was done with each set of samples.

REFERENCE:

- 1) White, Jane, *Diazinon, Chlorpyrifos, Parathion and Methidathion In Fog Water*, 1989, Environmental Monitoring Methods, California Department of Food and Agriculture.

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AIR SAMPLING METHODS

SCOPE:

This method is for the collection of air samples for malathion and malaaxon.

SUMMARY:

General Metal Works® high volume air samplers with Kurz® model 310 flow controllers calibrated at 1000 L min^{-1} were used to obtain samples in the schools and hospitals. A high volume air sample consisted of a glass jar containing 125 ml of Rohm and Haas XAD-2® resin. Gast® carbon-vented pumps or Anderson model 114 low volume air samplers running at approximately 15 L min^{-1} were used for private residences. A low volume air sample consisted of a glass tube containing 15 ml of XAD-2® resin. For both high volume and low volume samples, the air was drawn through the resin and the pesticide was trapped on its surface.

EQUIPMENT:

Sampling Equipment

General Metal Works high volume air sampler with Kurz model 310 controller
Top hat high volume calibrator
Rubber gaskets
Glass fiber filters
Sampler cover

Gast carbon-vented pump low volume air sampler
Anderson model 114 low volume air sampler
Rotometer
Duct tape
Utility Knife
Foam padding
Wooden dowel
Tygon tubing

3-prong adapter
Light socket adapter
Multiple plug adapter
Extension cord
Timer

Lantern or flashlight
Gloves

Samples

High volume sample jars, resin, and Chain of Custody Records
Low volume sample tubes, resin, and Chain of Custody Records

Equipment Cleanup

Trash bag
Paper towels
Soap
Water
Deionized Water
Alcohol

Sample Storage

Dry Ice
Icechest

SAMPLING:

All personnel must wear disposable gloves when handling samples, and change to clean gloves if contamination is suspected.

Sampler Setup

- 1) Place one Kurz model 310 high volume air sampler inside and one outside of the targeted building.
OR
Place two Anderson model 114 or one Gast carbon-vaned low volume air sampler(s) outside the targeted building, near an accessible window. Connect a length of tygon tubing to the intake of each Anderson sampler or two lengths of tubing to the Gast sampler; run one tube into the targeted building through the window, seal any gaps with duct tape and foam padding, and secure the window using the wooden dowel.
- 2) Connect the sampler(s) to electrical outlets, using the 3-prong adapter, light socket adapter, multiple plug adapter, or extension cord.
- 3) Connect the samplers to electrical timers, if desired.

Sample Preparation

- 4) With a clean pair of gloves, remove the high volume sample jars from their plastic bags and pour the premeasured XAD-2[®] resin (125 ml) into each jar.
OR
With a clean pair of gloves, remove the low volume sample tubes from their plastic bags and remove the rubber stoppers from both ends to expose the XAD-2 resin (15 ml).

Sampling

- 5) Put a glass fiber filter on the high volume sampler intake (used to maintain even flow over the intake, not to collect pesticide), attach the top plate on top of the filter, then connect the sample jar to the top plate using gaskets to prevent air leaks.
OR
Insert the low volume sample tube into the end of the tygon tube.

- 6) Start the sampler(s) and make sure that air is pulled through the resin and into the sampler(s). Using the rotometer, measure the flow rate through the low volume sample tubes.

Sample Collection

- 7) Wait the required amount of time (24 h for background and post spray samples, or the length of the application plus 0.5 h for the spray samples), then turn the sampler(s) off.
- 8) With a clean pair of gloves, remove the sample jars or tubes from the sampler(s), seal them in plastic bags, and immediately place them in an ice chest with dry ice. Keep the samples frozen until analyzed. Record the site and sampling information (including run time and flow rates) on the chain of custody record.

Equipment Cleanup

- 9) Wipe the outside of the samplers with alcohol soaked paper towels. Decontaminate all other sampling equipment by washing thoroughly (soap and water wash, water rinse, deionized water rinse, and alcohol rinse).

DISCUSSION:

The high volume and low volume samplers each have advantages and disadvantages. The primary advantage for high volume samplers is their lower detection limit. Low volume samplers are easier to transport and use, quieter, and require less power and resin. Since many samples had no detectable amount of pesticide, high volume samplers were used wherever possible to achieve the lower detection limit. High volume samplers could not be used at private residences because of the high noise of the pumps.

CALIFORNIA DEPT. OF FOOD & AGRIC.
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Original Date: 06/09/89
Supercedes: New
Current Date: 08/02/90
Method #:

MALATHION AND MALAOXON IN HIGH VOLUME AIR SAMPLER RESIN

SCOPE:

This method is for the determination of malathion and malaoxon in high volume air samplers containing XAD-2[®] resin.

PRINCIPLE:

Malathion and Malaoxon were extracted from XAD-2[®] resin with acetone. The solvent was rotary evaporated to dryness and the residues were brought back up to a final volume with acetone. The extract was analyzed using gas chromatography and a flame photometric detector (FPD).

REAGENTS AND EQUIPMENT:

Acetone; (pesticide residue grade)
Ultrasonic bath (Branson B72).
Chromatographic columns (19 mm by 500 mm Kimble).
Boiling flasks, flat bottom with ground glass joint 24/40 (500 mL).
Wide-mouth mason jars (pint size).
Rotary evaporator (Büchi/Brinkmann, R110).
Graduate test tubes (15 mL).
Nitrogen evaporator (Organomation Model # 12).
Vortex mixer for test tubes.
XAD-2[®] (Rohm and Haas); hexane-acetone soxhlet washed.

ANALYSIS:

- 1) Empty resin from the high volume air sampler into a wide mouth mason jar.
- 2) Add 150 mL of acetone to the mason jar. Cover the jar with foil and cap. Place it into an ultrasonic bath for 30 minutes.
- 3) Pour solvent and resin into a 19 mm diameter by 500 mm long chromatography column with a glass wool plug at the outlet end.
- 4) Allow solvent to flow from the column at a rate of 2-3 mL/minute into a 500 mL boiling flask.
- 5) Rinse the mason jar from step #1 with 100 mL of acetone; pour the solvent and any remaining resin into the column.
- 6) Allow solvent to elute into the same flask as before.
- 7) Elute column with an additional 50 mL of acetone.

- 8) Rotary evaporate the extract just to dryness at 35°C at approximately 20 mm Hg vacuum.
- 9) Add 1 mL of acetone to the flask. Then transfer the extract to a graduated test tube. Wash the flask 3 times each with 2 mL of acetone. Transfer each wash to the same graduated test tube.
- 10) Place extract on a nitrogen evaporator with waterbath set at 35°C and evaporate to a final volume of 1 mL under a gentle stream of nitrogen.
- 11) Stopper the graduated test tube and mix the contents by placing on a vortex mixer for about 15 seconds. Submit sample for gas chromatographic analysis.

EQUIPMENT CONDITIONS:

PRIMARY ANALYSIS

Varian 3700 GC with FPD

Column: DB-1701 (7% cyanopropyl & 7% phenol polysiloxane) 30 m x 0.552 mm
x 1.0 um

Carrier gas: Helium, Flow rate: 20 mL/min.

Injector: 200°C.

Detector: 250°C.

Temperature: 195°C isothermal

Injection volume: 2 uL

Retention times: Malathion 8.82 ±0.10 min. Malaoxon 7.86 ±0.10 min.

Linearity checked: 0.2 ng - 20 ng

CONFIRMATION ANALYSIS

VARIAN 3700 GC with FPD

Column: DB-210 (50% tri-fluoropropyl methyl polysiloxane) 15 m x 0.537 mm
x 1.0 um

Carrier gas: Helium, flow rate: 14 psi

Injection: 220°C.

Detector: 260°C.

Temperature program: Initial Temp: 130°C held for 2 minutes.

Rate: 20°C / minute.

Final Temp: 180°C held for 3 minutes.

Injection volume: 2 uL

Retention times: Malathion 2.78 ±0.10 min. Malaoxon 3.17 ±0.10 min.

Linearity checked: 0.2 ng - 20 ng

CONFIRMATION ANALYSIS

HEWLETT PACKARD 5880A GC with FPD

Column: HP-1 (100% methyl polysiloxane) 10 m x 0.52 mm x 1.0 um

Carrier gas: Helium, flow rate: 20 psi

Injector: 220°C.

Detector: 250°C.

Temperature: 170°C held for 7 minutes.

Injection volume: 2 uL

Retention times: Malathion 5.21 ±0.10 min. Malaoxon 3.85 ±0.10 min.

Linearity checked: 0.2 ng - 20 ng

CALCULATIONS:

Micrograms (UG) Malathion and Malaoxon

$$\text{ug in sample} = \frac{(\text{peak height sample})(\text{ng/uL std})(\text{uL injected std})(\text{final volume mLs})}{(\text{peak height std})(\text{uL sample injected})}$$

MINIMUM DETECTABLE LEVEL:

0.1 ug (125 mL resin in high volume air sampler) S/N=4

DISCUSSION:

Method validation was based on low volume air samplers validation. A separate spike for malathion and malaoxon at a 5 ug level was done for every 10 samples.

Due to the nature of the samples the injector liner had to be changed after every 20 samples to insure the minimum detectable limit.

REFERENCE:

- 1.) Echelberry, Jim., *Organophosphate Pesticides In High Volume Air Samples*, 1989 Environmental Monitoring Methods, California Department of Food and Agriculture.
- 2.) Schlocker, Peter L., *Wilder Ranch - Miscellaneous Organophosphate Pesticides in Low Volume Air Sampler Resin Samples*, 1983 Environmental Monitoring Methods, California Department of Food and Agriculture.

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Original Date: 06/09/89
Supercedes: New
Current Date: 08/02/90
Method #:

MALATHION AND MALAOXON IN LOW VOLUME AIR SAMPLER RESIN

SCOPE:

This method is for the determination of malathion and malaoxon in low volume air samplers containing resin.

PRINCIPLE:

Malathion and Malaoxon were extracted from XAD-2[®] resin with acetone. The solvent was rotary evaporated to dryness and the residues were brought back up to a final volume with acetone. The extract was analyzed using a gas chromatograph equipped with a flame photometric detector (FPD).

REAGENTS AND EQUIPMENT:

Acetone (pesticide residue grade)
Separatory funnels (125 mL)
Boiling flasks, flat bottom with ground glass joint 24/40 (250 mL)
Rotary evaporator (Büchi/Brinkmann, R110)
Graduate test tubes (15 mL)
Nitrogen evaporator (Organomation Model # 12)
Vortex mixer for test tubes
XAD-2[®] (Rohm and Haas); hexane:acetone soxhlet washed.

ANALYSIS:

- 1) Attach a low volume sampling tube containing XAD-2 resin over the mouth of a 250 mL flat bottom boiling flask.
- 2) Place a 125 mL separatory funnel containing 100 mL acetone above the low volume sampling tube.
- 3) Allow the solvent to drip into the low volume sampling tube at a rate such that the resin top surface is always covered with solvent, but without having any solvent run over the top of the tube.
- 4) Expell any remaining solvent in the resin tube with a gentle stream of house air.
- 5) Take extract just to dryness on a rotary evaporator at 35°C at approximately 20 mm Hg vacuum.
- 6) Add 1 mL of acetone to the flask. Then transfer the extract to a graduated test tube. Wash the flask 3 times each with 2 mL of acetone. Transfer each wash to the same graduated test tube.

- 7) Place extract in a nitrogen evaporator with waterbath set at 35°C and evaporate to a final volume of 1 mL under a gentle stream of nitrogen.
- 8) Stopper the graduated test tube and mix the content by placing on a vibrating mixer for about 15 seconds. Submit sample for gas chromatographic analysis.

EQUIPMENT CONDITIONS:

PRIMARY ANALYSIS

Varian 3700 GC with FPD
 Column: DB-1701 (7% cyanopropyl & 7% phenol polysiloxane) 30 m x 0.552 mm
 x 1.0 um
 Carrier gas: Helium, Flow rate: 20 mL/min.
 Injector: 200°C.
 Detector: 250°C.
 Temperature: 195°C isothermal.
 Injection volume: 2 uL.
 Retention times: Malathion 8.82 ±0.10 min. Malaoxon 7.86 ±0.10 min.
 Linearity checked: 0.2 ng - 20 ng.

CONFIRMATION ANALYSIS

Varian 3700 GC WITH FPD
 Column: DB-210 (50% tri-fluoropropyl methyl polysiloxane) 15 m x 0.537 mm
 x 1.0 um
 Carrier gas: Helium, Flow rate: 17 mL/min.
 Injector: 220°C.
 Detector: 260°C.
 Temperature program: Initial Temp: 130°C held for 2 minutes.
 Rate: 20°C minute.
 Final Temp: 180°C isothermal.
 Injection volume: 2 uL.
 Retention times: Malathion 2.78 ±0.10 min. Malaoxon 3.17 ±0.10 min.
 Linearity checked: 0.2 ng - 20 ng.

CONFIRMATION ANALYSIS

Hewlett Packard 5880A GC with FPD
 Column: HP-1 (100% methyl polysiloxane) 10 m x 0.52 mm x 1.0 um
 Carrier gas: Helium, Flow rate: 20 mL/min.
 Injector: 220°C.
 Detector: 250°.
 Temperature: 170°C isothermal.
 Injection volume: 2 uL.
 Retention times: Malathion 5.21 ±0.10 min. Malaoxon 3.85 ±0.10 min.
 Linearity checked: 0.2 ng - 20 ng

CALCULATIONS:

Micrograms (uG) MALATHION AND MALAOXON

$$\text{uG in sample} = \frac{(\text{peak height sample})(\text{ng/uL std})(\text{uL injected std})(\text{final volume mL})}{(\text{peak height std})(\text{uL injected sample})}$$

FORTIFICATION:

Malathion and malaoxon were spiked into low volume sampling tubes containing 15 mL of blank XAD-2[®] resin at the levels listed below.

RECOVERIES:

% Recoveries of malathion and malaoxon

Levels	Malathion(mean)	Malaoxon(mean)
0.5 ug (n=2)	110	128
5.0 ug (n=2)	108	119
50.0 ug (n=2)	110	108

Recovery validation done prior to analysis of samples.

MINIMUM DETECTABLE LEVEL:

The minimum detectable level was 0.1 ug (15 mL resin in low volume air sampler) S/N=4

DISCUSSION:

At the beginning and end of each run standards were run consisting of 0.1, 1, 2.5, 5 and 10 ng/uL. A 1, 2.5 and 5 ng/uL were ran after every 10-12 samples. A separate spike was done for malathion and malaoxon at 5 ug level for every 10 samples.

REFERENCE:

- 1) Schlocker, Peter L., *Wilder Ranch - Miscellaneous Organophate Pesticides In Low Volume Air Sampler Resin Samples*, 1983, Environmental Monitoring Methods, California Department of Food and Agriculture.

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AIR SAMPLE CALCULATIONS

The laboratory reported the results on a micrograms per sample basis. The air concentration was calculated using the following equation:

$$\text{air concentration } (\mu\text{g}/\text{m}^3) = \frac{\text{amount of pesticide } (\mu\text{g})}{\text{air flow } (\text{m}^3/\text{min}) \times \text{sampling period } (\text{min})}$$

Concentrations can also be expressed in parts per trillion (volume/volume basis). The following equation was used to convert from $\mu\text{g}/\text{m}^3$ to ppt (assuming the temperature is 81°F and air pressure is 1 atm):

$$\text{concentration (ppt)} = \frac{\text{Malathion } (\mu\text{g}/\text{m}^3) \times 82.05 \text{ (nL}/\mu\text{mol}\text{-}^\circ\text{K}) \times 300^\circ\text{K}}{330.36 \mu\text{g}/\mu\text{mol}}$$

The concentration for malaoxon can be calculated by substituting 314.30 for 330.36.

When malathion is converted to malaoxon the weight of the molecule changes (malathion molecular weight = 330.36, malaoxon MW = 314.30). To get an accounting of the pesticide mass it is necessary to adjust for the change in molecular weight. Therefore, total malathion and malaoxon is expressed as "malathion equivalents", with the malaoxon values adjusted to a malathion equivalent value. Malaoxon values are converted by multiplying by 330.36 and dividing by 314.30.

The sampling methods employed can produce artificially high values of malaoxon because malathion is converted to malaoxon within the sampler. A series of tests conducted to determine the rate of artificial oxidation is described in Appendix D.

APPENDIX B
FIELD SAMPLES-RAW DATA

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Mass Deposition.....	B-2
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Water.....	B-18
Air.....	B-23

Mass Deposition Data Key

Sample # - sample identification number

Date Collected - date of application

Corridor - Medfly Project spray area identification

Location Code - monitoring site identification

Sample Type - media type

FAL = plastic-backed paper (kimbie)

Sequence - application sequence number for monitoring purposes

Interval - period sample collected

S = Spray

Malathion - malathion concentration ($\mu\text{g}/\text{ft}^2$)

Malaoxon - malaoxon concentration ($\mu\text{g}/\text{ft}^2$)

Total - malathion + malaoxon concentration ($\mu\text{g}/\text{ft}^2$), with malaoxon adjusted for differences in molecular weight

Study 94: Medfly Mass Deposition Results

Date: 8/25/90

Sample #	Date Collected	Corridor	Location Code	Sample Type	Sequence	Interval	Malathion	Malaoxon	Total
1319	2/13/90	1	A 01	FAL	1	S	1496.94	8.46	1505.831
1315	2/13/90	1	A 02	FAL	1	S	2136.29	20.03	2157.342
1316	2/13/90	1	A 03	FAL	1	S	1623.28	11.96	1635.85
1313	2/13/90	1	A 04	FAL	1	S	1797.62	13.20	1811.493
1317	2/13/90	1	A 05	FAL	1	S	2216.69	11.82	2229.113
1314	2/13/90	1	A 06	FAL	1	S	2392.86	19.43	2413.281
1312	2/13/90	1	A 07	FAL	1	S	1275.79	13.57	1290.052
1311	2/13/90	1	A 08	FAL	1	S	1650.08	13.94	1664.731
1310	2/13/90	1	A 09	FAL	1	S	3594.95	43.89	3641.078
1309	2/13/90	1	A 10	FAL	1	S	2825.42	15.59	2841.805
1114	2/13/90	1	A 11	FAL	1	S	1901.57	14.06	1916.347
1120	2/13/90	1	A 12	FAL	1	S	436.24	4.34	440.8013
1116	2/13/90	1	A 13	FAL	1	S	2524.24	24.58	2550.074
1115	2/13/90	1	A 14	FAL	1	S	2550.34	24.35	2575.932
1118	2/13/90	1	A 15	FAL	1	S	2055.55	11.34	2067.468
1113	2/13/90	1	A 16	FAL	1	S	2580.16	11.62	2592.373
1130	2/13/90	1	A 17	FAL	1	S	2397.46	21.49	2420.046
1112	2/13/90	1	A 18	FAL	1	S	2388.06	26.55	2415.964
1117	2/13/90	1	A 19	FAL	1	S	1936.51	23.36	1961.061
1119	2/13/90	1	A 20	FAL	1	S	950.78	18.82	970.5598
1448	2/13/90	1	A 21	FAL	1	S	2457.03	23.44	2481.665
1449	2/13/90	1	A 22	FAL	1	S	1496.09	12.49	1509.217
1450	2/13/90	1	A 23	FAL	1	S	3246.09	29.76	3277.368
1451	2/13/90	1	A 24	FAL	1	S	2757.81	27.46	2786.67
1452	2/13/90	1	A 25	FAL	1	S	460.94	4.80	465.9848
1453	2/13/90	1	A 26	FAL	1	S	3453.13	41.50	3496.747
1454	2/13/90	1	A 27	FAL	1	S	1554.69	11.40	1566.671
1455	2/13/90	1	A 28	FAL	1	S	1828.13	9.00	1837.589
1456	2/13/90	1	A 29	FAL	1	S	1926.69	17.53	1945.114
1457	2/13/90	1	A 30	FAL	1	S	1382.81	13.40	1396.893
1324	2/13/90	1	A 31	FAL	1	S	1496.09	10.05	1506.653

Study 94: Medfly Mass Deposition Results

Date: 8/25/90

Sample #	Date		Location		Sample			Malathion	Malaoxon	Total
	Collected		Corridor	re Code	Type	Sequence	Interval			
1328	2/15/90		12	B 01	FAL	1	S	2583.05	17.17	2601.096
1333	2/15/90		12	B 02	FAL	1	S	3529.90	16.57	3547.315
1327	2/15/90		12	B 03	FAL	1	S	1756.64	9.54	1766.667
1326	2/15/90		12	B 04	FAL	1	S	3318.10	29.76	3349.378
1323	2/15/90		12	B 05	FAL	1	S	3488.37	31.41	3521.382
1322	2/15/90		12	B 06	FAL	1	S	1906.14	10.40	1917.07
1325	2/15/90		12	B 07	FAL	1	S	1823.09	5.83	1829.217
1320	2/15/90		12	B 08	FAL	1	S	2558.00	22.38	2581.521
1321	2/15/90		12	B 09	FAL	1	S	377.90	2.92	380.9689
1318	2/15/90		12	B 10	FAL	1	S	153.65	0.74	154.4277
1399	2/16/90		12	B 11	FAL	1	S	181.77	2.42	184.3134
1400	2/16/90		12	B 12	FAL	1	S	1382.89	15.93	1399.632
1401	2/16/90		12	B 13	FAL	1	S	1058.97	7.33	1066.674
1408	2/16/90		12	B 14	FAL	1	S	1965.46	14.41	1980.605
1404	2/15/90		12	B 15	FAL	1	S	1183.55	9.35	1193.377
1406	2/15/90		12	B 16	FAL	1	S	1681.89	12.41	1694.933
1402	2/15/90		12	B 17	FAL	1	S	3109.50	14.24	3124.466
1405	2/15/90		12	B 18	FAL	1	S	278.23	2.06	280.3951
1403	2/15/90		12	B 19	FAL	1	S	2155.31	1.79	2157.191
1407	2/15/90		12	B 20	FAL	1	S	780.73	5.82	786.8468
1374	2/16/90		12	B 21	FAL	1	S	1565.61	12.02	1578.243
1375	2/16/90		12	B 22	FAL	1	S	2570.60	14.22	2585.545
1361	2/16/90		12	B 23	FAL	1	S	2072.25	12.88	2085.787
1368	2/15/90		12	B 24	FAL	1	S	3666.94	33.98	3702.653
1367	2/15/90		12	B 25	FAL	1	S	2383.72	3.53	2387.43
1372	2/15/90		12	B 26	FAL	1	S	780.73	6.53	787.593
1363	2/15/90		12	B 27	FAL	1	S	2620.43	21.64	2643.174
1360	2/15/90		12	B 28	FAL	1	S			
1359	2/15/90		12	B 29	FAL	1	S	1723.42	11.98	1736.011
1362	2/15/90		12	B 30	FAL	1	S	523.26	3.59	527.0331

Study 94: Medfly Mass Deposition Results

Date: 8/25/90

Sample #	Date Collected	Corridor	Location Code	Sample Type	Sequence	Interval	Malathion	Malaoxon	Total
1433	2/19/90	9	C 01	FAL	1	S	201.55	1.88	203.5259
1434	2/19/90	9	C 02	FAL	1	S	2401.43	18.81	2421.199
1435	2/19/90	9	C 03	FAL	1	S	2473.12	15.26	2489.158
1436	2/19/90	9	C 04	FAL	1	S	3346.77	19.57	3367.338
1437	2/19/90	9	C 05	FAL	1	S	1751.79	9.76	1762.048
1438	2/19/90	9	C 06	FAL	1	no spray			
1440	2/19/90	9	C 08	FAL	1	S	1361	9.18	1370.648
1441	2/19/90	9	C 09	FAL	1	S	2105.73	10.28	2116.534
1442	2/19/90	9	C 10	FAL	1	S	1937.62	7.51	1945.513
1443	2/19/90	9	C 11	FAL	1	S	906.97	7.13	914.4636
3120	2/19/90	5	C 12	FAL	1	S	775.19	3.82	779.2048
3119	2/19/90	5	C 13	FAL	1	S	1143.41	6.34	1150.073
3118	2/19/90	5	C 14	FAL	1	S	2788.28	15.37	2804.434
3075	2/20/90	5	C 15	FAL	1	S	1003.88	5.77	1009.944
3116	2/20/90	5	C 16	FAL	1	S	2263.71	9.33	2273.516
3117	2/20/90	5	C 17	FAL	1	S	2079.4	9.98	2089.889
1289	2/19/90	5	C 18	FAL	1	S	4987.86	20.74	5009.658
1290	2/19/90	5	C 19	FAL	1	S	2981.39	18.23	3000.55
1288	2/19/90	5	C 20	FAL	1	S	3309.06	16.58	3326.486
1297	2/20/90	5	C 21	FAL	1	S	2609.22	26.8	2637.387
1298	2/20/90	5	C 22	FAL	1	S	2738.29	10.45	2749.273
1329	2/20/90	6	C 23	FAL	1	S	2589.61	14.07	2604.398
1332	2/20/90	6	C 24	FAL	1	S	2365.59	13.39	2379.663
1330	2/20/90	6	C 25	FAL	1	S	2267.03	9.51	2277.025
1331	2/20/90	6	C 26	FAL	1	S	2679.21	23.15	2703.541
1286	2/20/90	6	C 27	FAL	1	S	1970.06	10.76	1981.369
1296	2/20/90	6	C 28	FAL	1	S	1650.48	8.6	1659.519
1301	2/20/90	6	C 29	FAL	1	S	2284.9	9.93	2295.336
1300	2/20/90	6	C 30	FAL	1	S	2476.17	11.43	2488.183
1299	2/20/90	6	C 31	FAL	1	S	759.25	8.66	768.3517
1336	2/19/90	9	C 32	FAL	1	no spray			

Study 94: Medfly Mass Deposition Results

Date: 8/25/90

Sample #	Date Collected	Corridor	Location Code	Sample Type	Sequence	Interval	Malathion	Malaoxon	Total
1439	2/21/90	7	D 01	FAL	1	S	1023.81	6.51	1030.652
1444	2/21/90	7	D 02	FAL	1	S	1589.21	7.51	1597.103
1445	2/21/90	7	D 03	FAL	1	S	992.06	4.68	996.9787
1446	2/21/90	7	D 04	FAL	1	S	1073.64	7.68	1081.712
1356	2/22/90	7	D 05	FAL	1	S	1197.67	7.57	1205.626
1447	2/22/90	7	D 06	FAL	1	S	452.38	1.69	454.1562
1285	2/22/90	7	D 07	FAL	1	S	1147.29	7.30	1154.962
1284	2/22/90	7	D 08	FAL	1	S	1755.51	13.42	1769.614
1291	2/22/90	7	D 09	FAL	1	S	1870.40	9.95	1880.857
1295	2/22/90	7	D 10	FAL	1	S	3175.56	21.85	3198.524
1365	2/21/90	7	D 12	FAL	1	S	1819.85	6.50	1826.682
1366	2/21/90	7	D 13	FAL	1	S	3226.10	13.67	3240.467
1369	2/21/90	7	D 14	FAL	1	S	3465.07	24.56	3490.883
1370	2/21/90	7	D 15	FAL	1	S	3125.00	16.68	3142.531
1371	2/21/90	7	D 16	FAL	1	S	2486.21	15.34	2502.332
1373	2/21/90	7	D 17	FAL	1	S	3097.43	21.52	3120.048
1376	2/21/90	7	D 18	FAL	1	S	1267.44	7.47	1275.291
1377	2/21/90	7	D 19	FAL	1	S	1452.38	12.34	1465.349
1378	2/21/90	7	D 20	FAL	1	S	1265.87	7.70	1273.963
1379	2/21/90	7	D 21	FAL	1	no spray			
1380	2/21/90	7	D 22	FAL	1	S	1974.91	9.83	1985.241
3115	2/21/90	7	D 23	FAL	1	S	4541.67	28.30	4571.413
3114	2/21/90	7	D 24	FAL	1	S	580.88	2.71	583.7282
3113	2/21/90	7	D 25	FAL	1	no spray			
3112	2/21/90	7	D 26	FAL	1	S	1791.66	17.40	1809.947
3111	2/21/90	7	D 27	FAL	1	no spray			
3110	2/22/90	7	D 28	FAL	1	S	2694.70	15.98	2711.495
3109	2/22/90	7	D 29	FAL	1	S	1123.27	2.49	1125.887
3108	2/22/90	7	D 30	FAL	1	S	889.95	4.66	894.8477
3107	2/22/90	7	D 31	FAL	1	S	2179.37	20.22	2200.621
3104	2/22/90	7	D 32	FAL	1	S	1737.91	8.57	1746.917
3105	2/22/90	7	D 33	FAL	1	S	853.17	4.90	858.3199

Study 94: Medfly Mass Deposition Results

Date: 8/25/90

Sample #	Date	Location		Sample			Malathion	Malaaxon	Total
	Collected	Corridor	re Code	Type	Sequence	Interval			
3305	3/14/90	7	D 02	FAL	2	S	1461.53	5.88	1467.71
3304	3/14/90	7	D 03	FAL	2	S	1864.28	8.84	1873.571
3335	3/14/90	7	D 05	FAL	2	no spray			
3301	3/15/90	7	D 06	FAL	2	S	2770.19	15.90	2786.901
3300	3/15/90	7	D 07	FAL	2	S	884.92	6.09	891.3206
3297	3/15/90	7	D 08	FAL	2	S	173.71	0.00	173.71
3298	3/15/90	7	D 10	FAL	2	S	2143.50	12.28	2156.406
3296	3/14/90	7	D 12	FAL	2	S	2269.10	14.49	2284.329
3325	3/14/90	7	D 14	FAL	2	S	1682.99	1.31	1684.367
3324	3/14/90	7	D 15	FAL	2	S	1999.50	8.31	2008.234
3327	3/14/90	7	D 16	FAL	2	S	1265.91	5.48	1271.669
3326	3/15/90	7	D 17	FAL	2	S	1777.92	7.75	1786.065
3321	3/15/90	7	D 18	FAL	2	S	2480.52	11.99	2493.121
3320	3/15/90	7	D 19	FAL	2	S	2799.27	13.09	2813.028
3319	3/15/90	7	D 20	FAL	2	S	2495.52	11.03	2507.113
3318	3/15/90	7	D 22	FAL	2	S	1915.92	8.36	1924.706
3302	3/15/90	7	D 05	FAL	2	S	3809.91	14.94	3825.612
3331	3/14/90	7	D 27	FAL	2	no spray			
3338	3/15/90	7	D 29	FAL	2	S	1227.23	4.66	1232.128
3336	3/15/90	7	D 31	FAL	2	S	2184.81	11.24	2196.623
3328	3/15/90	7	D 33	FAL	2	S	1305.65	5.89	1311.84
3329	3/15/90	7	D 34	FAL	2	S	585.64	7.60	593.6276
3341	3/15/90	7	D 35	FAL	2	S	756.60	0.00	756.6
3306	3/14/90	7	D 36	FAL	2	S	2406.61	10.37	2417.509
3303	3/14/90	7	D 37	FAL	2	S	877.38	3.38	880.9324
3299	3/15/90	7	D 38	FAL	2	S	631.61	3.51	635.299
3333	3/14/90	7	D 40	FAL	2	S	1332.42	6.68	1339.441
3334	3/14/90	7	D 41	FAL	2	S	2632.89	14.85	2648.497
3340	3/14/90	7	D 42	FAL	2	S	705.55	3.37	709.0919
3342	3/15/90	7	D 43	FAL	2	S	695.88	2.91	698.9384
3330	3/15/90	7	D 44	FAL	2	S	2022.89	10.49	2033.915
3317	3/14/90	7	D 51	FAL	2	S	1042.79	3.84	1046.826

Sample #	Date		Location		Sample			Malathion	Malaoxon	Total
	Collected		Corridor	re Code	Type	Sequence	Interval			
3151	4/4/90		7	D 02	FAL	3	S	2317.83	11.01	2329.402
3150	4/4/90		7	D 03	FAL	3	S	2673.51	13.53	2687.73
3148	4/5/90		7	D 05	FAL	3	S	2162.72	9.11	2172.295
3146	4/5/90		7	D 06	FAL	3	S	3946.07	18.59	3965.608
3147	4/5/90		7	D 07	FAL	3	S	861.76	3.56	865.5016
3145	4/5/90		7	D 08	FAL	3	S	3548.86	16.62	3566.328
3167	4/5/90		7	D 12	FAL	3	S	1023.93	6.29	1030.541
3164	4/4/90		7	D 14	FAL	3	S	2344.31	10.47	2355.314
3163	4/5/90		7	D 15	FAL	3	S	2096.91	8.48	2105.822
3162	4/5/90		7	D 16	FAL	3	S	3191.37	11.64	3203.604
3161	4/5/90		7	D 17	FAL	3	S	2381.01	5.28	2386.559
3160	4/5/90		7	D 18	FAL	3	S	2577.38	11.11	2589.057
3159	4/5/90		7	D 19	FAL	3	S	1213.43	4.75	1218.422
3154	4/5/90		7	D 20	FAL	3	S	4847.89	23.81	4872.914
3157	4/5/90		7	D 22	FAL	3	S	2297.50	9.77	2307.768
3137	4/5/90		7	D 29	FAL	3	S	908.11	4.07	912.3876
3136	4/5/90		7	D 31	FAL	3	S	4573.99	21.73	4596.828
3135	4/5/90		7	D 33	FAL	3	S	3223.56	14.99	3239.314
3134	4/5/90		7	D 34	FAL	3	S	1550.79	8.09	1559.293
3141	4/5/90		7	D 35	FAL	3	S	3637.28	19.02	3657.27
3152	4/4/90		7	D 36	FAL	3	S	2524.07	12.07	2536.756
3149	4/4/90		7	D 37	FAL	3	S	3215.68	16.42	3232.937
3125	4/5/90		7	D 38	FAL	3	S	350.18	2.44	352.7444
3124	4/5/90		7	D 39	FAL	3	S	4065.56	20.68	4087.295
3144	4/5/90		7	D 40	FAL	3	S	1938.55	10.68	1949.775
3143	4/5/90		7	D 41	FAL	3	S	2738.21	14.53	2753.481
3139	4/5/90		7	D 43	FAL	3	S	2679.60	16.9	2697.362
3138	4/5/90		7	D 44	FAL	3	S	1889.79	11.23	1901.593
3142	4/5/90		7	D 45	FAL	3	S	2870.96	14.78	2886.494
3165	4/4/90		7	D 51	FAL	3	S	3029.75	13.6	3044.044

Study 94: Medfly Mass Deposition Results

Date: 8/25/90

Sample #	Date		Location		Sample			Malathion	Malaaxon	Total
	Collected		Corridor	re Code	Type	Sequence	Interval			
4970	4/25/90		7	D 02	FAL	4	S	2527.01	10.21	2537.741
4979	4/25/90		7	D 03	FAL	4	S	1952.48	7.61	1960.478
4992	4/26/90		7	D 05	FAL	4	S	2342.66	8.67	2351.772
4981	4/26/90		7	D 06	FAL	4	S	2667.55	10.59	2678.68
4991	4/26/90		7	D 08	FAL	4	S	1520.74	6.29	1527.351
3085	4/25/90		7	D 15	FAL	4	S	2163.21	8.75	2172.406
3072	4/26/90		7	D 17	FAL	4	S	298.85	1.27	300.1848
3073	4/26/90		7	D 18	FAL	4	S	2667.59	8.88	2676.923
3074	4/26/90		7	D 19	FAL	4	S	4990.56	17.32	5008.763
1382	4/26/90		7	D 20	FAL	4	S	2288.78	5.44	2294.497
4961	4/26/90		7	D 29	FAL	4	S	1979.96	5.40	1985.635
4959	4/26/90		7	D 31	FAL	4	S	1435.42	5.11	1440.791
4958	4/26/90		7	D 33	FAL	4	S	887.27	2.90	890.3179
4964	4/26/90		7	D 34	FAL	4	S	504.33	1.60	506.0116
4969	4/25/90		7	D 36	FAL	4	S	1248.60	4.77	1253.613
4980	4/25/90		7	D 37	FAL	4	S	2079.35	7.60	2087.338
4982	4/26/90		7	D 38	FAL	4	S	2557.73	8.93	2567.115
4990	4/26/90		7	D 39	FAL	4	S	2316.20	9.05	2325.712
4967	4/25/90		7	D 41	FAL	4	S	2571.18	10.08	2581.774
4960	4/26/90		7	D 44	FAL	4	S	2106.29	7.31	2113.973
4966	4/25/90		7	D 45	FAL	4	S	140.54	0	140.54
4968	4/25/90		7	D 52	FAL	4	S	2059.13	2.63	2061.894
4963	4/26/90		7	D 53	FAL	4	S	3509.94	14.19	3524.854
4962	4/26/90		7	D 54	FAL	4	S	1428.97	5.01	1434.236
4950	4/26/90		7	D 57	FAL	4	S	4623.68	18.76	4643.397

Droplet Size Data Key

Sample # - sample identification number

Location Code - monitoring site identification

Corridor - Medfly Project spray area identification

Sequence - application sequence number for monitoring purposes

Date Collected - date of application

Area-sq cm - area scanned for droplets (cm²)

The next 13 fields show the number of drops in each size category

Drops Counted - total number of drops counted

Drops (#/sq ft) - droplet density

Study 94: Medfly Droplet Size Results

Date: 8/25/90

Graticle	3	4	5	6	7	8	9	10	11	12	13	
Stain Dia	82	116	164	231	327	462	654	925	1308	1850	2616	
True Dia. Min	46	60	80	108	147	202	279	387	538	747	1034	
True Dia. Max	60	80	108	147	202	279	387	538	747	1034	1422	1422+

B-11

Samp #	Location	Corridor	Sequence	Date Collected	Area-sq cm													# Drops Counted	# Drops (#/sq ft)
1539	A01	1	1	2/13/90	37.5	2	2	3	2	14	10	4	6	2	0	0	0	45	1114.92
1540	A02	1	1	2/13/90	37.5	0	0	0	2	22	21	12	2	3	2	0	0	64	1585.664
1542	A03	1	1	2/13/90	33.0	2	6	2	1	4	3	5	5	1	0	0	0	29	816.4818
1543	A04	1	1	2/13/90	37.5	1	0	0	1	0	0	0	0	3	2	2	0	9	222.984
1487	A05	1	1	2/13/90	37.5	0	0	2	4	22	17	28	12	2	0	0	0	87	2155.512
1491	A06	1	1	2/13/90	37.5	0	0	2	0	5	1	4	5	1	1	0	0	19	470.744
1489	A07	1	1	2/13/90	37.5	0	1	1	3	3	3	1	0	0	3	0	0	15	371.64
1493	A08	1	1	2/13/90	37.5	1	1	0	0	0	0	0	1	1	0	0	1	5	123.88
1494	A09	1	1	2/13/90	32.4	0	1	0	2	8	1	3	6	0	1	1	0	23	659.5463
1488	A10	1	1	2/13/90	37.5	2	0	2	4	10	11	10	1	1	0	0	0	41	1015.816
1504	A11	1	1	2/13/90	32.7	0	0	0	0	4	3	4	3	1	0	0	0	15	426.1927
1510	A12	1	1	2/13/90	37.5	0	1	0	2	1	2	0	0	0	0	0	0	6	148.656
1505	A13	1	1	2/13/90	31.5	0	0	1	1	7	7	5	0	8	1	0	0	30	884.8571
1506	A14	1	1	2/13/90	37.5	0	1	0	0	1	3	7	10	2	1	1	0	26	644.176
1509	A15	1	1	2/13/90	37.5	0	1	2	6	5	6	4	0	0	0	0	0	24	594.624
1520	A16	1	1	2/13/90	37.5	0	4	2	8	13	1	6	1	0	0	3	0	38	941.488
1521	A17	1	1	2/13/90	DESTROY														
1519	A18	1	1	2/13/90	37.5	0	0	0	1	2	9	7	0	1	0	0	0	20	495.52
1507	A19	1	1	2/13/90	32.7	0	1	1	3	11	5	0	0	1	0	0	0	22	625.0826
1508	A20	1	1	2/13/90	32.4	0	1	4	5	8	4	0	1	1	1	0	0	25	716.8981
1152	A21	1	1	2/13/90	37.5	0	3	3	4	0	8	8	5	0	0	0	0	31	768.056
1169	A22	1	1	2/13/90	37.8	0	1	0	2	7	6	8	1	1	0	0	0	26	639.0635
1154	A23	1	1	2/13/90	37.5	0	0	0	2	2	14	17	8	3	0	1	0	47	1164.472
1155	A24	1	1	2/13/90	38.1	0	0	2	3	8	2	2	9	1	1	0	0	28	682.8031
1156	A25	1	1	2/13/90	37.5	0	2	0	1	0	0	0	0	0	0	0	0	3	74.328
1157	A26	1	1	2/13/90	33.0	0	0	3	1	5	2	4	2	0	4	0	0	21	591.2455
1168	A27	1	1	2/13/90	33.0	0	0	3	0	0	2	2	0	1	0	0	0	8	225.2364
1153	A28	1	1	2/13/90	37.5	0	0	0	0	1	0	1	0	4	5	0	0	11	272.536
1171	A29	1	1	2/13/90	37.5	0	0	0	1	2	7	2	0	0	0	1	0	13	322.088
1170	A30	1	1	2/13/90	37.5	0	1	0	0	1	4	8	3	0	0	0	0	17	421.192
1490	A31	1	1	2/13/90	37.5	0	1	2	3	17	11	7	3	2	2	0	0	48	1189.248

Study 94: Medfly Droplet Size Results

Date: 8/25/90

Graticle	3	4	5	6	7	8	9	10	11	12	13	
Stain Dia	82	116	164	231	327	462	654	925	1308	1850	2616	
True Dia. Min	46	60	80	108	147	202	279	387	538	747	1034	
True Dia. Max	60	80	108	147	202	279	387	538	747	1034	1422	1422+

B-13

Samp #	Location	Corridor	Sequence	Date	Area-sq cm	3	4	5	6	7	8	9	10	11	12	13	# Drops Counted	# Drops (#/sq ft)
1150	C01	9	1	2/19/90	38.1	0	0	0	0	0	0	0	0	0	0	0	0	0
1151	C02	9	1	2/19/90	38.1	0	0	5	14	23	14	6	1	0	0	0	63	1536.307
1158	C03	9	1	2/19/90	32.4	0	0	0	0	1	3	0	4	1	3	2	14	401.463
1159	C04	9	1	2/19/90	32.4	0	0	3	4	11	5	2	3	1	2	2	33	946.3056
1160	C05	9	1	2/19/90	31.8	0	0	3	5	2	4	3	0	1	0	0	18	525.9057
1161	C06	9	1	2/19/90		NO SPRAY												
1163	C08	9	1	2/19/90	38.1	0	0	8	13	12	6	3	2	1	0	2	47	1146.134
1164	C09	9	1	2/19/90	38.1	0	0	2	7	10	8	2	2	0	0	1	32	780.3465
1162	C10	9	1	2/19/90	38.1	0	0	6	6	4	7	4	3	5	1	3	39	951.0472
1165	C11	9	1	2/19/90	38.1	0	0	2	1	3	2	3	0	0	0	3	14	341.4016
3418	C12	5	1	2/19/90	38.1	0	1	2	6	4	3	5	2	0	0	0	23	560.874
3421	C13	5	1	2/19/90	38.1	0	0	8	23	23	7	0	0	0	0	1	62	1511.921
3414	C14	5	1	2/19/90	38.1	0	0	5	4	22	20	7	1	3	0	0	62	1511.921
3377	C15	5	1	2/19/90	38.1	0	0	0	5	10	5	2	1	1	0	0	24	585.2598
3413	C16	5	1	2/19/90	38.1	0	0	0	0	3	8	8	5	0	0	0	24	585.2598
3422	C17	5	1	2/19/90	38.1	0	0	0	1	1	0	0	1	1	0	0	4	97.54331
1564	C18	5	1	2/19/90	38.1	0	0	0	8	10	7	1	1	2	6	4	39	951.0472
1565	C19	5	1	2/19/90	38.1	0	0	2	6	2	4	2	0	0	3	1	20	487.7165
1483	C20	5	1	2/19/90	38.1	0	0	8	11	12	13	4	2	2	1	1	56	1365.606
1482	C21	5	1	2/19/90	38.1	0	0	4	15	14	8	4	3	4	2	0	54	1316.835
1566	C22	5	1	2/19/90	38.1	0	0	1	9	8	12	3	1	0	3	2	39	951.0472
3412	C23	6	1	2/19/90	38.1	0	0	1	2	6	7	1	1	2	0	0	21	512.1024
3416	C24	6	1	2/19/90	38.1	0	1	4	8	9	7	4	3	2	1	0	39	951.0472
3417	C25	6	1	2/19/90	38.1	0	0	1	4	6	1	4	12	3	3	0	34	829.1181
3415	C26	6	1	2/19/90	38.1	0	0	0	0	1	1	0	4	0	0	0	9	219.4724
1480	C27	6	1	2/19/90	38.1	0	1	2	0	0	0	3	3	2	2	0	14	341.4016
1481	C28	6	1	2/19/90	38.1	0	0	0	1	0	0	1	2	3	1	0	8	195.0866
1479	C29	6	1	2/19/90	38.1	0	0	1	0	4	1	0	1	1	2	1	11	268.2441
1478	C30	6	1	2/19/90	38.1	0	0	1	1	6	7	2	0	0	1	1	19	463.3307
1525	C31	6	1	2/19/90	38.1	0	0	1	2	6	4	2	1	0	2	0	18	438.9449
3389	C32	9	1	2/19/90		NO SPRAY												

Study 94: Medfly Droplet Size Results

Date: 8/25/90

Graticle	3	4	5	6	7	8	9	10	11	12	13	
Stain Dia	82	116	164	231	327	462	654	925	1308	1850	2616	
True Dia. Min	46	60	80	108	147	202	279	387	538	747	1034	
True Dia. Max	60	80	108	147	202	279	387	538	747	1034	1422	1422+

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Samp #	Location	Corridor	Sequence	Date Collected	Area-sq cm	3	4	5	6	7	8	9	10	11	12	13	# Drops Counted	# Drops (#/sq ft)	
1544	D01	7	1	2/21/90	38.1	0	0	0	0	1	1	15	2	1	0	0	0	20	487.7165
1546	D02	7	1	2/21/90	38.1	0	0	0	0	0	0	0	6	2	0	0	0	8	195.0866
1547	D03	7	1	2/21/90	38.1	0	0	0	0	0	4	10	1	0	1	0	0	16	390.1732
1548	D04	7	1	2/21/90	38.1	0	0	0	0	3	1	2	2	2	0	0	0	10	243.8583
1522	D05	7	1	2/21/90	32.1	0	0	0	3	12	17	5	0	0	0	0	0	37	1070.925
1549	D06	7	1	2/21/90	38.1	0	0	0	0	0	0	0	0	0	1	0	0	1	24.38583
1476	D07	7	1	2/21/90	38.1	0	0	0	0	6	8	6	3	0	0	0	0	23	560.874
1475	D08	7	1	2/21/90	38.1	0	0	0	0	0	0	0	0	1	2	0	0	3	73.15748
1474	D09	7	1	2/21/90		NO SPRAY													
1460	D10	7	1	2/21/90	38.1	0	0	0	0	11	14	11	4	3	0	0	0	43	1048.591
1550	D12	7	1	2/21/90	38.1	0	0	0	1	2	12	12	6	0	0	0	0	33	804.7323
1551	D13	7	1	2/21/90	38.1	0	0	2	0	9	19	20	12	0	0	0	0	62	1511.921
1569	D14	7	1	2/21/90	38.1	0	0	2	0	7	21	33	5	2	0	0	0	70	1707.008
1567	D15	7	1	2/21/90	38.1	0	0	0	0	0	3	8	13	3	0	0	0	27	658.4173
1568	D16	7	1	2/21/90	38.1	0	0	0	2	17	19	9	2	1	0	0	0	50	1219.291
1570	D17	7	1	2/21/90	38.1	0	0	0	0	4	4	6	1	6	2	0	0	23	560.874
1571	D18	7	1	2/21/90	38.1	0	0	0	0	0	3	12	2	2	0	0	0	19	463.3307
1572	D19	7	1	2/21/90	38.1	0	0	0	0	0	0	3	5	6	0	0	0	14	341.4016
1573	D20	7	1	2/21/90	32.4	0	0	0	0	0	0	5	0	2	1	0	0	8	229.4074
1574	D21	7	1	2/21/90		NO SPRAY													
1577	D22	7	1	2/21/90	38.1	0	0	0	0	7	7	6	3	1	2	0	0	26	634.0315
1536	D23	7	1	2/21/90	38.1	0	0	0	3	11	14	9	2	5	10	4	0	58	1414.378
1537	D24	7	1	2/21/90	38.1	0	0	1	0	0	0	0	0	0	0	0	0	1	24.38583
1535	D25	7	1	2/21/90		NO SPRAY													
3419	D26	7	1	2/21/90	38.1	0	0	0	0	0	0	0	0	0	2	3	1	6	146.315
3420	D27	7	1	2/21/90		NO SPRAY													
3411	D28	7	1	2/21/90	38.1	0	1	0	3	13	6	3	5	6	2	0	1	40	975.4331
3410	D29	7	1	2/21/90	38.1	0	0	0	0	3	2	3	3	1	1	0	0	13	317.0157
3409	D30	7	1	2/21/90	38.1	0	0	0	0	11	4	0	0	0	0	0	0	15	365.7874
3408	D31	7	1	2/21/90	38.1	0	1	0	1	6	2	13	1	2	0	3	0	29	707.189
3407	D32	7	1	2/21/90	38.1	0	0	0	2	1	0	0	1	1	2	1	0	8	195.0866
3406	D33	7	1	2/21/90	38.1	0	0	0	0	4	1	3	3	3	2	0	0	16	390.1732

Study 94: Medfly Droplet Size Results

Date: 8/25/90

Graticle	3	4	5	6	7	8	9	10	11	12	13	
Stain Dia	82	116	164	231	327	462	654	925	1308	1850	2616	
True Dia. Min	46	60	80	108	147	202	279	387	538	747	1034	
True Dia. Max	60	80	108	147	202	279	387	538	747	1034	1422	1422+

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Samp #	Location	Corridor	Sequence	Date Collected	Area-sq cm	Date											# Drops Counted	# Drops (#/sq ft)	
						3	4	5	6	7	8	9	10	11	12	13			
3358	D02	7	2	3/14/90	38.1	0	0	0	3	17	14	5	4	0	0	0	0	43	1048.591
3359	D03	7	2	3/14/90	38.1	0	0	1	5	3	4	5	7	4	0	0	0	29	707.189
3361	D05	7	2	3/14/90	38.1	0	0	1	14	10	15	16	14	2	1	1	0	74	1804.551
3362	D06	7	2	3/14/90	38.1	0	0	0	7	17	17	7	8	5	11	0	0	72	1755.78
3363	D07	7	2	3/14/90	38.1	0	0	0	0	0	3	10	5	1	0	0	0	19	463.3307
3370	D08	7	2	3/14/90	38.1	0	0	0	3	3	0	0	0	0	0	0	0	6	146.315
3372	D10	7	2	3/14/90	38.1	0	0	0	1	7	6	0	0	0	0	1	0	15	365.7874
3391	D12	7	2	3/14/90	38.1	0	0	1	12	9	7	10	1	1	0	0	0	41	999.8189
3393	D14	7	2	3/14/90	38.1	0	0	1	1	16	13	13	2	0	0	0	0	46	1121.748
3394	D15	7	2	3/14/90	38.1	0	0	0	0	4	12	0	2	2	2	1	0	23	560.874
3395	D16	7	2	3/14/90	38.1	0	0	0	1	12	7	1	0	6	1	0	0	28	682.8031
3397	D17	7	2	3/14/90	38.1	0	0	0	6	15	8	7	5	1	0	2	0	44	1072.976
3398	D18	7	2	3/14/90	38.1	0	0	0	0	0	0	13	14	11	4	0	0	42	1024.205
3399	D19	7	2	3/14/90	38.1	0	0	0	1	10	4	6	4	3	0	4	0	32	780.3465
3400	D20	7	2	3/14/90	38.1	0	0	2	11	15	9	5	13	4	3	0	0	62	1511.921
3401	D22	7	2	3/14/90	38.1	0	0	0	3	4	10	12	7	1	1	0	0	38	926.6614
1136	D27	7	2	3/14/90		NO SPRAY													
1135	D29	7	2	3/14/90	38.1	0	0	0	0	0	0	0	0	3	4	0	0	7	170.7008
3380	D31	7	2	3/14/90	38.1	0	0	0	0	1	7	7	2	0	2	1	0	20	487.7165
3405	D33	7	2	3/14/90	38.1	0	0	0	5	5	5	4	3	9	4	0	0	35	853.5039
3390	D34	7	2	3/14/90	38.1	0	0	0	0	2	0	0	0	0	0	3	0	5	121.9291
1137	D35	7	2	3/14/90	38.1	0	0	0	0	3	5	5	5	0	0	0	0	18	438.9449
3357	D36	7	2	3/14/90	38.1	0	0	5	11	16	12	5	11	0	0	0	0	60	1463.15
3360	D37	7	2	3/14/90	38.1	0	0	0	0	7	13	6	6	0	0	0	0	32	780.3465
3364	D38	7	2	3/14/90	38.1	0	0	1	5	6	2	3	3	0	0	0	0	20	487.7165
1167	D40	7	2	3/14/90	32.4	0	0	0	0	1	3	8	1	1	0	0	0	14	401.463
3404	D41	7	2	3/14/90	38.1	0	0	5	21	15	9	13	4	3	1	0	0	71	1731.394
3403	D42	7	2	3/14/90	38.1	0	0	0	1	0	0	0	1	2	0	0	0	4	97.54331
1166	D43	7	2	3/14/90	32.1	0	0	0	2	6	4	5	6	0	0	0	0	23	665.7103
1139	D44	7	2	3/14/90	38.1	0	0	0	0	3	5	4	1	5	1	1	0	20	487.7165
3392	D51	7	2	3/14/90	38.1	0	0	9	15	34	11	3	0	0	0	0	0	72	1755.78

Study 94: Medfly Droplet Size Results

Date: 8/25/90

Graticle	3	4	5	6	7	8	9	10	11	12	13	
Stain Dia	82	116	164	231	327	462	654	925	1308	1850	2616	
True Dia. Min	46	60	80	108	147	202	279	387	538	747	1034	
True Dia. Max	60	80	108	147	202	279	387	538	747	1034	1422	1422+

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Samp #	Location	Corridor	Sequence	Date Collected	Area-sq cm	3	4	5	6	7	8	9	10	11	12	13	# Drops Counted	# Drops (#/sq ft)	
3455	D02	7	3	4/4/90	38.1	0	1	1	0	6	6	6	1	2	2	1	0	26	634.0315
3454	D03	7	3	4/4/90	38.1	0	0	0	4	12	9	9	2	0	1	0	0	37	902.2756
3373	D05	7	3	4/4/90	38.1	0	1	1	6	6	10	2	3	2	0	0	0	31	755.9606
3374	D06	7	3	4/4/90	38.1	0	0	0	6	5	10	0	2	4	3	0	0	30	731.5748
3447	D07	7	3	4/4/90	37.7	0	0	7	23	13	1	0	0	0	0	0	0	44	1084.361
3451	D08	7	3	4/4/90	37.7	0	0	2	5	7	6	5	3	3	2	1	0	34	837.9151
3388	D12	7	3	4/4/90	37.7	0	0	0	0	0	7	7	1	2	0	0	0	17	418.9576
3384	D14	7	3	4/4/90	38.1	0	0	0	7	7	9	10	2	2	2	1	0	40	975.4331
3383	D15	7	3	4/4/90	38.1	0	0	1	11	22	8	5	3	1	4	0	0	55	1341.22
3376	D16	7	3	4/4/90	38.1	0	0	0	4	3	3	13	1	1	0	1	0	26	634.0315
1518	D17	7	3	4/4/90	38.1	0	0	1	2	12	9	6	8	5	0	1	0	44	1072.976
1552	D18	7	3	4/4/90	29.3	0	0	1	0	0	0	0	0	2	2	1	0	6	190.2594
1554	D19	7	3	4/4/90	40.0	0	0	2	11	11	7	5	1	1	0	0	0	38	882.645
1555	D20	7	3	4/4/90	38.1	0	0	2	8	13	5	0	6	1	2	5	1	43	1048.591
1557	D22	7	3	4/4/90	38.5	0	1	5	6	21	4	4	4	1	0	0	0	46	1110.094
3435	D29	7	3	4/4/90	38.1	0	0	4	6	4	1	0	0	0	1	0	0	16	390.1732
3438	D31	7	3	4/4/90	38.1	0	0	5	16	30	21	7	4	4	1	4	0	92	2243.496
3434	D33	7	3	4/4/90	38.1	0	0	5	13	14	9	2	1	3	1	1	0	49	1194.906
3433	D34	7	3	4/4/90	38.1	0	0	0	3	5	0	5	0	0	0	0	0	13	317.0157
3440	D35	7	3	4/4/90	38.1	0	0	1	2	12	6	3	0	1	1	0	3	29	707.189
3385	D36	7	3	4/4/90	38.1	0	0	1	1	0	3	3	1	1	2	0	0	12	292.6299
3375	D37	7	3	4/4/90	38.1	0	0	0	3	22	13	6	2	1	3	0	0	50	1219.291
3452	D38	7	3	4/4/90	38.1	0	2	9	18	16	0	0	0	0	0	0	0	45	1097.362
3450	D39	7	3	4/4/90	37.3	0	0	0	1	3	10	4	3	2	0	3	0	26	647.63
3443	D40	7	3	4/4/90	37.7	0	0	0	0	0	0	0	0	0	5	2	0	7	172.5119
3442	D41	7	3	4/4/90	38.1	0	0	1	0	5	7	5	0	2	0	0	0	20	487.7165
3437	D43	7	3	4/4/90	37.7	0	0	2	11	1	6	2	1	0	2	1	0	26	640.7586
3436	D44	7	3	4/4/90	38.1	0	0	0	3	2	7	5	3	1	1	0	0	22	536.4882
3441	D45	7	3	4/4/90	38.1	0	0	0	0	10	6	3	0	1	0	5	0	25	609.6457
3387	D51	7	3	4/4/90	37.7	0	0	1	6	11	8	6	3	1	5	0	0	41	1010.427
4507	D02	7	4	4/25/90	37.68	0	0	0	2	2	8	5	8	3	1	0	0	29	715.0717
4506	D03	7	4	4/25/90	DESTROYED														
4504	D05	7	4	4/26/90	37.25	0	0	10	30	9	2	8	0	0	0	3	0	62	1546.421
4503	D06	7	4	4/26/90	38.1	0	0	0	0	0	0	0	0	0	1	2	5	8	195.0866

Study 94: Medfly Droplet Size Results

Date: 8/25/90

Graticle	3	4	5	6	7	8	9	10	11	12	13	
Stain Dia	82	116	164	231	327	462	654	925	1308	1850	2616	
True Dia. Min	46	60	80	108	147	202	279	387	538	747	1034	
True Dia. Max	60	80	108	147	202	279	387	538	747	1034	1422	1422+

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Samp #	Location	Corridor	Sequence	Date Collected	Area-sq cm	3	4	5	6	7	8	9	10	11	12	13	# Drops Counted	# Drops (#/sq ft)	
4502	D08	7	4	4/26/90	38.1	0	0	0	0	3	4	4	2	0	0	0	0	13	317.0157
4517	D12	7	4	4/25/90	38.1	0	0	0	0	0	0	0	0	1	4	2	0	7	170.7008
4519	D14	7	4	4/26/90	38.1	0	0	1	8	13	3	2	2	3	1	0	0	33	804.7323
4520	D15	7	4	4/25/90	38.1	0	0	1	13	16	9	11	1	1	0	0	0	52	1268.063
4521	D16	7	4	4/26/90	37.25	0	2	2	8	12	14	1	1	3	2	1	0	46	1147.345
4522	D17	7	4	4/26/90	37.25	0	0	2	7	9	2	1	0	0	0	0	0	21	523.7879
4523	D18	7	4	4/26/90	37.25	0	0	0	0	7	3	3	2	0	0	0	0	15	374.1342
4524	D19	7	4	4/26/90	38.1	0	0	0	4	17	14	4	3	1	0	2	0	45	1097.362
4525	D20	7	4	4/26/90	37.25	0	0	0	0	4	0	4	1	1	0	3	0	13	324.2497
4526	D21	7	4	4/26/90	FLAGGED														
4552	D27	7	4	4/26/90	FLAGGED														
4549	D29	7	4	4/26/90	37.68	0	0	0	7	19	12	6	0	0	0	0	0	44	1084.936
4547	D31	7	4	4/26/90	38.1	0	0	0	3	2	0	0	0	0	2	1	1	9	219.4724
4546	D33	7	4	4/26/90	38.1	0	0	0	0	5	6	6	1	0	0	0	0	18	438.9449
4551	D34	7	4	4/26/90	37.25	0	0	0	2	7	3	0	0	0	0	0	0	12	299.3074
4508	D36	7	4	4/25/90	38.1	0	0	0	0	0	2	6	14	4	1	0	0	27	658.4173
4505	D37	7	4	4/26/90	37.25	0	0	2	7	6	10	10	6	0	3	0	0	44	1097.46
4501	D38	7	4	4/25/90	36.0	0	0	0	1	11	7	4	3	1	0	1	2	30	774.25
4516	D39	7	4	4/26/90	38.1	0	0	0	0	1	10	2	4	0	1	2	0	20	487.7165
4554	D41	7	4	4/25/90	38.1	0	0	0	0	1	4	4	6	10	1	0	0	26	634.0315
4548	D44	7	4	4/26/90	38.1	0	0	1	3	7	8	6	0	1	0	0	0	26	634.0315
4553	D45	7	4	4/25/90	38.1	0	0	0	0	0	1	4	0	0	0	0	0	5	121.9291
4518	D51	7	4	4/25/90	37.25	0	0	0	5	12	3	2	1	0	2	2	0	27	673.4416
4555	D52	7	4	4/25/90	38.1	0	0	0	0	0	0	0	0	1	0	0	0	1	24.38583
4544	D53	7	4	4/26/90	38.1	0	0	0	0	6	4	1	1	0	0	0	2	14	341.4016
4550	D54	7	4	4/26/90	38.1	0	0	0	6	16	8	10	3	0	0	0	0	43	1048.591
4527	D56	7	4	4/26/90	38.1	0	0	2	3	9	6	0	0	0	0	0	0	20	487.7165
4495	D57	7	4	4/26/90	37.25	0	0	0	15	25	16	17	3	0	0	0	0	76	1895.613

Water Data Key

Sample #1 - sample identification for replicate #1

Sample #2 - sample identification for replicate #2

Date Collected - date of application

Corridor - Medfly Project spray area identification

Location Code - monitoring site identification

Site Type - type of waterbody

PO - freshwater pond

SP - swimming pool

RC - river or creek

MA - marsh

DR - drinking water reservoir

Location Type - general location

NO - normal, treated site within spray area

RU - runoff site

OU - outside treated area

FL - flagged, untreated site within spray area

Sequence - application sequence number for monitoring purposes

Interval - period sample collected

B = Background

S = Spray, 0.5-2 hours after application

P = Post spray, several hours or more after application

pH - pH +/- 0.1

Thion 1 - malathion concentration for replicate #1. ND indicates none detected with 0.5 of the detection limit used for calculation purposes

Oxon 1 - malaaxon concentration for replicate #1. ND indicates none detected with 0.5 of the detection limit used for calculation purposes

Thion 2 - malathion concentration for replicate #2. ND indicates none detected with 0.5 of the detection limit used for calculation purposes

Oxon 2 - malaaxon concentration for replicate #2. ND indicates none detected with 0.5 of the detection limit used for calculation purposes

Thion Avg - average malathion concentration for reps 1 and 2

Oxon Avg - average malaaxon concentration for reps 1 and 2

Total Avg - malathion average + malaaxon average, with malaaxon adjusted for differences in molecular weight

$\% \text{ Oxon} = \frac{\text{Oxon Avg}}{\text{Total Avg}} \times 100$

$\text{Thion RPD} = \frac{\text{Thion 1} - \text{Thion 2}}{\text{Thion Avg}} \times 100$

$\text{Oxon RPD} = \frac{\text{Oxon 1} - \text{Oxon 2}}{\text{Thion Avg}} \times 100$

Sample #1	Sample #2	Date Collected	Location Corridor	Site Code	Location Type	Site Type	Location Type	Sequence	Interval	pH	Thion 1 (ppb)	Oxon 1 (ppb)	Thion 2 (ppb)	Oxon 2 (ppb)	Thion Avg (ppb)	Oxon Avg (ppb)	Total Avg (ppb)	% Oxon	Thion RPD (ppb)	Oxon RPD (ppb)
3644	3645	2/12/90	1	A 03	PO	NO	NO	1	B		1.09	ND 0.05	1.14	ND 0.05	1.115	0.05	1.16588	4.28859	4.484305	
3650	3651	2/13/90	1	A 03	PO	NO	NO	1	S		80.88	1.06	75.47	1.62	78.175	1.34	79.5387	1.68471	6.920371	41.79104
2506	2507	2/12/90	1	A 14	SP	NO	NO	1	B	7.2	ND 0.05	6.14	ND 0.05	6.39	0.05	6.265	6.42577	97.498		3.990423
2500	2501	2/13/90	1	A 14	SP	NO	NO	1	S	7.4	ND 0.05	25.57	ND 0.05	24.8	0.05	25.185	25.6803	98.0713		3.057375
3656	3657	2/15/90	12	B 07	SP	NO	NO	1	B		ND 0.05	0.13	ND 0.05	0.11	0.05	0.12	0.17212	69.7181		16.66667
3636	3637	2/15/90	12	B 07	SP	NO	NO	1	S		16.64	0.59	17.02	0.54	16.83	0.565	17.405	3.2462	2.257873	8.849558
3688	3689	2/15/90	12	B 27	PO	NO	NO	1	B		0.29	ND 0.05	0.66	ND 0.05	0.475	0.05	0.52588	9.5078	77.89474	
3640	3641	2/15/90	12	B 27	PO	NO	NO	1	S		20.14	0.12	21.19	0.41	20.665	0.265	20.9347	1.26584	5.081055	109.434
2486	2488	2/19/90	6	C 23	SP	NO	NO	1	B		1.86	ND 0.05	1.81	ND 0.05	1.835	0.05	1.88588	2.65128	2.724796	
2494	3652	2/20/90	6	C 23	SP	NO	NO	1	S	8.5	84.74	0.66	94.57	0.82	89.655	0.74	90.4081	0.81851	10.96425	21.62162
3668	3670	2/19/90	6	C 31	SP	NO	NO	1	B	7.8	0.25	2.72	0.24	3.96	0.245	3.34	3.64405	91.6562	4.081633	37.12575
3614	3616	2/20/90	6	C 31	SP	NO	NO	1	S	7.8	0.21	18.6	TR 0.05	25.46	0.13	22.03	22.5495	97.6961	123.0769	31.13936
2472	2473	2/21/90	7	D 16	SP	NO	NO	1	B	7.5	1.24	4.23	0.76	4.14	1	4.185	5.25899	79.5779	48	2.150538
2466	2467	2/21/90	7	D 16	SP	NO	NO	1	S	7.5	3.11	43.52	2.85	48.77	2.98	46.145	49.9409	92.3992	8.724832	11.37718
2452	2457	2/21/90	7	D 26	SP	NO	NO	1	B		0.59	0.54	0.14	0.2	0.365	0.37	0.74154	49.896	123.2877	91.89189
3803	3804	2/21/90	7	D 26	SP	NO	NO	1	S		0.35	2.87	0.24	3.62	0.295	3.245	3.59737	90.2047	37.28814	23.11248
4030	4031	3/14/90	7	D 16	SP	NO	NO	2	B	7.7	0.17	1.71	TR 0.05	1.72	0.11	1.715	1.85532	92.4367	109.0909	0.58309
4033	4034	3/14/90	7	D 16	SP	NO	NO	2	S		0.36	24.01	0.49	23.6	0.425	23.805	24.6509	96.5685	30.58824	1.722327
4105	4106	3/14/90	7	D 34	SP	NO	NO	2	B	8.1	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
3796	3797	3/15/90	7	D 34	SP	NO	NO	2	S		1.9	10.22	2	10.62	1.95	10.42	12.5542	82.9999	5.128205	3.838772
2476	2477	4/4/90	7	D 16	SP	NO	NO	3	B	7.8	ND 0.05	0.28	ND 0.05	0.25	0.05	0.265	0.31969	82.894		11.32075
3777	3779	4/5/90	7	D 16	SP	NO	NO	3	S		ND 0.05	45.65	ND 0.05	18.92	0.05	32.285	32.9058	98.1133		82.79387
4142	4143	4/4/90	7	D 34	SP	NO	NO	3	B	7.6	ND 0.05	0.21	ND 0.05	0.25	0.05	0.23	0.28407	80.9669		17.3913
4006	4008	4/5/90	7	D 34	SP	NO	NO	3	S		ND 0.05	8.18	ND 0.05	10.54	0.05	9.36	9.57549	97.7495		25.21368
4012	4013	4/25/90	7	D 16	SP	NO	NO	4	B	7.9	ND 0.05	TR 0.05	ND 0.05	0.1	0.05	0.075	0.12633	59.3702		66.66667
4021	4022	4/26/90	7	D 16	SP	NO	NO	4	S	8	ND 0.05	16.58	0.13	21.72	0.09	19.15	19.5786	97.8109	88.88889	26.84073
4168	4169	4/26/90	7	D 16	SP	NO	NO	4	P	7.9	ND 0.05	14.14	ND 0.05	14.05	0.05	14.095	14.3942	97.9213		0.638524
4084	4085	4/27/90	7	D 16	SP	NO	NO	4	P	7.5	ND 0.05	9.48	ND 0.05	8.67	0.05	9.075	9.28545	97.7335		8.92562
4042	4043	4/30/90	7	D 16	SP	NO	NO	4	P	7.6	ND 0.05	3.17	ND 0.05	3.13	0.05	3.15	3.25569	96.7535		1.269841
4081	4082	4/25/90	7	D 34	SP	NO	NO	4	B	7.3	ND 0.05	0.12	ND 0.05	0.11	0.05	0.115	0.16703	68.8485		8.695652
4018	4019	4/26/90	7	D 34	SP	NO	NO	4	S	7.5	ND 0.05	3.81	ND 0.05	5.61	0.05	4.71	4.84328	97.2482		38.21656
4171	4172	4/26/90	7	D 34	SP	NO	NO	4	P	7.6	ND 0.05	2.44	ND 0.05	2.43	0.05	2.435	2.52805	96.3192		0.410678
4087	4088	4/27/90	7	D 34	SP	NO	NO	4	P	7.4	ND 0.05	2.03	ND 0.05	1.99	0.05	2.01	2.09554	95.9181		1.99005
4099	4100	4/30/90	7	D 34	SP	NO	NO	4	P	7.5	ND 0.05	0.87	ND 0.05	0.96	0.05	0.915	0.98118	93.2552		9.836066
4144	4145	5/9/90	7	D 34	SP	NO	NO	4	P	7.7	ND 0.05	0.17	ND 0.05	0.18	0.05	0.175	0.22809	76.7227		5.714286

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Study 94: Water Results

Date: 8/25/90

B-21

Sample #1	Sample #2	Date Collected	Location Corridor	Site Code	Location Type	Site Type	Sequence	Interval	pH	Thion 1 (ppb)	Oxon 1 (ppb)	Thion 2 (ppb)	Oxon 2 (ppb)	Thion Avg (ppb)	Oxon Avg (ppb)	Total Avg (ppb)	% Oxon	Thion RPD (ppb)	Oxon RPD (ppb)
3825	3830	4/5/90	1	1	RC	RU	RA	P		0.21	ND 0.05	0.26	ND 0.05	0.235	0.05	0.28588	17.4896	21.2766	
3821	3822	4/5/90	2	1	RC	RU	RA	P		25.67	4.93	21.58	4.65	23.625	4.79	28.4997	16.8072	17.31217	5.845511
3820	3823	4/5/90	3	1	RC	RU	RA	P		48.23	12.24	48.78	12.18	48.505	12.21	60.9309	20.0391	1.133904	0.4914
3681	3684	4/4/90	4	1	RC	RU	RA	P		24.7	6.08	24.54	6.18	24.62	6.13	30.8584	19.8649	0.649878	1.631321
3682	3683	4/4/90	5	1	RC	RU	RA	P		25.08	6.39	27.8	6.67	26.44	6.53	33.0855	19.7368	10.28744	4.287902
3680	3685	4/4/90	6	1	RC	RU	RA	P		83.11	11.05	99.04	12.75	91.075	11.9	103.185	11.5326	17.49108	14.28571
4162	4163	5/1/90	1	2	RC	RU	RA	P	7.6	44.93	41.98	43.27	40.06	44.1	41.02	85.8453	47.7836	3.764172	4.680644
4166	4167	5/1/90	2	2	RC	RU	RA	P	7.7	1.01	ND 0.05	ND 0.05	ND 0.05	0.53	0.05	0.58088	8.60757	181.1321	
4164		5/1/90	8	1	MA	RU	RA	P	7.8	ND 0.05	ND 0.05			0.05	0.05	0.10088			
4165		5/1/90	8	2	MA	RU	RA	P	8.5	ND 0.05	ND 0.05			0.05	0.05	0.10088			
3919	3920	5/23/90	1	2	RC	RU	DR	P	8.5	TR 0.05	ND 0.05	TR 0.05	ND 0.05	0.05	0.05	0.10088			
3931	3932	5/23/90	3	2	RC	RU	DR	P	8.9	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
3935	3936	5/23/90	7	1	RC	RU	DR	P	9.5	0.18	ND 0.05	0.21	ND 0.05	0.195	0.05	0.24588	20.3348	15.38462	
3933	3934	5/23/90	8	3	MA	RU	DR	P	8.1	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
3930	9099	5/30/90	1	2	RC	RU	RA	P	8.7	0.61	0.27	0.7	0.33	0.655	0.3	0.9603	31.2401	13.74046	20
3921	3922	5/30/90	2	3	RC	RU	RA	P	7.8	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
3926	3927	5/30/90	3	2	RC	RU	RA	P	8.2	4.14	1.91	4.28	2.26	4.21	2.085	6.33186	32.9287	3.325416	16.78657
3928	3929	5/30/90	7	1	RC	RU	RA	P	8.7	3.46	1.79	3.42	1.76	3.44	1.775	5.24638	33.8328	1.162791	1.690141
3924	3925	5/30/90	8	3	MA	RU	RA	P	8.1	1.66	0.8	1.62	0.78	1.64	0.79	2.44397	32.3245	2.439024	2.531646
3967	3968	6/1/90	1	2	RC	RU	DR	P	8.8	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4134	4135	6/1/90	3	2	RC	RU	DR	P	8	ND 0.05	0.12	ND 0.05	0.14	0.05	0.13	0.1823	71.3116		15.38462
4132	4133	6/1/90	7	1	RC	RU	DR	P	7.5	1.29	0.14	1.24	0.13	1.265	0.135	1.40239	9.62644	3.952569	7.407407
4136	4137	6/1/90	8	3	MA	RU	DR	P	7.6	0.16	ND 0.05	0.16	ND 0.05	0.16	0.05	0.21088	23.7097	0	
3937	3938	6/6/90	1	3	RC	RU	DR	P	9.9	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
3975	3976	6/6/90	2	3	RC	RU	DR	P	8	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
3941	3942	6/6/90	3	2	RC	RU	DR	P	8.3	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
3939	3940	6/6/90	7	1	RC	RU	DR	P	9	0.69	0.63	0.78	0.69	0.735	0.66	1.40667	46.9193	12.2449	9.090909
3973	3974	6/6/90	8	3	MA	RU	DR	P	7.8	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4616	4617	6/15/90	1	3	RC	RU	DR	P	9.5	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4622	4623	6/15/90	3	2	RC	RU	DR	P	9	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4618	4619	6/15/90	7	1	RC	RU	DR	P	9.1	0.12	ND 0.05	0.13	ND 0.05	0.125	0.05	0.17588	28.4278	8	
4624	4625	6/15/90	8	3	MA	RU	DR	P	8	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4610	4611	6/20/90	1	3	RC	RU	DR	P		ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4606	4607	6/20/90	3	2	RC	RU	DR	P	8.6	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4608	4609	6/20/90	7	1	RC	RU	DR	P	9.3	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4604	4605	6/20/90	8	3	MA	RU	DR	P		ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
3969	3970	6/28/90	1	3	RC	RU	DR	P		ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4147	4149	6/28/90	3	2	RC	RU	DR	P	8.7	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
3971	3972	6/28/90	7	1	RC	RU	DR	P	8.9	0.24	0.18	0.36	0.41	0.3	0.295	0.60022	49.149	40	77.9661
4048	4049	6/28/90	8	3	MA	RU	DR	P	7.9	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			

Study 94: Water Results

Date: 8/25/90

Sample #1	Sample #2	Date Collected	Location Corridor	Site Code	Location Type	Site Type	Sequence	Interval	pH	Thion 1 (ppb)	Oxon 1 (ppb)	Thion 2 (ppb)	Oxon 2 (ppb)	Thion Avg (ppb)	Oxon Avg (ppb)	Total Avg (ppb)	% Oxon	Thion RPD (ppb)	Oxon RPD (ppb)
4106	4161	3/12/90	9	C 32	DR	OU	2	B		ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4152	4153	3/16/90	9	C 32	DR	OU	2	B	8	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
3791	3792	3/17/90	9	C 32	DR	OU	2	P		0.15	ND 0.05	0.11	ND 0.05	0.13	0.05	0.18088	27.642	30.76923	
4102	4103	3/14/90	7	D 27	PO	FL	2	B	9	2.23	0.1	3.49	TR 0.05	2.86	0.075	2.93633	2.55421	44.05594	66.66667
3799	3780	3/15/90	7	D 27	PO	FL	2	S		2.26	ND 0.05	3.13	TR 0.05	2.695	0.05	2.74588	1.82091	32.282	
4066	4067	4/4/90	7	D 27	PO	FL	3	B	7.3	1.37	0.35	0.71	0.12	1.04	0.235	1.27916	18.3715	63.46154	97.87234
4055	4057	4/5/90	7	D 27	PO	FL	3	S		3.8	1.36	4.46	1.63	4.13	1.495	5.65143	26.4535	15.98063	18.0602
4078	4079	4/25/90	7	D 27	PO	FL	4	B	7.4	10.95	5.3	11.17	5.63	11.06	5.465	16.6216	32.8789	1.98915	6.038426
4015	4016	4/26/90	7	D 27	PO	FL	4	S	7.7	12.56	5.51	11.13	4.93	11.845	5.22	17.1573	30.4244	12.0726	11.11111
4073	4074	3/26/90	10	E 1	PO	OU		B	8.2	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4076	4077	3/27/90	10	E 1	PO	OU		P	8.5	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4036	4037	4/17/90	10	E 1	PO	OU		B	8.8	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4000	4001	4/23/90	10	E 1	PO	OU		P		ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4096	4097	4/30/90	10	E 1	PO	OU		B		ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			
4045	4046	5/1/90	10	E 1	PO	OU		P	7.6	ND 0.05	ND 0.05	ND 0.05	ND 0.05	0.05	0.05	0.10088			

Air Data Key

Sample # - sample identification

Date Collected - date of application

Corridor - Medfly Project spray area identification

Location Code - monitoring site identification

I = indoor

O = outdoor

Sample Type - type of sample cannister

LOV = low volume sample

HIV = high volume sample

Interval - period sample collected

B = Background

S = Spray

P = 1st post spray

F = 2nd post spray

Run Time - total time of sample collection

Flow Rate - sampler air flow rate

Malathion (ug/sample) - total amount of malathion in sample. ND or tr indicates none detected or trace with 0.5 of the detection limit used for calculation purposes

Malaoxon (ug/sample) - total amount of malaoxon in sample. ND or tr indicates none detected or trace with 0.5 of the detection limit used for calculation purposes

Total (ug/sample) - malathion + malaoxon with malaoxon adjusted for differences in molecular weight

Malathion (ug/cu m) - 1000 times malathion (ug/sample) divided by air volume (run time X flow rate)

Malaoxon (ug/cu m) - 1000 times malaoxon (ug/sample) divided by air volume (run time X flow rate)

Total (ug/cu m) - 1000 times total (ug/sample) divided by air volume (run time X flow rate)

Malathion Adjust - malathion concentration adjusted for sampler oxidation (see appendix D for calculation)

Malaoxon Adjust - malaoxon concentration adjusted for sampler oxidation (see appendix D for calculation)

Sample #	Date Collected	Corridor	Location Code	Sample Type	Sequence	Interval	Run Time (min)	Flow Rate (L/min)	Malathion (ug/samp)	Malaoxon (ug/samp)	Total (ug/samp)	Malathion (ug/cu m)	Malaoxon (ug/cu m)	Total (ug/cu m)	Malathion Ajdust	Malaoxon Ajdust
3012	2/11/90	1	A I 18	LOV	1	B	1440	14	tr 0.05	ND 0.05	0.102555	0.0025	0.0025	0.0051	0.005754	-0.000633
3040	2/11/90	1	A I 22	LOV	1	B	1430	15	tr 0.05	ND 0.05	0.102555	0.0023	0.0023	0.0048	0.005408	-0.000595
3020	2/12/90	1	A I 25	LOV	1	B	445	14	tr 0.05	ND 0.05	0.102555	0.0080	0.0080	0.0165	0.01862	-0.002049
3028	2/11/90	1	A I 01	LOV	1	B	1435	15	tr 0.05	ND 0.05	0.102555	0.0023	0.0023	0.0048	0.005389	-0.000593
3582	2/14/90	12	B I 02	LOV	1	B	1500	15	tr 0.05	ND 0.05	0.102555	0.002222	0.002222	0.004558	0.005156	-0.000567
3004	2/14/90	12	B I 05	LOV	1	B	1440	15	tr 0.05	ND 0.05	0.102555	0.002315	0.002315	0.004748	0.00537	-0.000591
3044	2/14/90	12	B I 17	LOV	1	B	1440	15	0.10	ND 0.05	0.152555	0.00463	0.002315	0.007063	0.010741	-0.003497
3578	2/14/90	12	B I 19	LOV	1	B	1447	15	ND 0.05	ND 0.05	0.102555	0.002304	0.002304	0.004725	0.005344	-0.000588
3606	2/14/90	12	B I 23	LOV	1	B	1440	15	tr 0.05	ND 0.05	0.102555	0.002315	0.002315	0.004748	0.00537	-0.000591
3725	2/18/90	9	C I 07	LOV	1	B	1440	14	tr 0.05	ND 0.05	No Spray					
3721	2/18/90	5	C I 15	LOV	1	B	1440	15	0.21	ND 0.05	0.262555	0.009722	0.002315	0.012155	0.022556	-0.00989
3757	2/18/90	5	C I 22	LOV	1	B	1440	15	0.44	ND 0.05	0.492555	0.02037	0.002315	0.022803	0.047259	-0.023257
3741	2/18/90	6	C I 24	LOV	1	B	1440	15	ND 0.05	ND 0.05	0.102555	0.002315	0.002315	0.004748	0.00537	-0.000591
3765	2/18/90	6	C I 25	LOV	1	B	1440	15	tr 0.05	ND 0.05	0.102555	0.002315	0.002315	0.004748	0.00537	-0.000591
3859	2/20/90	7	D I 02	LOV	1	B	1440	15	tr 0.05	ND 0.05	0.102555	0.002315	0.002315	0.004748	0.00537	-0.000591
3843	2/20/90	7	D I 05	LOV	1	B	1440	15	0.36	0.24	0.612264	0.016667	0.011111	0.028346	0.038667	-0.009811
3835	2/20/90	7	D I 13	LOV	1	B	1440	16	0.14	ND 0.05	0.192555	0.006076	0.00217	0.008357	0.014097	-0.005458
3749	2/20/90	7	D I 26	LOV	1	B	1440	13	tr 0.05	ND 0.05	0.102555	0.002671	0.002671	0.005478	0.006197	-0.000682
3847	2/20/90	7	D I 32	LOV	1	B	1470	15	0.37	0.13	0.506643	0.01678	0.005896	0.022977	0.03893	-0.015169
4196	3/13/90	7	D I 02	HIV	2	B	1440	1000	2.68	2.21	5.002931	0.001861	0.001535	0.003474	0.005379	-0.00181
4226	3/13/90	7	D I 05	HIV	2	B	1440	1000	2.40	2.86	5.406146	0.001667	0.001986	0.003754	0.004817	-0.00101
3705	3/13/90	7	D I 34	LOV	2	B	1422	20	ND 0.05	ND 0.05	0.102555	0.001758	0.001758	0.003606	0.004079	-0.000449
4222	3/13/90	7	D I 35	HIV	2	B	1432	1000	3.70	3.39	7.263229	0.002584	0.002367	0.005072	0.007467	-0.002277
4291	3/13/90	7	D I 51	LOV	2	B	1450	20	0.86	0.21	1.080731	0.029655	0.007241	0.037267	0.0688	-0.029985
4190	4/3/90	7	D I 02	HIV	3	B	1440	1000	5.90	7.65	13.94092	0.004097	0.005313	0.009681	0.011841	-0.002052
4256	4/3/90	7	D I 05	HIV	3	B	1440	1000	4.37	4.59	9.194549	0.003035	0.003188	0.006385	0.00877	-0.002267
3863	4/03/90	7	D I 34	LOV	3	B	1451	20	0.19	ND 0.05	0.242555	0.006547	0.001723	0.008358	0.01519	-0.006496
4238	4/3/90	7	D I 35	HIV	3	B	1440	1000	4.78	ND 0.25	5.042775	0.003319	0.000174	0.003502	0.009593	-0.005793
3855	4/03/90	7	D I 51	LOV	3	B	1410	20	0.88	0.25	1.142775	0.031206	0.008865	0.040524	0.072397	-0.030308
4429	4/24/90	7	D I 02	HIV	4	B	1410	1000	5.42	4.40	10.04484	0.003844	0.003121	0.007124	0.011109	-0.003789
4453	4/24/90	7	D I 05	HIV	4	B	1447	1000	2.42	2.96	5.531256	0.001672	0.002046	0.003823	0.004833	-0.00096
4327	4/24/90	7	D I 34	LOV	4	B	1437	20	0.10	ND 0.05	0.152555	0.003479	0.00174	0.005308	0.008072	-0.002628
4279	4/24/90	7	D I 51	LOV	4	B	654	20	0.35	ND 0.05	0.402555	0.026758	0.003823	0.030776	0.06208	-0.029768
4474	4/24/90	7	D I 53	HIV	4	B	1440	1000	13.62	80.17	97.88669	0.009458	0.055674	0.067977	0.027335	0.038673

Sample #	Date Collected	Corridor	Location Code	Sample Type	Sequence	Interval	Run Time (min)	Flow Rate (L/min)	Malathion (ug/samp)	Malaoxon (ug/samp)	Total (ug/samp)	Malathion (ug/cu m)	Malaoxon (ug/cu m)	Total (ug/cu m)	Malathion Ajdust	Malaoxon Ajdust
3015	2/14/90	1	A | 18	LOV	1	F	1440	15	tr 0.05	ND 0.05	0.102555	0.0023	0.0023	0.0047	0.00537	-0.000591
3010	2/14/90	1	A | 22	LOV	1	F	1455	15	tr 0.05	ND 0.05	0.102555	0.0023	0.0023	0.0047	0.005315	-0.000585
3039	2/14/90	1	A | 25	LOV	1	F	1453	15	0.12	ND 0.05	0.172555	0.0055	0.0023	0.0079	0.012774	-0.004617
3031	2/14/90	1	A | 01	LOV	1	F	1440	15	0.12	ND 0.05	0.172555	0.0056	0.0023	0.0080	0.012889	-0.004659
3591	2/17/90	12	B | 02	LOV	1	F	1440	15	tr 0.05	ND 0.05	0.102555	0.002315	0.002315	0.004748	0.00537	-0.000591
3007	2/17/90	12	B | 05	LOV	1	F	1440	16	tr 0.05	ND 0.05	0.102555	0.00217	0.00217	0.004451	0.005035	-0.000554
3047	2/17/90	12	B | 17	LOV	1	F	1440	15	0.72	ND 0.05	0.772555	0.033333	0.002315	0.035766	0.077333	-0.039529
3581	2/17/90	12	B | 19	LOV	1	F	1435	16	0.26	ND 0.05	0.312555	0.011324	0.002178	0.013613	0.026272	-0.012038
3609	2/17/90	12	B | 23	LOV	1	F	1585	15	0.16	ND 0.05	0.212555	0.00673	0.002103	0.00894	0.015613	-0.006345
3833	2/21/90	9	C | 07	LOV	1	F	1435	14	tr 0.05	ND 0.05	No Spray					
3724	2/20/90	5	C | 15	LOV	1	F	1425	15	tr 0.05	ND 0.05	0.102555	0.002339	0.002339	0.004798	0.005427	-0.000597
3760	2/21/90	5	C | 22	LOV	1	F	1420	14	0.27	0.12	0.396132	0.013581	0.006036	0.019926	0.031509	-0.011013
3744	2/21/90	5	C | 24	LOV	1	F	1413	15	0.15	ND 0.05	0.202555	0.007077	0.002359	0.009557	0.016419	-0.006525
3768	2/21/90	5	C | 25	LOV	1	F	1407	15	tr 0.05	0.16	0.218176	0.002369	0.007581	0.010338	0.005496	0.004607
3862	2/23/90	7	D | 02	LOV	1	F	1500	15	0.4	0.13	0.536643	0.017778	0.005778	0.023851	0.041244	-0.016539
3846	2/23/90	7	D | 05	LOV	1	F	1410	15	0.21	0.21	0.430731	0.009929	0.009929	0.020366	0.023035	-0.002535
3853	2/23/90	7	D | 13	LOV	1	F	1440	16	1.5	0.76	2.298836	0.065104	0.032986	0.099776	0.151042	-0.04874
3752	2/23/90	7	D | 26	LOV	1	F	1395	14	0.16	tr 0.05	0.212555	0.008193	0.00256	0.010884	0.019007	-0.007724
3850	2/23/90	7	D | 32	LOV	1	F	1425	15	0.65	0.13	0.786643	0.030409	0.006082	0.036802	0.07055	-0.032092
4199	3/16/90	7	D | 02	HIV	2	F	1440		lost sample							
4229	3/16/90	7	D | 05	HIV	2	F	1440	1000	8.14	10.93	19.62852	0.005653	0.00759	0.013631	0.016337	-0.00257
3708	3/16/90	7	D | 34	LOV	2	F	1440	20	0.36	ND 0.05	0.412555	0.0125	0.001736	0.014325	0.029	-0.013955
4224	3/16/90	7	D | 35	HIV	2	F	1440	1000	5.22	1.28	6.565408	0.003625	0.000889	0.004559	0.010476	-0.005627
4294	3/16/90	7	D | 51	LOV	2	F	1440	20	1.96	0.44	2.422484	0.068056	0.015278	0.084114	0.157889	-0.070154
4193	4/6/90	7	D | 02	HIV	3	F	1440	1000	14.77	13.93	29.41182	0.010257	0.009674	0.020425	0.029643	-0.008762
4376	4/6/90	7	D | 05	HIV	3	F	1440	1000	5.25	5.81	11.35689	0.003646	0.004035	0.007887	0.010536	-0.002518
3866	4/06/90	7	D | 34	LOV	3	F	1440	20	0.34	ND 0.05	0.392555	0.011806	0.001736	0.01363	0.027389	-0.013084
4386	4/6/90	7	D | 35	HIV	3	F	1440	1000	24.74	11.30	36.61743	0.017181	0.007847	0.025429	0.049652	-0.023033
3858	4/06/90	7	D | 51	LOV	3	F	1450	20	1.51	0.23	1.751753	0.052069	0.007931	0.060405	0.1208	-0.057432
4465	4/27/90	7	D | 02	HIV	4	F	1455	1000	32.86	46.27	81.4944	0.022584	0.031801	0.05601	0.065268	-0.008792
4446	4/27/90	7	D | 05	HIV	4	F	1440	1000	2.32	1.89	4.306579	0.001611	0.001313	0.002991	0.004656	-0.001583
4330	4/27/90	7	D | 34	LOV	4	F	1500	20	0.30	ND 0.05	0.352555	0.01	0.001667	0.011752	0.0232	-0.010887
4282	4/27/90	7	D | 51	LOV	4	F	1380	20	2.57	1.75	4.409425	0.093116	0.063406	0.159762	0.216029	-0.053485
4426	4/27/90	7	D 53	HIV	4	F	1440	1000	7.64	3.04	10.83534	0.005306	0.002111	0.007525	0.015333	-0.007425

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Study 94: Medfly Air Results

Date 8/25/90

Sample #	Date Collected	Corridor	Location Code	Sample Type	Sequence	Interval	Run Time (min)	Flow Rate (L/min)	Malathion (ug/samp)	Malaoxon (ug/samp)	Total (ug/samp)	Malathion (ug/cu m)	Malaoxon (ug/cu m)	Total (ug/cu m)	Malathion Ajdust	Malaoxon Ajdust
3014	2/13/90	1	A I 18	LOV	1	P	1440	14	tr 0.05	ND 0.05	0.102555	0.0025	0.0025	0.0051	0.005754	-0.000633
3008	2/14/90	1	A I 22	LOV	1	P	1470	17	0.14	ND 0.05	0.192555	0.0056	0.0020	0.0077	0.012997	-0.005032
3038	2/13/90	1	A I 25	LOV	1	P	1440	14	0.24	ND 0.05	0.292555	0.0119	0.0025	0.0145	0.027619	-0.012464
3030	2/13/90	1	A I 01	LOV	1	P	1440	15	2.27	ND 0.05	2.322555	0.1051	0.0023	0.1075	0.243815	-0.12961
3585	2/16/90	12	B I 02	LOV	1	P	1430	17	0.21	ND 0.05	0.262555	0.008638	0.002057	0.0108	0.020041	-0.008787
3006	2/16/90	12	B I 05	LOV	1	P	1521	16	0.38	ND 0.05	0.432555	0.015615	0.002055	0.017774	0.036226	-0.017547
3046	2/16/90	12	B I 17	LOV	1	P	1470	15	1.86	0.51	2.396061	0.084354	0.023129	0.108665	0.195701	-0.082762
3580	2/16/90	12	B I 19	LOV	1	P	1481	16	0.49	ND 0.05	0.542555	0.020679	0.00211	0.022896	0.047974	-0.023848
3608	2/16/90	12	B I 23	LOV	1	P	1432	15	0.17	ND 0.05	0.222555	0.007914	0.002328	0.010361	0.018361	-0.007607
3831	2/20/90	9	C I 07	LOV	1	P	1560	15	tr 0.05	ND 0.05	No Spray					
3723	2/20/90	5	C I 15	LOV	1	P	1415	15	tr 0.05	ND 0.05	0.102555	0.002356	0.002356	0.004832	0.005465	-0.000601
3759	2/20/90	5	C I 22	LOV	1	P	1425	16	tr 0.05	ND 0.05	0.102555	0.002193	0.002193	0.004498	0.005088	-0.00056
3743	2/20/90	6	C I 24	LOV	1	P	1440	15	0.12	ND 0.05	0.172555	0.005556	0.002315	0.007989	0.012889	-0.004659
3767	2/20/90	5	C I 25	LOV	1	P	1507	15	tr 0.05	0.19	0.249709	0.002212	0.008405	0.011047	0.005132	0.005629
3861	2/22/90	7	D I 02	LOV	1	P	1452	15	0.57	0.15	0.727665	0.026171	0.006887	0.03341	0.060716	-0.025966
3845	2/22/90	7	D I 05	LOV	1	P	1420	15	0.3	0.3	0.61533	0.014085	0.014085	0.028889	0.032676	-0.003596
3851	2/22/90	7	D I 13	LOV	1	P	1485	15	1.03	tr 0.05	1.082555	0.04624	0.002245	0.0486	0.107277	-0.055802
3751	2/22/90	7	D I 26	LOV	1	P	1500	13	tr 0.05	ND 0.05	0.102555	0.002564	0.002564	0.005259	0.005949	-0.000655
3849	2/22/90	7	D I 32	LOV	1	P	1485	15	0.57	tr 0.05	0.622555	0.025589	0.002245	0.027949	0.059367	-0.029878
4198	3/15/90	7	D I 02	HIV	2	P	1469	1000	24.05	35.98	61.86858	0.016372	0.024493	0.042116	0.047314	-0.004933
4228	3/15/90	7	D I 05	HIV	2	P	1440	1000	8.60	13.01	22.27481	0.005972	0.009035	0.015469	0.01726	-0.0017
3707	3/15/90	7	D I 34	LOV	2	P	1445	20	0.46	0.21	0.680731	0.015917	0.007266	0.023555	0.036927	-0.012714
4223	3/15/90	7	D I 35	HIV	2	P	1470	1000	5.87	2.32	8.308552	0.003993	0.001578	0.005652	0.01154	-0.005599
4293	3/15/90	7	D I 51	LOV	2	P	1455	20	1.93	0.61	2.571171	0.066323	0.020962	0.088356	0.153869	-0.062294
4192	4/5/90	7	D I 02	HIV	3	P	1450	1000	16.03	14.15	30.90307	0.011055	0.009759	0.021312	0.031949	-0.010112
4260	4/5/90	7	D I 05	HIV	3	P	1440	1000	6.52	6.05	12.87916	0.004528	0.004201	0.008944	0.013085	-0.003937
3865	4/05/90	7	D I 34	LOV	3	P	1441	20	0.43	ND 0.05	0.482555	0.01492	0.001735	0.016744	0.034615	-0.016995
4387	4/5/90	7	D I 35	HIV	3	P	1440	1000	2.79	ND 0.25	3.052775	0.001938	0.000174	0.00212	0.005599	-0.003309
3857	4/05/90	7	D I 51	LOV	3	P	1440	20	1.36	0.21	1.580731	0.047222	0.007292	0.054886	0.109556	-0.051987
4434	4/26/90	7	D I 02	HIV	4	P	1475	1000	33.03	40.02	75.09502	0.022393	0.027132	0.050912	0.064716	-0.013117
4457	4/26/90	7	D I 05	HIV	4	P	1520	1000	11.32	13.24	25.23656	0.007447	0.008711	0.016603	0.021523	-0.004675
4329	4/26/90	7	D I 34	LOV	4	P	1455	20	0.35	0.10	0.45511	0.012027	0.003436	0.01564	0.027904	-0.011662
4281	4/26/90	7	D I 51	LOV	4	P	1440	20	3.07	1.66	4.814826	0.106597	0.057639	0.167181	0.247306	-0.076175
4424	4/26/90	7	D I 53	HIV	4	P	1440	1000	15.39	8.98	24.82888	0.010688	0.006236	0.017242	0.030887	-0.012973

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Study 94: Medfly Air Results

Date 8/25/90

Sample #	Date Collected	Corridor	Location Code	Sample Type	Sequence	Interval	Run Time (min)	Flow Rate (L/min)	Malathion (ug/samp)	Malaoxon (ug/samp)	Total (ug/samp)	Malathion (ug/cu m)	Malaoxon (ug/cu m)	Total (ug/cu m)	Malathion Ajdust	Malaoxon Ajdust
3013	2/12/90	1	A I 18	LOV	1	S	390	13	ND 0.05	ND 0.05	0.102555	0.0099	0.0099	0.0202	0.017653	0.002453
3042	2/12/90	1	A I 22	LOV	1	S	360	16	tr 0.05	ND 0.05	0.102555	0.0087	0.0087	0.0178	0.015538	0.002159
3037	2/12/90	1	A I 25	LOV	1	S	357	14	tr 0.05	ND 0.05	0.102555	0.0100	0.0100	0.0205	0.017907	0.002488
3029	2/12/90	1	A I 01	LOV	1	S	395	15	tr 0.05	ND 0.05	0.102555	0.0084	0.0084	0.0173	0.015105	0.002099
3583	2/15/90	12	B I 02	LOV	1	S	292	17	tr 0.05	ND 0.05	0.102555	0.010073	0.010073	0.02066	0.01803	0.002505
3005	2/15/90	12	B I 05	LOV	1	S	218	12	tr 0.05	ND 0.05	0.102555	0.019113	0.019113	0.039203	0.034213	0.004754
3045	2/15/90	12	B I 17	LOV	1	S	300	15	tr 0.05	ND 0.05	0.102555	0.011111	0.011111	0.02279	0.019889	0.002763
3579	2/15/90	12	B I 19	LOV	1	S	292	14	tr 0.05	ND 0.05	0.102555	0.012231	0.012231	0.025087	0.021893	0.003042
3607	2/15/90	12	B I 23	LOV	1	S	300	14	ND 0.05	ND 0.05	0.102555	0.011905	0.011905	0.024418	0.02131	0.002961
3727	2/19/90	9	C I 07	LOV	1	S	396	15	tr 0.05	ND 0.05	No Spray					
3722	2/19/90	5	C I 15	LOV	1	S	393	15	ND 0.05	ND 0.05	0.102555	0.008482	0.008482	0.017397	0.015182	0.002109
3758	2/18/90	5	C I 22	LOV	1	S	400	14	0.12	ND 0.05	0.172555	0.021429	0.008929	0.030813	0.038357	-0.007171
3742	2/19/90	6	C I 24	LOV	1	S	405	15	ND 0.05	ND 0.05	0.102555	0.00823	0.00823	0.016881	0.014733	0.002047
3766	2/19/90	6	C I 25	LOV	1	S	380	15	tr 0.05	ND 0.05	0.102555	0.008772	0.008772	0.017992	0.015702	0.002182
3860	2/21/90	7	D I 02	LOV	1	S	370	15	tr 0.05	ND 0.05	0.102555	0.009009	0.009009	0.018478	0.016126	0.002241
3844	2/21/90	7	D I 05	LOV	1	S	370	15	tr 0.05	ND 0.05	0.102555	0.009009	0.009009	0.018478	0.016126	0.002241
3837	2/21/90	7	D I 13	LOV	1	S	375	16	tr 0.05	ND 0.05	0.102555	0.008333	0.008333	0.017093	0.014917	0.002073
3750	2/21/90	7	D I 26	LOV	1	S	360	14	tr 0.05	ND 0.05	0.102555	0.009921	0.009921	0.020348	0.017758	0.002467
3848	2/21/90	7	D I 32	LOV	1	S	385	15	0.16	ND 0.05	0.212555	0.027706	0.008658	0.036806	0.049593	-0.012157
4197	3/14/90	7	D I 02	HIV	2	S	431	1000	3.02	0.39	3.429929	0.007007	0.000905	0.007958	0.019059	-0.010557
4227	3/14/90	7	D I 05	HIV	2	S	457	1000	1.55	0.78	2.369858	0.003392	0.001707	0.005186	0.009225	-0.003841
3706	3/14/90	7	D I 34	LOV	2	S	461	20	0.12	ND 0.05	0.172555	0.013015	0.005423	0.018715	0.023297	-0.004355
4220	3/14/90	7	D I 35	HIV	2	S	429	1000	3.65	1.25	4.963875	0.008508	0.002914	0.011571	0.023142	-0.011003
4292	3/14/90	7	D I 51	LOV	2	S	430	20	0.12	ND 0.05	0.172555	0.013953	0.005814	0.020065	0.024977	-0.004669
4191	4/4/90	7	D I 02	HIV	3	S	435	1000	5.02	1.41	6.502051	0.01154	0.003241	0.014947	0.031389	-0.015635
4258	4/4/90	7	D I 05	HIV	3	S	425	1000	2.47	1.19	3.720809	0.005812	0.0028	0.008755	0.015808	-0.006706
3864	4/04/90	7	D I 34	LOV	3	S	440	20	ND 0.05	ND 0.05	0.102555	0.005682	0.005682	0.011654	0.01017	0.001413
4388	4/4/90	7	D I 35	HIV	3	S	435	1000	2.63	ND 0.25	2.892775	0.006046	0.000575	0.00665	0.016445	-0.009315
3856	4/04/90	7	D I 51	LOV	3	S	436	20	0.30	ND 0.05	0.352555	0.034404	0.005734	0.040431	0.061583	-0.020113
4433	4/25/90	7	D I 02	HIV	4	S	420	1000	64.49	52.91	120.1037	0.153548	0.125976	0.285961	0.41765	-0.125185
4455	4/25/90	7	D I 05	HIV	4	S	426	1000	2.92	0.81	3.771391	0.006854	0.001901	0.008853	0.018644	-0.009311
4328	4/25/90	7	D I 34	LOV	4	S	425	20	ND 0.05	ND 0.05	0.102555	0.005882	0.005882	0.012065	0.010529	0.001463
4280	4/25/90	7	D I 51	LOV	4	S	430	20	0.32	ND 0.05	0.372555	0.037209	0.005814	0.04332	0.066605	-0.022141
4425	4/25/90	7	D I 53	HIV	4	S	435	1000	1.79	10.59	12.92115	0.004115	0.024345	0.029704	0.011193	0.017614

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Sample #	Date		Location		Sample		Run Time (min)	Flow Rate (L/min)	Malathion (ug/samp)	Malaoxon (ug/samp)	Total (ug/samp)	Malathion (ug/cu m)	Malaoxon (ug/cu m)	Total (ug/cu m)	Malathion Ajdust	Malaoxon Ajdust
	Collected	Corridor	Code	Type	Sequence	Interval										
3602	2/11/90	1	A O 18	LOV	1	B	1440	13	tr 0.05	ND 0.05	0.102555	0.0027	0.0027	0.0055	0.006197	-0.000682
3041	2/11/90	1	A O 22	LOV	1	B	1430	15	tr 0.05	ND 0.05	0.102555	0.0023	0.0023	0.0048	0.005408	-0.000595
3021	2/12/90	1	A O 25	LOV	1	B	445	14	tr 0.05	ND 0.05	0.102555	0.0080	0.0080	0.0165	0.01862	-0.002049
3000	2/11/90	1	A O 01	LOV	1	B	1435	15	tr 0.05	ND 0.05	0.102555	0.0023	0.0023	0.0048	0.005389	-0.000593
3598	2/12/90	1	A O 02	LOV	1	B	1410	15	0.11	ND 0.05	0.162555	0.0052	0.0024	0.0077	0.012066	-0.004165
3586	2/14/90	12	B O 02	LOV	1	B	1500	16	tr 0.05	ND 0.05	0.102555	0.002083	0.002083	0.004273	0.004833	-0.000532
3024	2/14/90	12	B O 05	LOV	1	B	1440	15	tr 0.05	ND 0.05	0.102555	0.002315	0.002315	0.004748	0.00537	-0.000591
3048	2/14/90	12	B O 17	LOV	1	B	1440	15	ND 0.05	ND 0.05	0.102555	0.002315	0.002315	0.004748	0.00537	-0.000591
3016	2/14/90	12	B O 19	LOV	1	B	1447	15	tr 0.05	ND 0.05	0.102555	0.002304	0.002304	0.004725	0.005344	-0.000588
3610	2/14/90	12	B O 23	LOV	1	B	1440	15	tr 0.05	ND 0.05	0.102555	0.002315	0.002315	0.004748	0.00537	-0.000591
3726	2/18/90	9	C O 07	LOV	1	B	1440	14	tr 0.05	ND 0.05	No Spray					
3713	2/18/90	5	C O 15	LOV	1	B	1440	15	tr 0.05	ND 0.05	0.102555	0.002315	0.002315	0.004748	0.00537	-0.000591
3761	2/18/90	5	C O 22	LOV	1	B	1440	14	ND 0.05	ND 0.05	0.102555	0.00248	0.00248	0.005087	0.005754	-0.000633
3753	2/18/90	6	C O 24	LOV	1	B	1445	15	ND 0.05	ND 0.05	0.102555	0.002307	0.002307	0.004731	0.005352	-0.000589
3709	2/18/90	6	C O 25	LOV	1	B	1440	15	0.27	ND 0.05	0.322555	0.0125	0.002315	0.014933	0.029	-0.013377
3839	2/20/90	7	D O 02	LOV	1	B	1450	15	0.73	0.32	1.066352	0.033563	0.014713	0.049028	0.077867	-0.02742
3871	2/20/90	7	D O 05	LOV	1	B	1440	15	0.36	0.46	0.843506	0.016667	0.021296	0.039051	0.038667	0.000374
3836	2/20/90	7	D O 13	LOV	1	B	1440	16	0.24	0.21	0.460731	0.010417	0.009115	0.019997	0.024167	-0.003962
3729	2/20/90	7	D O 26	LOV	1	B	1445	15	0.22	0.21	0.440731	0.01015	0.009689	0.020334	0.023548	-0.003053
3717	2/20/90	7	D O 32	LOV	1	B	1470	17	0.20	0.34	0.557374	0.008003	0.013605	0.022304	0.018567	0.003559
4214	3/13/90	7	D O 02	HIV	2	B	1440	1000	6.98	7.7	15.07347	0.004847	0.005347	0.010468	0.014008	-0.003365
4232	3/13/90	7	D O 05	HIV	2	B	1440	1000	8.46	10.97	19.99057	0.005875	0.007618	0.013882	0.016979	-0.002942
3701	3/13/90	7	D O 34	LOV	2	B	1420	20	0.27	0.11	0.385621	0.009507	0.003873	0.013578	0.022056	-0.008061
4268	3/13/90	7	D O 35	HIV	2	B	1409	1000	8.23	8.35	17.00669	0.005841	0.005926	0.01207	0.016881	-0.004572
3867	3/13/90	7	D O 51	LOV	2	B	1450	20	0.4	0.15	0.557665	0.013793	0.005172	0.01923	0.032	-0.012142
4250	4/3/90	7	D O 02	HIV	3	B	1440	1000	13.88	9.65	24.02312	0.009639	0.006701	0.016683	0.027856	-0.010623
4257	4/3/90	7	D O 05	HIV	3	B	1440	1000	38.98	18.77	58.70915	0.027069	0.013035	0.04077	0.078231	-0.03562
3770	4/03/90	7	D O 34	LOV	3	B	1446	20	0.40	0.25	0.662775	0.013831	0.008645	0.022918	0.032089	-0.008718
4385	4/3/90	7	D O 35	HIV	3	B	1440	1000	29.96	12.97	43.59277	0.020806	0.009007	0.030273	0.060128	-0.028389
4283	4/03/90	7	D O 51	LOV	3	B	1410	20	0.41	0.27	0.693797	0.014539	0.009574	0.024603	0.03373	-0.008677
4432	4/24/90	7	D O 02	HIV	4	B	1440	1000	11.40	6.82	18.5685	0.007917	0.004736	0.012895	0.022879	-0.009493
4454	4/24/90	7	D O 05	HIV	4	B	1442	1000	20.11	26.34	47.79597	0.013946	0.018266	0.033146	0.040304	-0.0068
4287	4/24/90	7	D O 34	LOV	4	B	1440	20	0.12	0.32	0.456352	0.004167	0.011111	0.015846	0.009667	0.005881
4275	4/24/90	7	D O 51	LOV	4	B	1440	20	0.25	0.51	0.786061	0.008681	0.017708	0.027294	0.020139	0.006811
4471	4/24/90	7	D O 53	HIV	4	B	1438	1000	5.18	15.44	21.40898	0.003602	0.010737	0.014888	0.01041	0.004263

Study 94: Medfly Air Results

Date 8/25/90

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Sample #	Date Collected	Corridor	Location Code	Sample Type	Sequence	Interval	Run Time (min)	Flow Rate (L/min)	Malathion (ug/samp)	Malaoxon (ug/samp)	Total (ug/samp)	Malathion (ug/cu m)	Malaoxon (ug/cu m)	Total (ug/cu m)	Malathion Adjust	Malaoxon Adjust
3605	2/14/90	1	A O 18	LOV	1	F	1440	15	0.60	0.27	0.883797	0.0278	0.0125	0.0409	0.064444	-0.02237
3011	2/14/90	1	A O 22	LOV	1	F	1455	15	0.45	0.18	0.639198	0.0206	0.0082	0.0293	0.047835	-0.017635
3597	2/14/90	1	A O 25	LOV	1	F	1453	15	ND 0.05	ND 0.05	0.102555	0.0023	0.0023	0.0047	0.005322	-0.000586
3003	2/14/90	1	A O 01	LOV	1	F	1440	15	0.37	0.17	0.548687	0.0171	0.0079	0.0254	0.039741	-0.013633
3601	2/14/90	1	A O 02	LOV	1	F	1440	15	1.11	0.51	1.646061	0.0514	0.0236	0.0762	0.119222	-0.040898
3589	2/17/90	12	B O 02	LOV	1	F	1440	15	0.54	0.15	0.697665	0.025	0.006944	0.032299	0.058	-0.024439
3027	2/17/90	12	B O 05	LOV	1	F	1440	16	0.41	ND 0.05	0.462555	0.017795	0.00217	0.020076	0.041285	-0.020168
3051	2/17/90	12	B O 17	LOV	1	F	1440	15	0.56	0.11	0.675621	0.025926	0.005093	0.031279	0.060148	-0.027453
3019	2/17/90	12	B O 19	LOV	1	F	1440	16	0.30	ND 0.05	0.352555	0.013021	0.00217	0.015302	0.030208	-0.014175
3613	2/17/90	12	B O 23	LOV	1	F	1440	15	0.63	ND 0.05	0.682555	0.029167	0.002315	0.0316	0.067667	-0.034299
3834	2/21/90	9	C O 07	LOV	1	F	1435	14	tr 0.05	tr 0.05	No Spray					
3716	2/21/90	5	C O 15	LOV	1	F	1425	15	1.98	1.10	3.13621	0.092632	0.051462	0.146723	0.214905	-0.06482
3764	2/21/90	5	C O 22	LOV	1	F	1420	17	2.00	0.77	2.809347	0.08285	0.031897	0.116377	0.192212	-0.072106
3756	2/21/90	5	C O 24	LOV	1	F	1413	16	3.29	1.04	4.383144	0.145524	0.046001	0.193876	0.337615	-0.136677
3712	2/20/90	5	C O 25	LOV	1	F	1424	15	1.37	0.97	2.389567	0.064139	0.045412	0.111871	0.148801	-0.035102
3842	2/23/90	7	D O 02	LOV	1	F	1440	15	1.47	1.56	3.109716	0.068056	0.072222	0.143968	0.157889	-0.013209
3874	2/23/90	7	D O 05	LOV	1	F	1410	15	1.15	1.69	2.926359	0.054374	0.079905	0.138362	0.126147	0.011649
3854	2/23/90	7	D O 13	LOV	1	F	1440	15	3.1	1.96	5.160156	0.143519	0.090741	0.238896	0.332963	-0.089421
3732	2/23/90	7	D O 26	LOV	1	F	1395	14	0.79	1.22	2.072342	0.040451	0.062468	0.106111	0.093845	0.01169
3720	2/23/90	7	D O 32	LOV	1	F	1425	16	1.92	3.97	6.092867	0.084211	0.174123	0.267231	0.195368	0.068412
4217	3/16/90	7	D O 02	HIV	2	F	1440	1000	35.25	27.84	64.51262	0.024479	0.019333	0.0448	0.070745	-0.024665
4235	3/17/90	7	D O 05	HIV	2	F	1440	1000	70.14	111.99	187.8527	0.048708	0.077771	0.130453	0.140767	-0.009777
3703	3/16/90	7	D O 34	LOV	2	F	1440	20	1.33	0.62	1.981682	0.046181	0.021528	0.068808	0.107139	-0.036444
4272	3/16/90	7	D O 35	HIV	2	F	1425	1000	35.96	39.53	77.50998	0.025235	0.02774	0.054393	0.072929	-0.017617
3870	3/16/90	7	D O 51	LOV	2	F	1440	20	2.60	1.52	4.197672	0.090278	0.052778	0.145753	0.209444	-0.06055
4253	4/6/90	7	D O 02	HIV	3	F	1440	1000	89.67	22.67	113.4984	0.062271	0.015743	0.078818	0.179963	-0.096182
4372	4/6/90	7	D O 05	HIV	3	F	1440	1000	68.08	26.21	95.62933	0.047278	0.018201	0.066409	0.136633	-0.066775
3052	4/06/90	7	D O 34	LOV	3	F	1440	20	1.00	0.28	1.294308	0.034722	0.009722	0.044941	0.080556	-0.033865
4241	4/6/90	7	D O 35	HIV	3	F	1495	1000	94.96	24.31	120.5122	0.063518	0.016261	0.08061	0.183568	-0.097906
4286	4/06/90	7	D O 51	LOV	3	F	1440	20	1.30	0.42	1.741462	0.045139	0.014583	0.060467	0.104722	-0.04208
4466	4/27/90	7	D O 02	HIV	4	F	1455	1000	52.91	64.49	120.6954	0.036364	0.044323	0.082952	0.105093	-0.021038
4442	4/27/90	7	D O 05	HIV	4	F	1440	1000	15.39	8.98	24.82888	0.010688	0.006236	0.017242	0.030887	-0.012973
4290	4/27/90	7	D O 34	LOV	4	F	1440	20	0.95	1.72	2.757892	0.032986	0.059722	0.09576	0.076528	0.018314
4278	4/27/90	7	D O 51	LOV	4	F	1440	20	1.75	1.73	3.568403	0.060764	0.060069	0.123903	0.140972	-0.016209
4473	4/27/90	7	D O 53	HIV	4	F	1440	1000	74.25	102.99	182.5028	0.051563	0.071521	0.126738	0.149016	-0.021157

Sample #	Date Collected	Corridor	Location Code	Sample Type	Sequence	Interval	Run Time (min)	Flow Rate (L/min)	Malathion (ug/samp)	Malaoxon (ug/samp)	Total (ug/samp)	Malathion (ug/cu m)	Malaoxon (ug/cu m)	Total (ug/cu m)	Malathion Adjust	Malaoxon Adjust
3604	2/14/90	1	A O 18	LOV	1	P	1440	14	0.54	0.19	0.739709	0.0268	0.0094	0.0367	0.062143	-0.0242
3009	2/13/90	1	A O 22	LOV	1	P	1470	13	0.85	0.23	1.091753	0.0321	0.0087	0.0413	0.074528	-0.031633
3596	2/14/90	1	A O 25	LOV	1	P	1440	14	1.53	0.39	1.939929	0.0759	0.0193	0.0962	0.176071	-0.075925
3002	2/13/90	1	A O 01	LOV	1	P	1440	15	1.53	0.29	1.834819	0.0708	0.0134	0.0849	0.164333	-0.075493
3600	2/13/90	1	A O 02	LOV	1	P	1440	15	1.91	0.62	2.561682	0.0884	0.0287	0.1186	0.205148	-0.082299
3588	2/16/90	12	B O 02	LOV	1	P	1430	15	1.51	0.44	1.972484	0.070396	0.020513	0.091957	0.163319	-0.067857
3026	2/16/90	12	B O 05	LOV	1	P	1521	16	1.24	0.49	1.755039	0.050953	0.020135	0.072117	0.118212	-0.043828
3050	2/16/90	12	B O 17	LOV	1	P	1478	15	1.95	0.47	2.444017	0.087957	0.0212	0.11024	0.20406	-0.089214
3018	2/16/90	12	B O 19	LOV	1	P	1481	16	1.36	0.32	1.696352	0.057394	0.013504	0.071588	0.133153	-0.058543
3612	2/16/90	12	B O 23	LOV	1	P	1442	17	0.69	ND 0.05	0.742555	0.028147	0.00204	0.030291	0.065301	-0.033294
3832	2/20/90	9	C O 07	LOV	1	P	1560	12	0.12	0.11	No Spray					
3715	2/20/90	5	C O 15	LOV	1	P	1415	15	2.22	0.83	3.092413	0.104594	0.039105	0.145697	0.242657	-0.092194
3763	2/20/90	5	C O 22	LOV	1	P	1425	15	2.28	0.61	2.921171	0.106667	0.028538	0.136663	0.247467	-0.105363
3755	2/20/90	5	C O 24	LOV	1	P	1440	15	5.38	0.83	6.252413	0.249074	0.038426	0.289464	0.577852	-0.274242
3711	2/21/90	5	C O 25	LOV	1	P	1508	15	1.70	0.75	2.488325	0.075155	0.033156	0.110006	0.174359	-0.061187
3841	2/22/90	7	D O 02	LOV	1	P	1446	15	2.29	1.66	4.034826	0.105579	0.076533	0.186022	0.244942	-0.056002
3873	2/22/90	7	D O 05	LOV	1	P	1419	15	2.23	2.02	4.353222	0.104769	0.094903	0.204521	0.243063	-0.036616
3852	2/22/90	7	D O 13	LOV	1	P	1485	15	4.96	2.07	7.135777	0.222671	0.092929	0.320349	0.516597	-0.186594
3731	2/22/90	7	D O 26	LOV	1	P	1500	13	1.17	1.04	2.263144	0.06	0.053333	0.116059	0.1392	-0.021986
3719	2/22/90	7	D O 32	LOV	1	P	1490	17	2.8	3.37	6.342207	0.110541	0.133044	0.250383	0.256455	-0.00572
4216	3/15/90	7	D O 02	HIV	2	P	1457	1000	61.23	65.83	130.4239	0.042025	0.045182	0.089515	0.121451	-0.030353
4234	3/15/90	7	D O 05	HIV	2	P	1440	1000	101.48	105.13	211.9821	0.070472	0.073007	0.14721	0.203665	-0.053659
3704	3/15/90	7	D O 34	LOV	2	P	1443	20	1.97	1.44	3.483584	0.068261	0.049896	0.120706	0.158365	-0.035793
4269	3/15/90	7	D O 35	HIV	2	P	1469	1000	186.63	213.78	411.3342	0.127046	0.145528	0.28001	0.367162	-0.082823
3869	3/15/90	7	D O 51	LOV	2	P	1455	20	3.99	2.13	6.228843	0.137113	0.073196	0.21405	0.318103	-0.098925
4252	4/5/90	7	D O 02	HIV	3	P	1450	1000	65.86	21.50	88.45865	0.045421	0.014828	0.061006	0.131266	-0.066811
4371	4/5/90	7	D O 05	HIV	3	P	1440	1000	82.76	41.17	126.0338	0.057472	0.02859	0.087523	0.166095	-0.07471
3577	4/05/90	7	D O 34	LOV	3	P	1440	20	1.83	0.71	2.576281	0.063542	0.024653	0.089454	0.147417	-0.055112
4240	4/5/90	7	D O 35	HIV	3	P	1440	1000	107.76	27.07	136.2133	0.074833	0.018799	0.094593	0.216268	-0.115706
4285	4/05/90	7	D O 51	LOV	3	P	1440	20	2.90	0.90	3.84599	0.100694	0.03125	0.133541	0.233611	-0.095154
4431	4/26/90	7	D O 02	HIV	4	P	1465	1000	140.56	91.35	236.578	0.095945	0.062355	0.161487	0.277282	-0.110096
4289	4/26/90	7	D O 34	LOV	4	P	1455	20	2.40	2.44	4.964684	0.082474	0.083849	0.170608	0.19134	-0.019683
4277	4/26/90	7	D O 51	LOV	4	P	1440	20	3.18	2.40	5.70264	0.110417	0.083333	0.198008	0.256167	-0.055275
4476	4/26/90	7	D O 53	HIV	4	P	1440	1000	183.91	101.89	291.0066	0.127715	0.070757	0.202088	0.369097	-0.158797

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Sample #	Date Collected	Corridor	Location Code	Sample Type	Sequence	Interval	Run Time (min)	Flow Rate (L/min)	Malathion (ug/samp)	Malaoxon (ug/samp)	Total (ug/samp)	Malathion (ug/cu m)	Malaoxon (ug/cu m)	Total (ug/cu m)	Malathion Ajdust	Malaoxon Ajdust
3603	2/12/90	1	A O 18	LOV	1	S	390	13	tr 0.05	ND 0.05	0.102555	0.0099	0.0099	0.0202	0.017653	0.002453
3043	2/12/90	1	A O 22	LOV	1	S	360	16	0.17	ND 0.05	0.222555	0.0295	0.0087	0.0386	0.05283	-0.013493
3595	2/12/90	1	A O 25	LOV	1	S	357	14	tr 0.05	ND 0.05	0.102555	0.0100	0.0100	0.0205	0.017907	0.002488
3001	2/12/90	1	A O 01	LOV	1	S	395	15	0.18	ND 0.05	0.232555	0.0304	0.0084	0.0392	0.05438	-0.014385
3599	2/12/90	1	A O 02	LOV	1	S	410	15	0.24	ND 0.05	0.292555	0.0390	0.0081	0.0476	0.069854	-0.021189
3587	2/15/90	12	B O 02	LOV	1	S	292	17	0.38	ND 0.05	0.432555	0.076551	0.010073	0.087138	0.137027	-0.04744
3025	2/15/90	12	B O 05	LOV	1	S	216	15	0.11	ND 0.05	0.162555	0.033951	0.015432	0.050171	0.060772	-0.010075
3049	2/15/90	12	B O 17	LOV	1	S	300	15	0.38	ND 0.05	0.432555	0.084444	0.011111	0.096123	0.151156	-0.052331
3017	2/15/90	12	B O 19	LOV	1	S	292	16	0.10	ND 0.05	0.152555	0.021404	0.010702	0.032653	0.038313	-0.005379
3611	2/15/90	12	B O 23	LOV	1	S	300	15	tr 0.05	ND 0.05	0.102555	0.011111	0.011111	0.02279	0.019889	0.002763
3728	2/19/90	9	C O 07	LOV	1	S	396	15	tr 0.05	ND 0.05	No Spray					
3714	2/19/90	5	C O 15	LOV	1	S	380	15	0.28	ND 0.05	0.332555	0.049123	0.008772	0.058343	0.08793	-0.028134
3762	2/19/90	5	C O 22	LOV	1	S	400	15	0.10	ND 0.05	0.152555	0.016667	0.008333	0.025426	0.029833	-0.004188
3754	2/19/90	6	C O 24	LOV	1	S	405	15	0.27	ND 0.05	0.322555	0.044444	0.00823	0.053095	0.079556	-0.02516
3710	2/19/90	6	C O 25	LOV	1	S	362	15	0.73	ND 0.05	0.782555	0.134438	0.009208	0.144117	0.240645	-0.091794
3840	2/21/90	7	D O 02	LOV	1	S	375	15	0.85	tr 0.05	0.902555	0.151111	0.008889	0.160454	0.270489	-0.104639
3872	2/21/90	7	D O 05	LOV	1	S	373	15	1.45	ND 0.05	1.502555	0.25916	0.008937	0.268553	0.463896	-0.185768
3838	2/21/90	7	D O 13	LOV	1	S	375	16	1.22	ND 0.05	1.272555	0.203333	0.008333	0.212093	0.363967	-0.144429
3730	2/21/90	7	D O 26	LOV	1	S	360	14	0.12	ND 0.05	0.172555	0.02381	0.009921	0.034237	0.042619	-0.007967
3718	2/21/90	7	D O 32	LOV	1	S	380	17	0.23	ND 0.05	0.282555	0.035604	0.00774	0.043739	0.063731	-0.019009
4215	3/14/90	7	D O 02	HIV	2	S	432	1000	13.76	0.97	14.77957	0.031852	0.002245	0.034212	0.086637	-0.049855
4233	3/14/90	7	D O 05	HIV	2	S	455	1000	15.94	1.53	17.54818	0.035033	0.003363	0.038567	0.09529	-0.053941
3702	3/14/90	7	D O 34	LOV	2	S	465	20	0.39	ND 0.05	0.442555	0.041935	0.005376	0.047587	0.075065	-0.026129
4270	3/14/90	7	D O 35	HIV	2	S	442	1000	6.78	1.13	7.967743	0.015339	0.002557	0.018027	0.041723	-0.022534
3868	3/14/90	7	D O 51	LOV	2	S	430	20	1.37	ND 0.05	1.422555	0.159302	0.005814	0.165413	0.285151	-0.113868
4251	4/4/90	7	D O 02	HIV	3	S	435	1000	21.15	2.07	23.32578	0.048621	0.004759	0.053622	0.132248	-0.074771
4259	4/4/90	7	D O 05	HIV	3	S	425	1000	24.06	2.43	26.61417	0.056612	0.005718	0.062622	0.153984	-0.086883
3769	4/04/90	7	D O 34	LOV	3	S	490	20	0.52	ND 0.05	0.572555	0.053061	0.005102	0.058424	0.09498	-0.034762
4243	4/4/90	7	D O 35	HIV	3	S	435	1000	22.28	2.27	24.666	0.051218	0.005218	0.056703	0.139314	-0.078561
4284	4/04/90	7	D O 51	LOV	3	S	436	20	0.62	ND 0.05	0.672555	0.071101	0.005734	0.077128	0.127271	-0.047683
4430	4/25/90	7	D O 02	HIV	4	S	425	1000	21.28	1.65	23.01432	0.050071	0.003882	0.054151	0.136192	-0.078019
4456	4/25/90	7	D O 05	HIV	4	S	416	1000	43.92	2.51	46.55826	0.105577	0.006034	0.111919	0.287169	-0.166661
4288	4/25/90	7	D O 34	LOV	4	S	425	20	0.44	ND 0.05	0.492555	0.051765	0.005882	0.057948	0.092659	-0.033008
4276	4/25/90	7	D O 51	LOV	4	S	430	20	0.53	ND 0.05	0.582555	0.061628	0.005814	0.067739	0.110314	-0.040486
4475	4/25/90	7	D O 53	HIV	4	S	447	1000	18.41	1.14	19.60825	0.041186	0.00255	0.043866	0.112025	-0.064818

APPENDIX C
QUALITY CONTROL RAW DATA

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Table C-1. Method validation (malathion mass deposition) for the 1990 Medfly Project.

Study: 94 Matrix Sample Type: Kimbie (Mass Deposition)
 Chemical: Malathion Lab: CDFA
 MDL: 1.0 ug/sample Chemist: Jane White

Lab Sample #	Spike Level (ug)	Results (ug)	Recovery (%)	\bar{X}	SD	CV
1983	10	9.38	94			
1983	10	9.77	98	96	2.8	2.9
1983	100	73.4	73			
1983	100	91.6	92	83	13	16
1983	1000	1075.90	108			
1983	1000	1082	108	108	0	0
1983	5000	5013.56	100			
1983	5000	5260.74	105	103	3.54	3.44
OVERALL:				97	12	12
\bar{X}	SD	LWL	UWL	LCL	UCL	
97	12	73	121	61	133	

Table C-2. Method validation (malaoxon mass deposition) for the 1990 Medfly Project.

Study: 94 Matrix Sample Type: Kimbie (Mass Deposition)
 Chemical: Malaoxon Lab: CDFA
 MDL: 1.0 ug/sample Chemist: Jane White

Lab Sample #	Spike Level (ug)	Results (ug)	Recovery (%)	\bar{X}	SD	CV
1984	10	10.24	102			
1984	10	11.84	118	110	11.3	10.3
1984	100	89.3	89			
1984	100	91.7	92	91	2.1	2.3
1984	1000	1048.70	105			
1984	1000	904.15	90	98	11	11
1984	5000	4838.51	97			
1984	5000	4910.87	98	98	0.71	0.72
OVERALL:				99	9.6	9.7
\bar{X}	SD	LWL	UWL	LCL	UCL	
99	9.6	80	118	70	128	

Table C-3. Continuing quality control data (malathion mass deposition) for the 1990 Medfly Project.

Study: 94
 Analyte: Malathion
 MDL: 1.0 ug/sample

Matrix Sample Type: Kimble (Mass Deposition)
 Lab: CDFA
 Chemist: Jane White

Extraction Set #	Lab Sample #	Results (ug)	Spike Level (ug)	Recovery %	\bar{X}	SD	CV (%)
1112-1130	2173	1166.66	1000	116			
1309-1457	2175	1174.6	1000	117			
1318, 1320-28, 1360-68, 1372-5, 1400-058	2133	1206.97	1000	120			
1286, 1288, 1296-9, 1300-1, 1433-43, 3116-19, 1329, 1336	2288	1016.00	1000	102			
1284-5, 1291, 1295, 1365-6, 1369-73, 1376-80, 3104-15, 1439, 1444-46	2349	970.59	1000	97			
3296-8, 3300-5, 3319-27, 3335	2708	909.48	1000	91			
3303, 3306, 3317-18, 3328-34, 3336, 3340-42, 3299	2711	916.26	1000	92			
3124-5, 3134-6	2863	1106.50	1000	110			
3147-52, 3154, 3157-65, 3167	2864	1044.67	1000	104			
1345-7, 1349-53, 1382-3, 3072-74, 3085, 3088, 3091	3350	936.59	1000	94			
4950, 4958-82, 4990-92	3353	883.66	1000	88			
1121-2, 3087, 4576-8	3386	956.12	1023	93			

OVERALL: 102 11.3 11.1

Table C-4. Continuing quality control data (malaoxon mass deposition) for the 1990 Medfly Project.

Study: 94
 Analyte: Malaoxon
 MDL: 1.0 ug/sample

Matrix Sample Type: Kimble (Mass Deposition)
 Lab: CDFA
 Chemist: Jane White

Extraction Set #	Lab Sample #	Results (ug)	Spike Level (ug)	Recovery (%)	\bar{X}	SD	CV
1112-1130	2173	1152.01	1000	115			
1309-1457	2176	1147.22	1000	115			
1318, 1320-28, 1360-68, 1372-5, 1400-08	2133	924.00	1000	92			
1286, 1288, 1296-9, 1300-1, 1433-43, 3116-19, 1329, 1336	2289	961.90	1000	96			
1284-5, 1291, 1295, 1365-6, 1369-73, 1376-80, 3104-15, 1439, 1444-46	2350	944.77	1000	94			
3296-8, 3300-5, 3319-27, 3335	2709	972.69	1000	97			
3303, 3306, 3317-18, 3328-34, 3336, 3340-42, 3299	2712	963.50	1000	96			
3124-5, 3134-6	2862	690.66*	1000	69			
3147-52, 3154, 3157-65, 3167	2861	845.67	1000	85			
1345-7, 1349-53, 1382-3, 3072-74, 3085, 3088, 3091	3251	969.26	1000	97			
4950, 4958-82, 4990-92	3354	971.12	1000	97			
1121-2, 3087, 4576-8	3385	998.60	1016	98			

* Sample result fell below the LCL set for malaoxon at 70%.

OVERALL: 96 12 13

Table C-5. Blind spike recoveries (mass deposition) for the 1990 Medfly Project.

Study: 94

Analyte: Malathion, Malaoxon

MDL: 1.0 ug/sample

Matrix Sample Type: Kimbie (Mass Dep)

Lab: CDFA

Chemist: Jane White

Analyte	Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery (%)	\bar{X}	SD	CV
Malathion	3343	895.35	1000	90			
Malaoxon	3343	10.11	...	...	
Malathion	3344	887.6	1000	89			
Malaoxon	3344	6.16	...	...	
Malathion	3345	<1.0	...	...	
Malaoxon	3345	973.84	1000	97			
Malathion	3346	<1.0	...	...	
Malaoxon	3346	962.21	1000	96			

Table C-6. Storage dissipation analyses (malathion mass deposition) for the 1990 Medfly Project.

Study: 94 Matrix Sample Type: Kimbie (Mass Deposition)
 Analyte: Malathion Lab: CDFA
 MDL: 1.0 ug/sample Chemist: Jane White

Lab Sample #	Day	Date Extracted	Date Analyzed	Results (ug)	Spike Level (ug)	Recovery (%)	\bar{X}	SD	CV
1985	0	2/09/90	2/13/90	1044.61	1000	104			
1985	0	2/09/90	2/13/90	1096.10	1000	109	107	3.54	3.31
1986	4	2/13/90	2/13/90	1049.85	1000	105			
1986	4	2/13/90	2/13/90	1054.33	1000	105	105	0	0
2169	7	2/16/90	2/16/90	1022.9	1000	102			
2169	7	2/16/90	2/16/90	995	1000	100	101	1.41	1.40

Table C-7. Storage dissipation analyses (malaoxon mass deposition) for the 1990 Medfly Project.

Study: 94 Matrix Sample Type: Kimbie (Mass Deposition)
 Analyte: Malaoxon Lab: CDFA
 MDL: 1.0 ug/sample Chemist: Jane White

Lab Sample #	Day	Date Extracted	Date Analyzed	Results (ug)	Spike Level (ug)	Recovery (%)	\bar{X}	SD	CV
1985	0	2/09/90	2/13/90	113.23	100	113			
1985	0	2/09/90	2/13/90	86.57	100	87	100	18.4	18.4
1986	4	2/13/90	2/13/90	86.34	100	86			
1986	4	2/13/90	2/13/90	65.47	100	65	76	15	20
2169	7	2/16/90	2/16/90	92.12	100	92			
2169	7	2/16/90	2/16/90	107.00	100	107	100	10.6	10.6

Table C-8. Method validation (malathion water) for the 1990 Medfly Project.

Study: 94
 Chemical: Malathion
 MDL: 0.1 ppb

Matrix Sample Type: Tap Water pH=8.9
 Lab: CDFA
 Chemist: Jane White

Lab Sample #	Spike Level (ppb)	Results (ppb)	Recovery (%)	\bar{X}	SD	CV
1980	0.5	0.50	100			
1980	0.5	0.49	98	99	1.4	1.4
1980	5.0	5.35	107			
1980	5.0	5.26	105	106	1.41	1.33
1980	50	53.19	106			
1980	50	53.12	106	106	0	0
1980	500	513.54	103			
1980	500	516.19	103	103	0	0
OVERALL:				104	3.16	3.04
\bar{X}	SD	LWL	UWL	LCL	UCL	
104	3.16	98	110	95	113	

Table C-9. Method validation (malaoxon water) for the 1990 Medfly Project.

Study: 94
 Chemical: Malaoxon
 MDL: 0.1 ppb

Matrix Sample Type: Tap Water pH=8.9
 Lab: CDFA
 Chemist: Jane White

Lab Sample #	Spike Level (ppb)	Results (ppb)	Recovery (%)	\bar{X}	SD	CV
1979	0.5	0.69	138			
1979	0.5	0.69	138	138	0	0
1979	5.0	6.72	134			
1979	5.0	5.69	113	124	14.9	12.0
1979	50	49.23	98			
1979	50	51.32	103	101	3.54	3.50
1979	500	463.05	93			
1979	500	496.19	99	96	4.2	4.4
OVERALL:				115	19.3	16.8
\bar{X}	SD	LWL	UWL	LCL	UCL	
115	19.3	76	154	57	173	

Table C-10. Continuing quality control data (malathion water) for the 1990 Medfly Project.

Study: 94
 Analyte: Malathion
 MDL: 0.1 ppb

Sample Type: Water
 Lab: CDFA
 Chemist: Jane White

Extraction Set #	Lab Sample #	Results (ppb)	Spike Level (ppb)	Recovery (%)	\bar{X}	SD	CV
2500-1, 2506-11, 3644-51	1993	5.25	5.0	105			
2069-83	2067	5.74 *	5.0	114			
2177-88, 2191-95	2199	4.16 **	5.0	83			
2452-7, 2464-7, 2470-5, 3801-4	2312	4.34 **	5.0	87			
3799-800, 4030-35, 4102-4	2704	5.44	5.0	108			
3789-92, 3796-98, 4150-53, 4156-61, 4105-7	2608	4.80	5.0	96			
4072-77	2764	4.98	5.0	100			
2476-77, 2480, 3797, 3779, 3781, 4006, 4008, 4010, 4055, 4057, 4059, 4066-67, 4070, 4138, 4142-3	2804	4.77	5.0	95			
3680-5, 3820-3, 3825, 3830	2971	4.94	5.0	99			
4036-38	3049	4.94	5.0	99			
4012-23, 4078-83	3140	4.61 **	5.0	92			
4000-2	3271	4.44 **	5.0	88			
84-9, 4168-73	3311	5.09	5.0	101			
4042-43, 4162-63, 4044-47, 4096-4101, 4164-67	3343	4.64 **	5.0	93			
4144-5, 4148	3419	4.89	5.0	98			
3921-22, 3924-30, 9099	3725	4.63**	5.0	93			
3921-22, 3924-30, 9099	3725	4.63**	5.0	93			
3937-42, 3973-76	4260	4.03**	5.0	81			
4604-11	4219	4.46**	5.0	89			
4616-25	45	4.76	5.0	95			
3969-72, 4048-9	84	4.43**	5.0	89			

OVERALL: 95 8.0 8.4

* Above UCL set for Malathion at 110%.

** Below LCL set for Malathion at 95%.

Table C-11. Continuing quality control data (malaoxon water) for the 1990 Medfly Project.

Study: 94
 Analyte: Malaoxon
 MDL: 0.1 ppb

Sample Type: Water
 Lab: CDFA
 Chemist: Jane White

Extraction Set #	Lab Sample #	Results (ppb)	Spike Level (ppb)	Recovery (%)	\bar{X}	SD	CV
2500-1, 2506-11, 3644-51	1992	5.30	5.0	106			
2069-83	2066	5.25	5.0	105			
2177-88, 2191-95	2198	5.25	5.0	105			
2452-7, 2464-7, 2470-5, 3801-4	2313	5.56	5.0	111			
3799-800, 4030-35, 4102-4	2705	5.34	5.0	107			
3789-92, 3796-98, 4150-53, 4156-61, 4105-7	2607	5.42	5.0	108			
4072-77	2765	4.50	5.0	90			
2476-77, 2480, 3797, 3779, 3781, 4006, 4008, 4010, 4055, 4057, 4059, 4066-67, 4070, 4138, 4142-3	2804	4.93	5.0	99			
3680-5, 3820-3, 3825, 3830	2972	4.55	5.0	91			
4036-38	3048	4.67	5.0	93			
4012-23, 4078-83	3141	5.10	5.0	102			
4000-2	3270	5.40	5.0	108			
84-9, 4168-73	3312	5.25	5.0	105			
4042-43, 4162-63, 4044-47, 4096-4101, 4164-67	3344	5.20	5.0	104			
4144-5, 4148	3418	4.79	5.0	96			
3921-22, 3924-30, 9099	3724	4.62	5.0	93			
3921-22, 3924-30, 9099	3724	4.62	5.0	93			
3937-42, 3973-76	4259	4.35	5.0	87			
4606-11	4218	4.74	5.0	95			
4616-25	46	5.00	5.0	100			
3969-72, 4048-9	85	5.59	5.0	112			

OVERALL: 100 7.44 7.41

Table C-12. Blind spike recoveries (water) for the 1990 Medfly Project.

Study: 94
 Analyte: Malathion, Malaoxon
 MDL: 0.1 ppb

Matrix Sample Type: Water
 Lab: CDFA
 Chemist: Jane White

Analyte	Lab Sample #	Results (ppb)	Spike Level (ppb)	Recovery (%)	\bar{X}	SD	CV
Malathion	3988	61.43	50	123			
Malaoxon	3988	0.32	...	...	
Malathion	3990	80.25	50	161			
Malaoxon	3990	<0.10	...	...	
Malathion	3989	0.21	...	...	
Malaoxon	3989	47.60	50	95			
Malathion	3995	3.00	...	...	
Malaoxon	3995	83.71	50	167			
Malathion	3998	57.17	50	114			
Malaoxon	3998	<0.10	...	...	
Malathion	3999	<0.10	...	...	
Malaoxon	3999	47.07	50	94			

Table C-13. Blind spike recoveries (water) for the 1990 Medfly Project.

Study: 94
 Analyte: Malathion, Malaoxon
 MDL: 0.1 ppb

Matrix Sample Type: Water
 Lab: Enseco-CAL

Analyte	Lab Sample #	Results (ppb)	Spike Level (ppb)	Recovery (%)	\bar{X}	SD	CV
Malathion	3996	35	50	70			
Malaoxon	3996	<0.10	...	...	
Malathion	3997	<0.10	...	...	
Malaoxon	3997	34	50	68			
Malathion	4493	34	50	68			
Malaoxon	4493	<0.10	...	...	
Malathion	4494	<0.10	...	...	
Malaoxon	4494	39	50	78			

Table C-14. Split /Confirmation analyses (malathion water) for the 1990 Medfly Project.

Study: 94
 Analyte: Malathion
 MDL: 0.1 ppb, both labs

Matrix Sample Type: Water
 QC Sample Type: Splits

EHAP Sample #	Lab/Method #1 CDFA (ppb)	Lab/Method #2 Enseco-CAL (ppb)	\bar{X}	SD	CV
2476	<0.10				
2478		<0.10	0	0	0
2477	<0.10				
2479		<0.10	0	0	0
2480	<0.10				
2481		<0.10	0	0	0
3777	<0.10				
3778		<0.10	0	0	0
3779	<0.10				
3780		<0.10	0	0	0
3781	<0.10				
3782		<0.10	0	0	0
4006	<0.10				
4007		<0.10	0	0	0
4008	<0.10				
4009		<0.10	0	0	0
4010	<0.10				
4011		<0.10	0	0	0
4055	3.80				
4056		2.5	3.2	0.92	29
4057	4.46				
4058		2.2	3.3	1.6	48
4059	<0.10				
4054		<0.10	0	0	0
4066	1.37				
4069		0.58	0.98	0.56	57
4067	0.71				
4068		0.59	0.65	0.08	12.3
4070	<0.10				
4071		<0.10	0	0	0
4138	<0.10				
4139		<0.10	0	0	0
4142	<0.10				
4140		<0.10	0	0	0
4143	<0.10				
4141		<0.10	0	0	0

Table C-15. Split /Confirmation analyses (malaoxon water) for the 1990 Medfly Project

Study: 94
 Analyte: Malaoxon
 MDL: 0.1 ppb, both labs

Matrix Sample Type: Water
 QC Sample Type: Splits

EHAP Sample #	Lab/Method #1 CDFA (ppb)	Lab/Method #2 Enseco-CAL (ppb)	\bar{X}	SD	CV
2476	0.28				
2478		0.17	0.23	0.08	34.8
2477	0.25				
2479		0.17	0.21	0.06	28.6
2480	<0.10				
2481		<0.10	0	0	0
3777	45.65				
3778		27	36.3	13.2	36.4
3779	18.92				
3780		13	16.0	4.19	26.2
3781	<0.10				
3782		<0.10	0	0	0
4006	8.18				
4007		10	9.09	1.29	14.2
4008	10.54				
4009		7.2	8.87	2.36	26.6
4010	<0.10				
4011		<0.10	0	0	0
4055	1.36				
4056		0.96	1.16	0.28	24.1
4057	1.63				
4058		0.89	1.26	0.52	41.3
4059	<0.10				
4054		<0.10	0	0	0
4066	0.35				
4069		0.17	0.26	0.13	50
4067	0.12				
4068		0.12	0.12	0	0
4070	<0.10				
4071		<0.10	0	0	0
4138	<0.10				
4139		<0.10	0	0	0
4142	0.21				
4140		0.17	0.19	0.03	15.8
4143	0.25				
4141		0.15	0.20	0.07	35

Table C-16. Storage dissipation analyses (malathion water) for the 1990 Medfly Project.

Study: 94 Matrix Sample Type: Tap Water, pH=9.13
 Analyte: Malathion Lab: CDFA
 MDL: 0.1 ppb Chemist: Jane White

Lab Sample #	Day	Date Extracted	Date Analyzed	Results (ppb)	Spike Level (ppb)	Recovery (%)	\bar{X}	SD	CV
2557	0	2/20/90	2/22/90	47.17	50	94			
2557	0	2/20/90	2/22/90	39.83	50	80	87	9.9	11
2559	3	2/23/90	3/08/90	8.15	50	16			
2559	3	2/23/90	3/08/90	8.77	50	18	17	1.4	8.20
2563	7	2/27/90	3/09/90	4.33	50	9			
2563	7	2/27/90	3/09/90	3.49	50	7	8	4	13

Table C-17. Storage dissipation analyses (malathion water) for the 1990 Medfly Project.

Study: 94 Matrix Sample Type: Pool Water, pH=8.02
 Analyte: Malathion Lab: CDFA
 MDL: 0.1 ppb Chemist: Jane White

Lab Sample #	Day	Date Extracted	Date Analyzed	Results (ppb)	Spike Level (ppb)	Recovery (%)	\bar{X}	SD	CV
2556	0	2/20/90	2/22/90	49.12	50	98			
2556	0	2/20/90	2/22/90	53.61	50	107	103	6.36	6.17
2559	3	2/23/90	3/08/90	33.41	50	67			
2559	3	2/23/90	3/08/90	29.42	50	59	63	5.7	9.1
2562	7	2/27/90	3/09/90	32.92	50	66			
2562	7	2/27/90	3/09/90	27.85	50	56	61	7.1	12

Table C-20. Storage dissipation analyses (malaoxon water) for the 1990 Medfly Project.

Study: 94
 Analyte: Malaoxon
 MDL: 0.1 ppb

Matrix Sample Type: Tap Water, pH=9.13
 Lab: CDFA
 Chemist: Jane White

Lab Sample #	Day	Date Extracted	Date Analyzed	Results (ppb)	Spike Level (ppb)	Recovery (%)	\bar{X}	SD	CV
2556	0	2/20/90	2/22/90	41.58	50	83			
2556	0	2/20/90	2/22/90	44.25	50	89	86	4.2	4.9
2559	3	2/23/90	3/08/90	3.56	50	7.1			
2559	3	2/23/90	3/08/90	2.79	50	5.6	6.4	1.1	17
2562	7	2/27/90	3/09/90	0.83	50	1.7			
2562	7	2/27/90	3/09/90	0.21	50	0.42	1.1	0.91	83

Table C-21. Storage dissipation analyses (malaoxon water) for the 1990 Medfly Project.

Study: 94
 Analyte: Malaoxon
 MDL: 0.1 ppb

Matrix Sample Type: Pool Water, pH=8.02
 Lab: CDFA
 Chemist: Jane White

Lab Sample #	Day	Date Extracted	Date Analyzed	Results (ppb)	Spike Level (ppb)	Recovery (%)	\bar{X}	SD	CV
2556	0	2/20/90	2/22/90	52.55	50	105			
2556	0	2/20/90	2/22/90	63.75	50	128	117	16.3	13.9
2560	3	2/23/90	3/08/90	39.02	50	78			
2560	3	2/23/90	3/08/90	45.79	50	92	85	9.9	12
2562	7	2/27/90	3/09/90	32.32	50	65			
2562	7	2/27/90	3/09/90	38.78	50	78	72	9.2	13

Table C-22. Method validation (malathion air) for the 1990 Medfly Project.

Study: 94
 Chemical: Malathion
 MDL: 0.1 ug/sample

Matrix Sample Type: Resin (XAD-2)
 Lab: CDFA
 Chemist: Jane White

Lab Sample #	Spike Level (ug)	Results (ug)	Recovery (%)	\bar{X}	SD	CV
1981	0.5	0.55	110			
1981	0.5	lost	\	\	\	\
1981	5.0	5.36	107			
1981	5.0	5.38	108	108	0.71	0.7
1981	50	55.52	111			
1981	50	54.81	109	110	1.41	1.28
OVERALL:				109	1.58	1.45
\bar{X}	SD	LWL	UWL	LCL	UCL	
109	1.58	106	112	104	114	

Table C-23. Method validation (malaoxon air) for the 1990 Medfly Project.

Study: 94
 Chemical: Malaoxon
 MDL: 0.1 ug/sample

Matrix Sample Type: Resin (XAD-2)
 Lab: CDFA
 Chemist: Jane White

Lab Sample #	Spike Level (ug)	Results (ug)	Recovery (%)	\bar{X}	SD	CV
1982	0.5	0.63	126			
1982	0.5	0.65	130	128	2.83	2.21
1982	5.0	5.89	118			
1982	5.0	6.0	120	119	1.41	1.2
1982	50	54.13	108			
1982	50	53.34	107	108	0.71	0.66
OVERALL:				118	9.30	7.88
\bar{X}	SD	LWL	UWL	LCL	UCL	
118	9.3	99	137	90	146	

Table C-24. Continuing quality control data (malathion air) for the 1990 Medfly Project.

Study: 94
 Analyte: Malathion
 MDL: 0.1 ug/sample

Matrix Sample Type: XAD-2 Resin
 Lab: CDFA
 Chemist: Jane White

Extraction Set #	Sample #	Results (ug)	Spike Level (ug)	Recovery (%)	\bar{X}	SD	CV
3012-3, 3020-21, 3040-3, 3602-3	2011	4.92 **	5.0	98			
3001, 3028-29, 3037, 3041	2063	5.55	5.0	111			
3002, 3014, 3017, 3024, 3030, 3031, 3039, 3045, 3049, 3579, 3583, 3587, 3604	2091	5.09 **	5.0	100			
3005, 3016, 3025, 3038, 3044, 3048, 3590, 3596-7, 3600, 3606-7, 3610	2088	5.09 **	5.0	102			
3003-4, 3008-11, 3015, 3578, 3582, 3586, 3601, 3605, 3611	2085	5.01**	5.0	100			
3007, 3027, 3608, 3612	2252	5.28	5.0	106			
3006, 3026, 3046-7, 3050-51, 3581, 3585, 3588	2249	5.36	5.0	107			
3018-19, 3580, 3589, 3591, 3609, 3613, 3741-42	2246	4.84 **	5.0	97			
3709, 3713-14, 3721-22, 3725-28	2243	5.19	5.0	104			
3710, 3753-54, 3757-58, 3761-62, 3765-66	2241	5.20	5.0	104			
3743-44, 3755, 3831-34, 3844, 3872	2392	4.35 **	5.0	87			
3715-16, 3723-24, 3730, 3735-36, 3750, 3756	2395	4.54 **	5.0	91			
3717-18, 3729, 3748-49, 3847-48, 3767	2398	4.48 **	5.0	89			
3711-12, 3759-64, 3768, 3839, 3859	2401	4.48 **	5.0	89			
3840, 3843, 3860, 3871	2404	5.16 **	5.0	103			
3849-54, 3861-2, 3873-4	2429	4.92 **	5.0	98			
3719-20, 3731-2, 3751-2, 3841-2, 3845-6	2426	4.35 **	5.0	87			
3701-8, 3867-9, 4291-4	2716	4.73 **	5.0	95			
3052, 3577, 3769-70, 3855-8, 3863-4	2942	4.60 **	5.0	92			
3865-6, 4283-6	2945	4.75 **	5.0	94			
4238, 4243, 4256-8, 4385, 4388	3017	4.99 **	5.0	99			
4190-3, 4240-2, 4250-1, 4259-60, 4371-2, 4376, 4386-7	3020	4.69 **	5.0	94			
4275-6, 4279-80, 4287-8, 4327-8	3388	4.27 **	5.0	85			
4277-8, 4281-21, 4289-90, 4329-30	3391	4.41 **	5.0	88			
4455-6, 4458, 4466, 4471, 4474-6, 4488	3452	5.25	5.0	105			
4424, 4426, 4434, 4442, 4453, 4457, 4465, 4473	3453	4.24 **	5.0	85			
4425, 4429-33, 4441, 4446, 4454	3458	5.43	5.0	108			
4303-6, 4350-2, 4652-9, 4663	65	5.43	5.0	109			
4303-6, 4350-2, 4652-9, 4663	67	5.23	5.0	105			
4628-9, 4634-42, 4647-51	77	5.94*	5.0	119			
4628-9, 4634-42, 4647-51	79	4.34**	5.0	87			

* Below UCL set or malathion at 114%
 ** Below LCL set for malathion at 104%.

OVERALL: 98 8.7 8.9

Table C-25. Continuing quality control data (malaoxon air) for the 1990 Medfly Project.

Study: 94
 Analyte: Malaoxon
 MDL: 0.1 ug/sample

Matrix Sample Type: XAD-2 Resin
 Lab: CDFA
 Chemist: Jane White

Extraction Set #	Sample #	Results (ug)	Spike Level (ug)	Recovery (%)	\bar{X}	SD	CV
3012-3, 3020-21, 3040-3, 3602-3	2012	5.44	5.0	108			
3001, 3028-29, 3037, 3041	2062	5.48	5.0	109			
3002, 3014, 3017, 3024, 3030, 3031, 3039, 3045, 3049, 3579, 3583, 3587, 3604	2092	5.46	5.0	109			
3005, 3016, 3025, 3038, 3044, 3048, 3590, 3596-7, 3600, 3606-7, 3610	2088	5.32	5.0	106			
3003-4, 3008-11, 3015, 3578, 3582, 3586, 3601, 3605, 3611	2086	5.70	5.0	114			
3007, 3027, 3608, 3612	2253	5.03	5.0	101			
3006, 3026, 3046-7, 3050-51, 3581, 3585, 3588	2250	4.96	5.0	99			
3018-19, 3580, 3589, 3591, 3609, 3613, 3741-42	2247	4.71	5.0	94			
3709, 3713-14, 3721-22, 3725-28	2244	4.92	5.0	98			
3710, 3753-54, 3757-58, 3761-62, 3765-66	2241	5.31	5.0	106			
3743-44, 3755, 3831-34, 3844, 3872	2391	4.36 *	5.0	87			
3715-16, 3723-24, 3730, 3735-36, 3750, 3756	2394	4.87	5.0	97			
3717-18, 3729, 3748-49, 3847-48, 3767	2397	5.20	5.0	104			
3711-12, 3759-64, 3768, 3839, 3859	2400	5.36	5.0	107			
3840, 3843, 3860, 3871	2403	5.07	5.0	101			
3849-54, 3861-2, 3843-4	2430	5.31	5.0	106			
3719-20, 3731-2, 3751-2, 3841-2, 3845-6	2427	5.41	5.0	108			
3701-8, 3867-9, 4291-4	2716	4.93	5.0	98			
3052, 3577, 3769-70, 3855-8, 3863-4	2943	4.48	5.0	90			
3865-6, 4283-6	2945	4.50	5.0	90			
4238, 4243, 4256-8, 4385, 4388	3016	4.50	5.0	90			
4190-3, 4240-2, 4250-1, 4259-60, 4371-2, 4376, 4386-7	3021	3.54 *	5.0	71			
4275-6, 4279-80, 4287-8, 4327-8	3389	4.77	5.0	95			
4277-8, 4281-2, 4289-90, 4329-30	3392	5.13	5.0	103			
4455-6, 4458, 4466, 4471, 4474-6, 4488	3450	5.62	5.0	112			
4424, 4426, 4434, 4442, 4453, 4457, 4465, 4473	3454	4.94	5.0	99			
4425, 4429-33, 4441, 4446, 4454	3457	5.64	5.0	112			
4303-6, 4350-59, 4663	65	5.19	5.0	104			
4303-6, 4350-59, 4663	67	4.36*	5.0	87			
4628-29, 4634-51	78	4.49	5.0	90			
4628-29, 4634-51	80	5.44	5.0	109			

OVERALL: 100 9.51 9.50

* Below LCL for malaoxon set at 90%.

Table C-26. Storage dissipation analyses (malathion air) for the 1990 Medfly Project.

Study: 94
 Analyte: Malathion
 MDL: 0.1 ug/sample

Matrix Sample Type: Resin (XAD-2)
 Lab: CDFA
 Chemist: Jane White

Lab Sample #	Day	Date Extracted	Date Analyzed	Results (ug)	Spike Level (ug)	Recovery (%)	\bar{X}	SD	CV
1987	0	2/09/90	2/13/90	5.59	5	112			
1987	0	2/09/90	2/13/90	4.63	5	92	102	14.1	13.8
1988	4	2/13/90	2/13/90	5.76	5	115			
1988	4	2/13/90	2/13/90	4.84	5	97	106	12.7	12.0
2170	7	2/16/90	2/16/90	5.53	5	111			
2170	7	2/16/90	2/16/90	5.59	5	112	112	0.71	0.63

Table C-27. Storage dissipation analyses (malaoxon air) for the 1990 Medfly Project.

Study: 94
 Analyte: Malaoxon
 MDL: 0.1 ug/sample

Matrix Sample Type: Resin (XAD-2)
 Lab: CDFA
 Chemist: Jane White

Lab Sample #	Day	Date Extracted	Date Analyzed	Results (ug)	Spike Level (ug)	Recovery (%)	\bar{X}	SD	CV
1987	0	2/09/90	2/13/90	4.95	5	99			
1987	0	2/09/90	2/13/90	5.04	5	101	100	1.41	1.41
1988	4	2/13/90	2/13/90	5.23	5	105			
1988	4	2/13/90	2/13/90	4.95	5	99	102	4.24	4.16
2170	7	2/16/90	2/16/90	5.53	5	111			
2170	7	2/16/90	2/16/90	5.40	5	108	110	2.12	1.93

APPENDIX D
ADJUSTED DATA

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Droplet Sizes Using 1981 Spread Factor.....	D-2
Air Concentrations Adjusted for Sampler Oxidation.....	D-4

Droplet Sizes Using 1981 Spread Factor

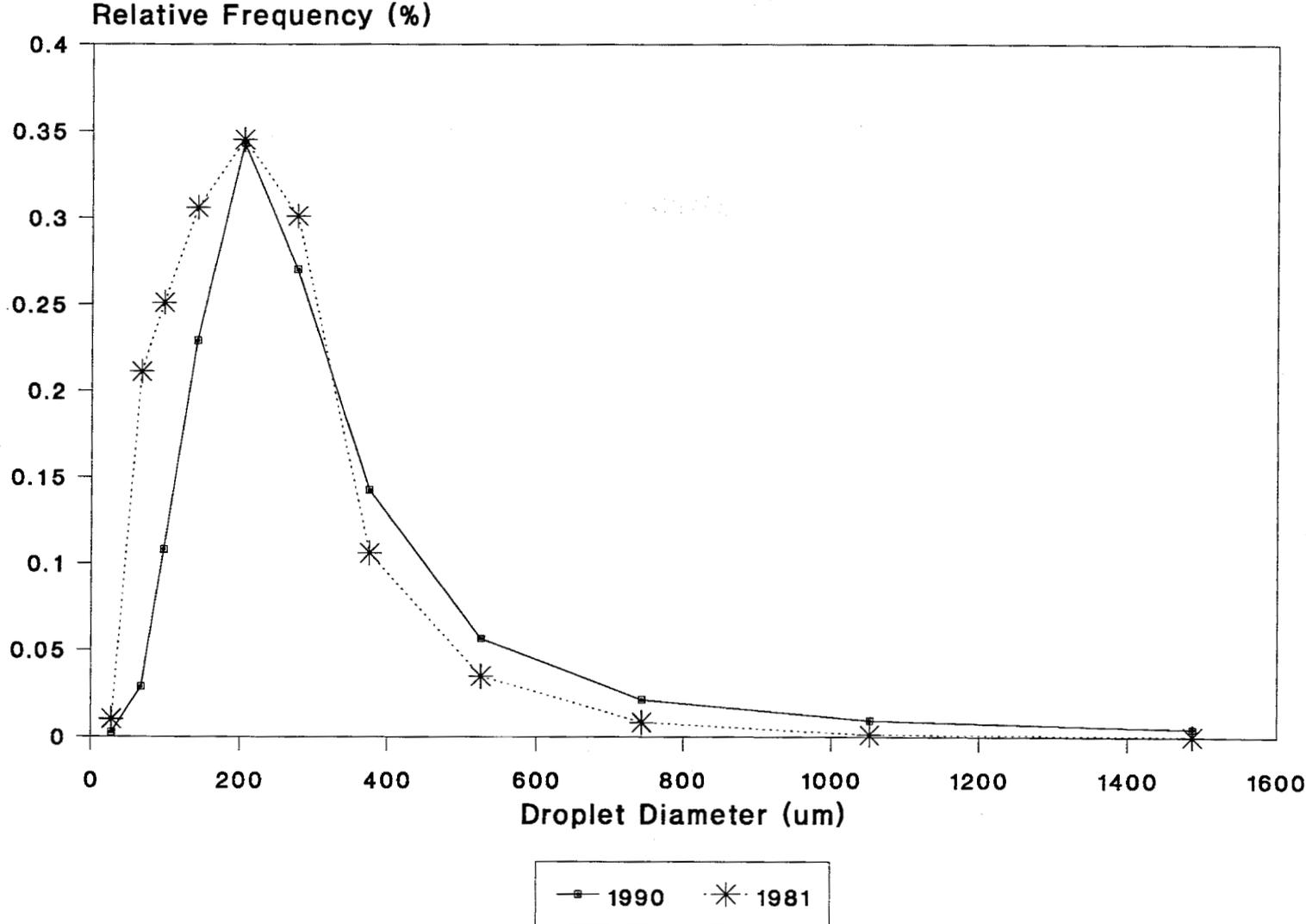
The spread factor determined in 1990 was similar to the one determined in 1981. Since essentially the same formulation was used for both programs, the difference may only be natural variation. If the 1981 spread factor is applied to the 1990 data, the mean droplet size is larger (356 μm vs 308 μm), and the difference between the 1990 and 1981 distributions is more pronounced (Table D-1 and Figure D-1).

Table D-1. The 1990 malathion droplet size comparison using the 1981 and 1990 spread factors.

<u>Volumetric Diameter (μm)</u>		<u>Total Number Droplets</u>	<u>Droplet Density (#/ft²)</u>	<u>Percent Number</u>
<u>1990 Factor</u>	<u>1981 Factor</u>			
46 - 60	45 - 55	8	0.97	0.14
60 - 80	55 - 80	42	5.11	0.72
80 - 108	80 - 115	222	27.0	3.80
108 - 147	115 - 170	735	89.4	12.57
147 - 202	170 - 240	1404	170.8	24.02
202 - 279	240 - 315	1184	144.0	20.25
279 - 387	315 - 436	1008	122.6	17.24
387 - 538	436 - 616	594	72.3	10.16
538 - 747	616 - 872	318	38.7	5.44
747 - 1034	872 - 1242	197	24.0	3.37
1034 - 1422	1242 - 1742	110	13.4	1.88
1422+	1742+	24	2.92	0.41

Figure D-1. Comparison of 1981 and 1990 Medfly droplet size distribution using the 1981 spread factor

D-3



Air Concentrations Adjusted for Artificial Oxidation

The malaoxon values determined by the laboratory are probably an overestimate, since artificial oxidation from malathion to malaoxon occurs with the sampling technique employed. An estimate of the amount of artificial oxidation was determined. The efficiency of the CDFA high volume and low volume air samplers in converting malathion to malaoxon were both measured. Testing took place on the UC Riverside campus between June 28 and 29, 1990. Maximum temperature during this period was 38.6°C, while ozone concentration reached 0.15 ppm. Flow rates for the high volume and low volume samplers were 1000 and 15 l/min, respectively. Three intervals were sampled: 24 hours (07:23 - 07:23), 8 hour-day (07:55 - 15:55), and 8 hour-night (23:00 - 07:00). The results are shown in Table D-2.

These estimates differ significantly from the 1981 estimates and there are substantial differences between samples collected at night and samples collected during the day. In addition, the oxidation test was conducted during a summer period of high temperature and ozone concentrations, and may not be indicative of winter and spring conditions when the 1990 Medfly samples were collected.

Table D-3 uses the 24 hr % conversion to adjust the background, and post spray samples. The 8 hr-night % conversion is used to adjust the spray samples. Using these oxidation estimates, the great majority of the malaoxon values are now negative, which also indicates the inaccuracy of these estimates.

Table D-2. Results of malathion air sampler oxidation conversion test.

Sample	N	Spiked (μmol)	Recovered (μmol)			% Conversion
		Malathion	Malathion	Malaoxon	Total	
Low Volume						
24 hr	3	0.0303	0.0121	0.0160	0.0281	56.9
8 hr-dy	2	0.0303	0.0159	0.0125	0.0284	44.0
8 hr-nt	2	0.0303	0.0296	0.00232	0.0319	7.27
High Volume						
24 hr	3	0.303	0.186	0.352	0.538	65.4
8 hr-dy	2	0.303	0.126	0.217	0.343	63.3
8 hr-nt	2	0.303	0.286	0.0235	0.309	7.61

The measured values for malathion and malaoxon are adjusted using the following equations:

$$\text{Adjusted Malathion } (\mu\text{g}) = \frac{100 \times \text{Measured Malathion } (\mu\text{g})}{100 - \% \text{ conversion}}$$

$$\text{Adj Oxon } (\mu\text{g}) = \text{Meas Oxon } (\mu\text{g}) - [(\text{Adj Thion} - \text{Meas Thion}) \times 314.3/330.36]$$

Table D-3. Malathion and malaoxon air concentrations associated with the Medfly aerial applications adjusted for artificial oxidation. Background samples were collected prior to application (24-hr duration). Spray samples were collected during application (application duration). Post-spray samples were collected immediately after application (24-hr duration each).

		Air Concentration ($\mu\text{g}/\text{m}^3$)			
		Background	Spray	1st Post-Spray	2nd Post-Spray
Malathion Indoor	# Samples	33	33	33	32
	# Neg Samples	0	0	0	0
	Average	0.0174	0.0345	0.0532	0.0396
	Std. Error	0.0034	0.0122	0.0115	0.0089
	Minimum	ND ^a	ND	ND	ND
	Maximum	0.0724	0.4176	0.2473	0.2160
Malathion Outdoor	# Samples	34	34	33	34
	# Neg Samples	0	0	0	0
	Average	0.0218	0.1245	0.2172	0.1213
	Std. Error	0.0033	0.0178	0.0198	0.0134
	Minimum	ND	ND	0.0621	ND
	Maximum	0.0782	0.4639	0.5779	0.3376
Malaoxon Indoor	# Samples	33	33	33	32
	# Neg Samples	32	14	32	31
	Average	-0.0047	-0.0061	-0.0211	-0.0142
	Std. Error	0.0021	0.0040	0.0052	0.0033
	Minimum	ND	ND	ND	ND
	Maximum	0.0387	0.0176	0.0056	0.0046
Malaoxon Outdoor	# Samples	34	34	33	34
	# Neg Samples	29	31	33	30
	Average	-0.0053	-0.0512	-0.0750	-0.0316
	Std. Error	0.0016	0.0083	0.0092	0.0066
	Minimum	ND	ND	ND	ND
	Maximum	0.0068	0.0028	-0.0057	0.0684

^a None Detected, these samples are assumed to have concentrations of one-half the detection limit, adjusted for artificial oxidation.

APPENDIX E
STATISTICAL ANALYSIS

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Mass Deposition

The mass deposition comparison is made only with malathion, since no malaoxon was detected in 1981. The relative frequency distributions of malathion mass deposited in 1981 and 1990 are shown in Figure 4. Compared to 1981, 1990 had deposition levels more symmetrically distributed around the target application rate of 2210 $\mu\text{g}/\text{ft}^2$. In 1981, there was a preponderance of samples well below the application rate of 1836 $\mu\text{g}/\text{ft}^2$ as well as a few very high samples (>5000 $\mu\text{g}/\text{ft}^2$). In 1990, the modal interval was the interval containing the application rate, moreover there were no samples greater than 5000 $\mu\text{g}/\text{ft}^2$. In both years, the 95th percentile of the distribution was approximately 3600 $\mu\text{g}/\text{ft}^2$.

In Table E-1, the relative frequency distributions are further collapsed into five categories which contain equal percentages of the distribution in 1981. A chi-square test was done to test whether the 1990 samples could have come from a population with equal proportions in each of these categories. The hypothesis was rejected at the 0.05 level. The percentages in the second row of Table E-1 reveal that 1990 had many fewer samples in the lowest category, increasing to many more than expected in the highest category. Note however, that the highest category is only >2066 $\mu\text{g}/\text{ft}^2$ (reflecting the fact that 80% of samples in 1981 were below 2066 $\mu\text{g}/\text{ft}^2$), while the average application rate measured for 1990 was 2210 $\mu\text{g}/\text{ft}^2$. The third row of Table E-1 shows the 1990 distribution adjusted for the difference in application rate. The adjustment was made by subtracting the difference between the two application rates from each 1990 observation. While the difference between the two years becomes less pronounced, the pattern remains the same, and the chi-square test is still significant ($p < 0.05$).

In Table E-2, the distribution for each year has been divided into three intervals: more than 500 $\mu\text{g}/\text{ft}^2$ below application rate, within 500 of application rate, and more than 500 above application rate. The chi-square test of whether the 1990 data could have come from a population with the 1981 percentages rejected the null hypothesis at the 0.05 level. In Table E-2, it is evident that 1990, relative to 1981, had many more samples near the application rate, fewer below the application rate, and slightly more above.

Table E-1. Relative frequency distributions of malathion mass deposition ($\mu\text{g}/\text{ft}^2$) in 1981, 1990, and 1990 adjusted for the higher application rate.

Year	Percent of Samples				
	0-431	431-907	907-1407	1407-2066	>2066
1981	20.0	20.0	20.0	20.0	20.0
1990	4.4	10.8	12.8	23.2	48.8
1990 adjusted	11.8	13.8	13.8	27.5	33.0

Table E-2. Relative frequency of samples within $500 \mu\text{g}/\text{ft}^2$ of application rate (AR) in 1981^a and 1991^b.

Year	Percent of Samples		
	< AR-500	AR \pm 500	> AR+500
1981	57.0	27.4	15.6
1990	36.4	43.8	19.7

^aAR = $1836 \mu\text{g}/\text{ft}^2$

^bAR = $2210 \mu\text{g}/\text{ft}^2$

Air Concentrations

The 1981 air concentration data were compared to three sets of 1990 data: adjusted for artificial oxidation, unadjusted for artificial oxidation, and total (malathion + malaoxon). All of the air data sets have undergone considerable manipulation. Samples which had no detectable amount have been computed assuming they contain one-half the detection limit. Where total residue amounts (malathion + malaoxon) have been compared, the malaoxon concentrations have been converted to their malathion equivalents. The 1981 air data set has been adjusted for artificial oxidation using the 1981 correction factors. Where the 1990 air data has been adjusted for artificial oxidation using the 1990 correction factors, the resulting negative values are assumed to be zero. Since the amount of artificial oxidation cannot be estimated accurately, more confidence is placed in the total (malathion + malaoxon) data sets.

The relative frequency distributions of $\mu\text{g}/\text{m}^3$ of malathion (both adjusted for oxidation and unadjusted) and malaoxon (adjusted and unadjusted) are shown for 1981 and 1990 in Figures E-1 - E-20. These figures show the distribution separately for each sampling period and location (indoors or outdoors).

The graphs demonstrate that in almost all cases the concentrations in 1990 tended to be less widely spread out and more clustered at the low levels. Exceptions to this pattern were malathion (adjusted) and oxon (unadjusted) outdoors in the post-spray period, which appear roughly the same as the 1981 distributions, while oxon indoors in the spray period (both adjusted and unadjusted) had some slightly higher values in 1990.

To statistically compare the distributions of the two years, the 1990 distribution was divided into three intervals which in 1981 each contained one third of the distribution. A chi-square test of goodness-of-fit was done to determine whether these intervals contained equal portions of the 1990 distribution. Because so many (40) tests were done, an alpha-level of .01 was used (only two cases occurred of $0.01 < p < 0.05$). Figures E-21 - E-24 show the 1990 relative frequency in each interval. The horizontal reference line indicates the 1981 relative frequency of 33.3%. Cases in which the 1990 frequencies departed significantly from the expected had three general patterns. The predominant pattern, exemplified by the malathion outdoor background period (Figure E-21), had greater than expected number of samples in the lowest interval and decreasing frequencies in the second and third intervals, usually with considerably fewer than expected in the highest interval. In other words, 1990 concentrations tended to be lower than 1981 concentrations. The second pattern is the reverse of the first: 1990 concentrations tended to be higher than 1981. A third pattern had more than the expected number of samples in the middle interval and fewer in the high and low intervals. In other words, the average concentration was roughly similar, but in 1990 the samples were more tightly clustered in the center of the distribution. Table E-3 lists the significant differences fitting each pattern. These results indicate that the only occurrences of higher air concentrations in 1990 were for malaoxon outdoors during the spray periods. The chi-square test for the total malathion plus malaoxon shows that the outdoor spray period distribution fits pattern 1. Thus, while the 1990 spray period had significantly more outdoor samples with high malaoxon levels, the combined amount of malathion and malaoxon was lower in 1990 (Figures E-25, E-26).

Collapsing the data into three intervals carries the possibility of hiding differences in the occurrence of extremely high values. For example, there could be significantly fewer samples in the highest concentration interval in 1990, and yet some samples falling in that highest interval might have much higher concentrations than were seen in 1981. Very high concentrations, even if occurring in few samples, could be of concern. However, as can be seen in Figures E-1 - E-20, the highest levels observed in 1981 exceed those of 1990 in all but a few cases. These cases are the final period indoor samples, where the highest levels of both adjusted malathion and unadjusted malaoxon are very similar for both years, and the spray period indoor samples, where higher values of both adjusted and unadjusted malaoxon concentrations occurred in 1990. When total malathion plus malaoxon is considered, however, the highest values occurred in 1981.

Table E-3. Patterns of significant differences of 1990 air concentrations from 1981, and cases fitting each pattern (chi-square tests of goodness-of-fit of 1990 frequencies in three intervals with equal expected frequencies based on 1981).

Pattern	Compound	Period	Location
1 (decreasing, 1990<1981)	Malathion (adj)	Bkgd	Outdoor
		Spray	Indoor, outdoor
	Malathion (unadj)	Bkgd	Indoor, outdoor
		Spray	Indoor, outdoor
		1st Post	Indoor, outdoor
		2nd Post	Indoor, outdoor
Malaoxon (adj)	Bkgd	Indoor, outdoor	
	1st Post	Indoor, outdoor	
	2nd Post	Indoor, outdoor	
Malaoxon (unadj)	Bkgd	Outdoor	
Total	Bkgd	Outdoor	
	Spray	Indoor, outdoor	
2 (increasing, 1990>1981)	Malaoxon (adj)	Spray	Outdoor
		Spray	Outdoor
	Malaoxon (unadj)	Spray	Outdoor
3 (centrally clustered)	Malaoxon (adj)	Spray	Indoor
		Bkgd	Indoor
	Malaoxon (unadj)	Spray	Indoor
		1st Post	Indoor
		2nd Post	Indoor
Non-significantly different	Malathion (adj)	Bkgd	Indoor
		1st Post	Indoor, outdoor
		2nd Post	Indoor, outdoor
	Malaoxon (unadj)	1st Post	Outdoor
		2nd Post	Outdoor
	Total	Bkgd	Indoor
1st Post		Indoor, outdoor	
2nd Post		Indoor, outdoor	

Figure E-1. Comparison of 1981 and 1990 Medfly indoor background (B) malathion air concentrations.

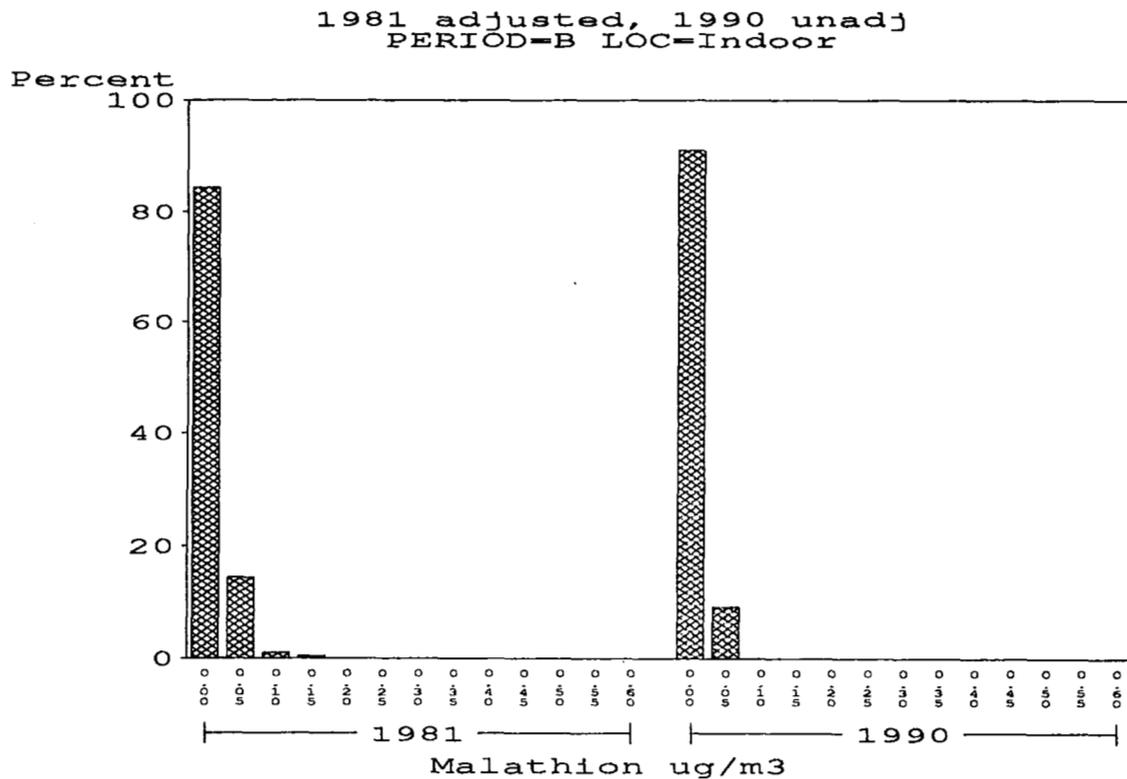
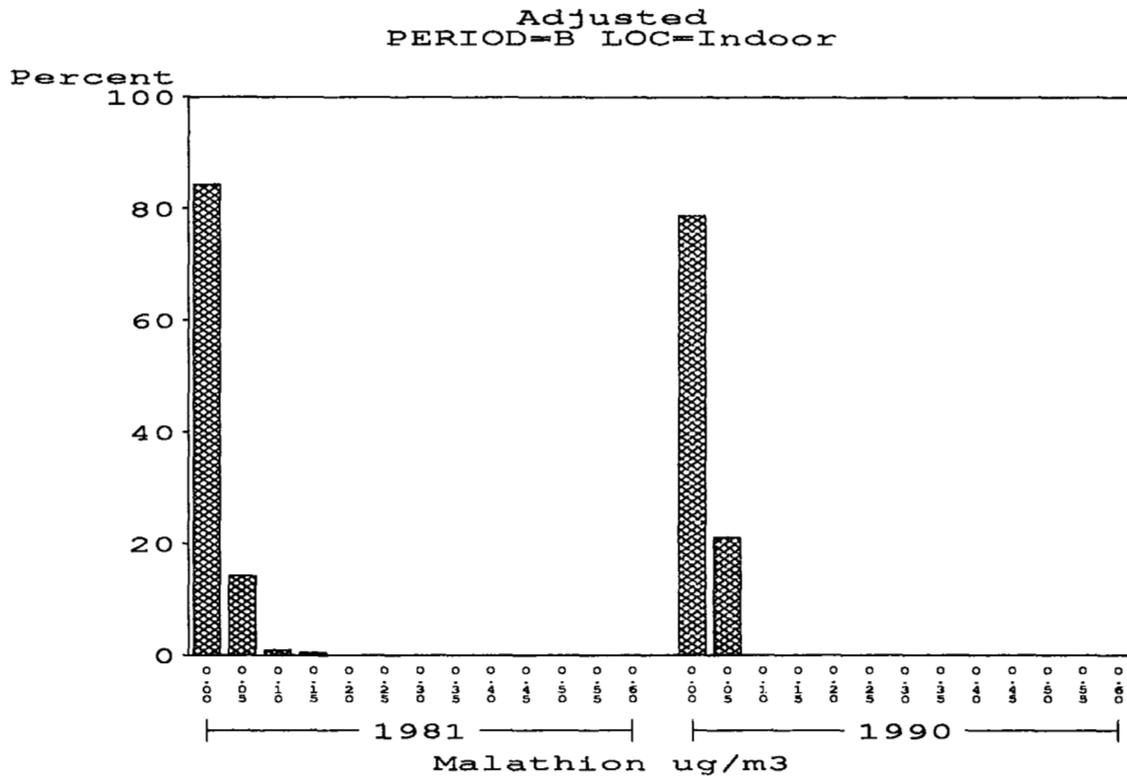


Figure E-2. Comparison of 1981 and 1990 Medfly outdoor background (B) malathion air concentrations.

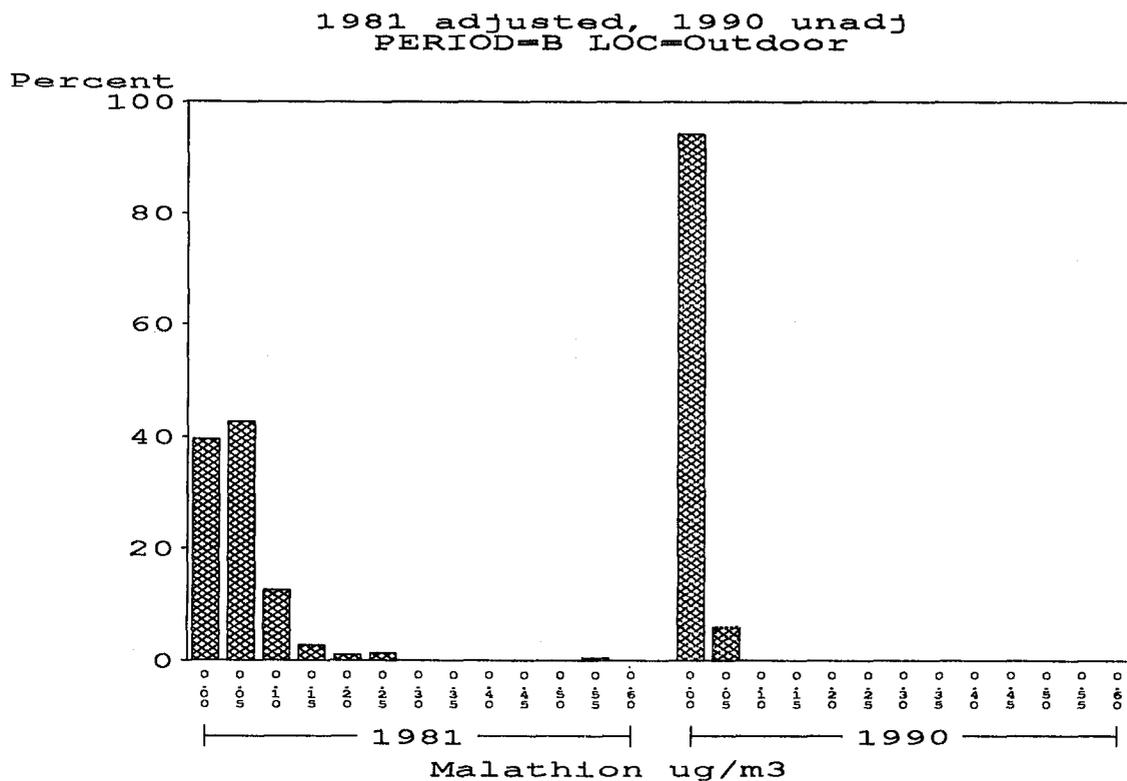
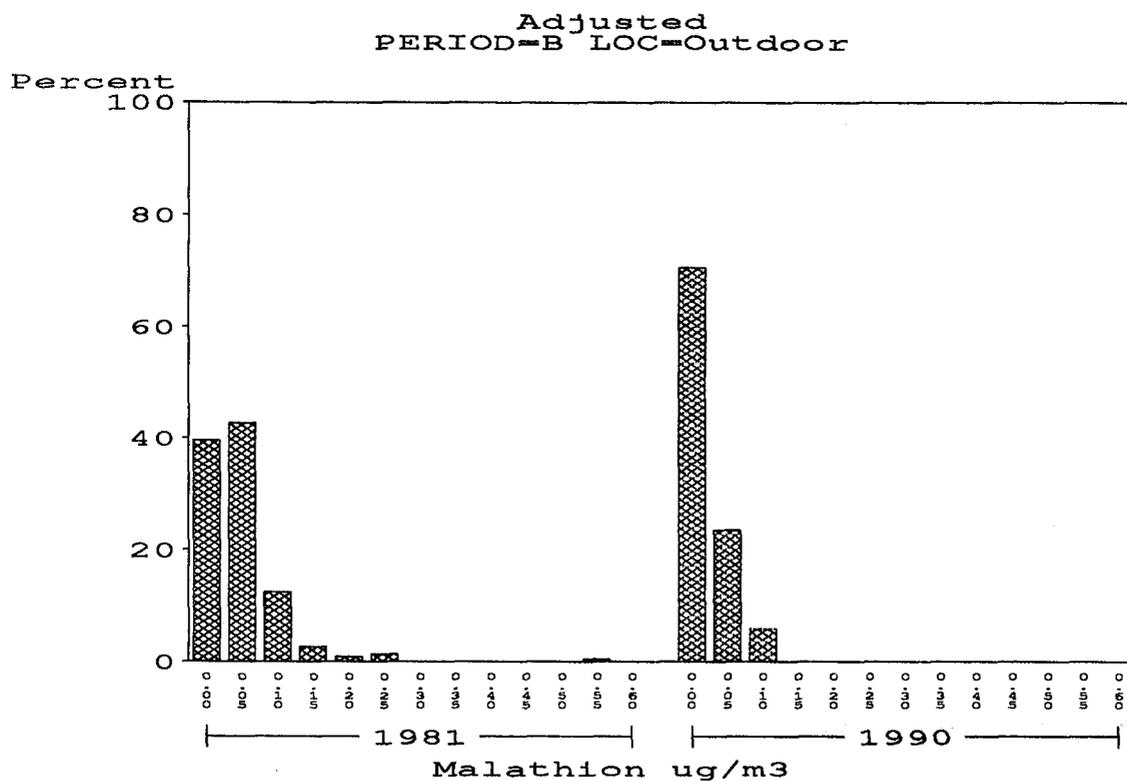


Figure E-3. Comparison of 1981 and 1990 Medfly indoor spray period (S) malathion air concentrations.

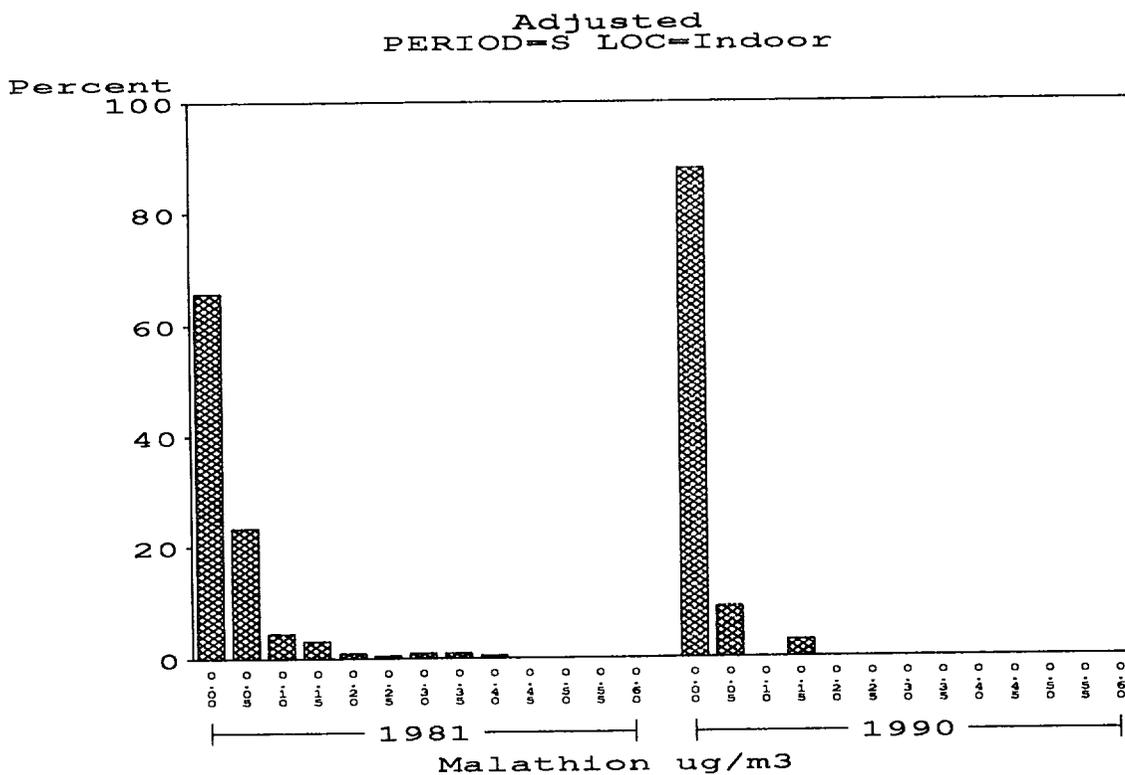


Figure E-4. Comparison of 1981 and 1990 Medfly outdoor spray period (S) malathion air concentrations.

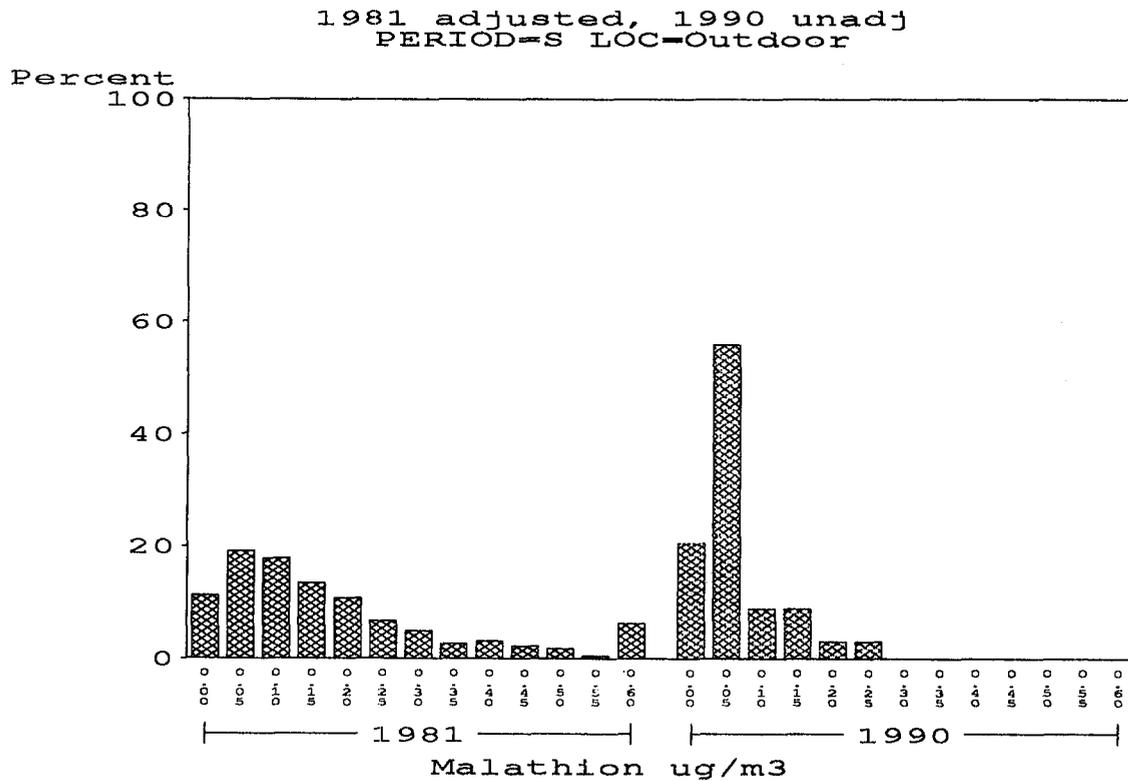
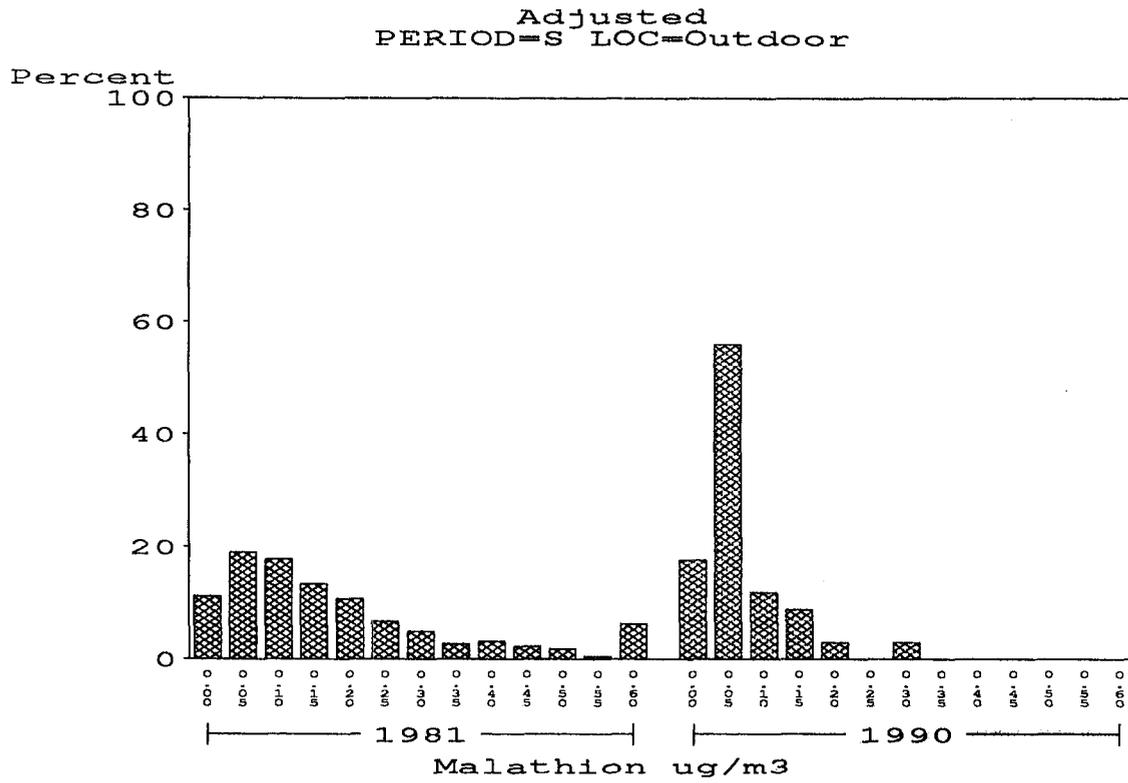


Figure E-5. Comparison of 1981 and 1990 Medfly indoor 1st post-spray period (P) malathion air concentrations.

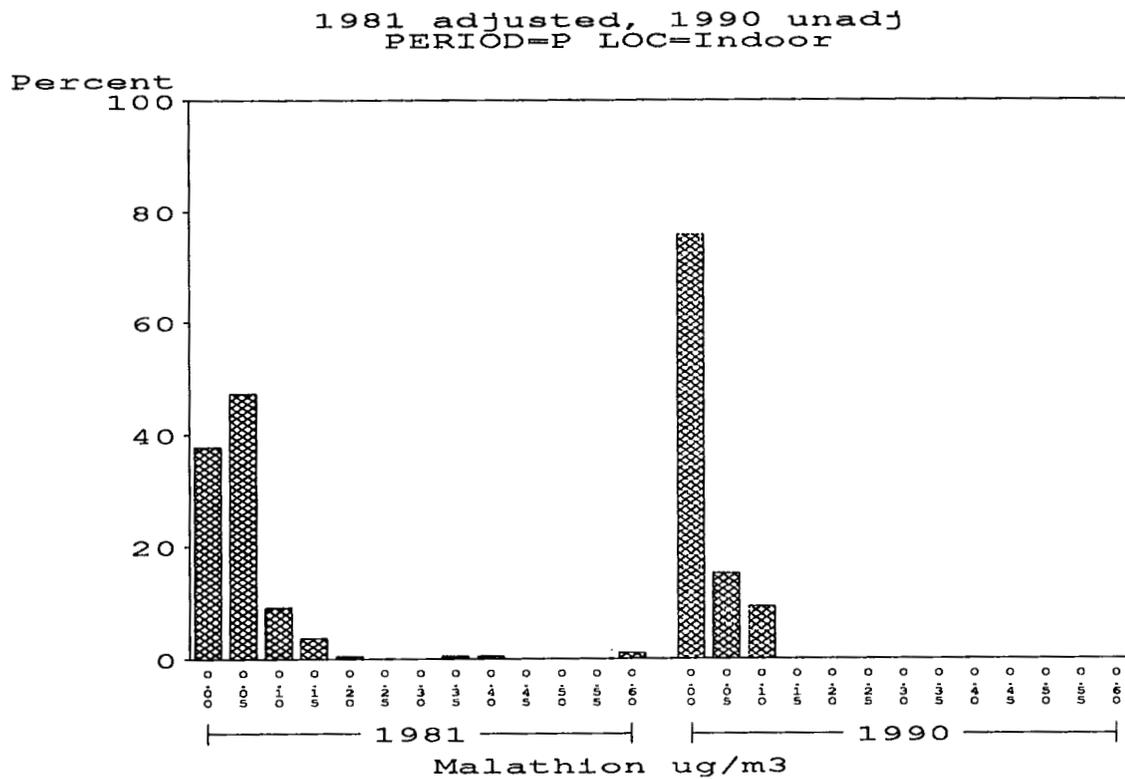
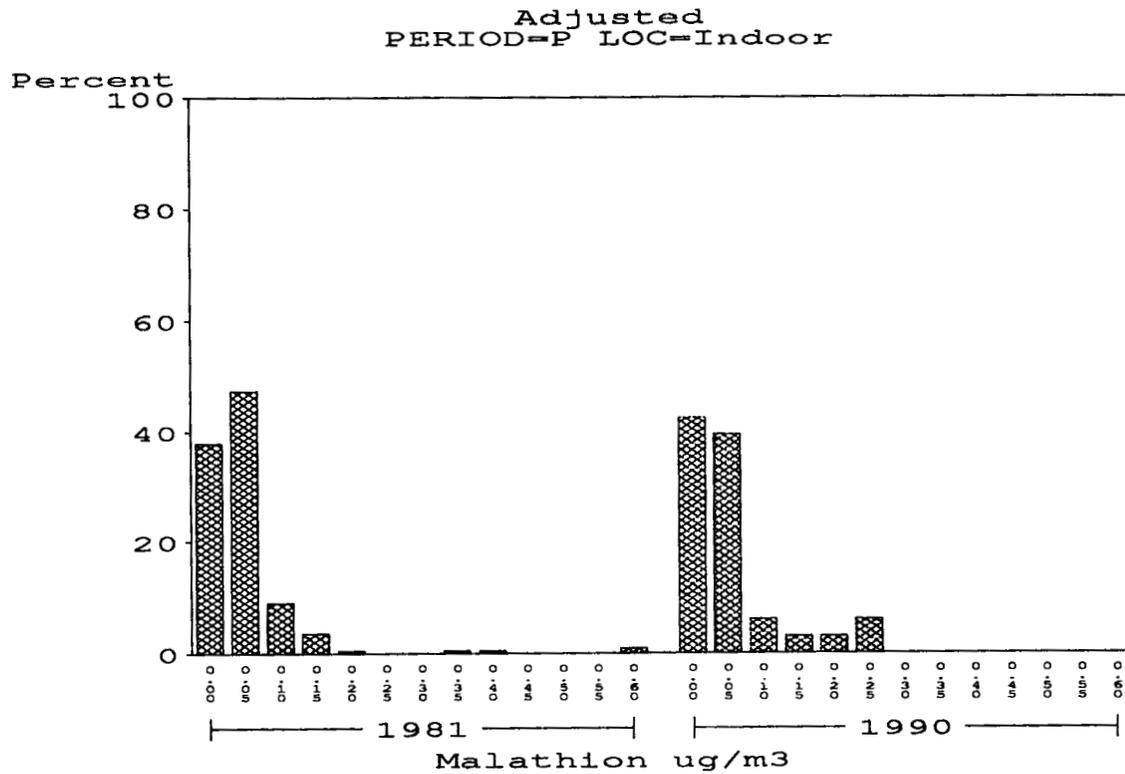


Figure E-6. Comparison of 1981 and 1990 Medfly outdoor 1st post-spray period (P) malathion air concentrations.

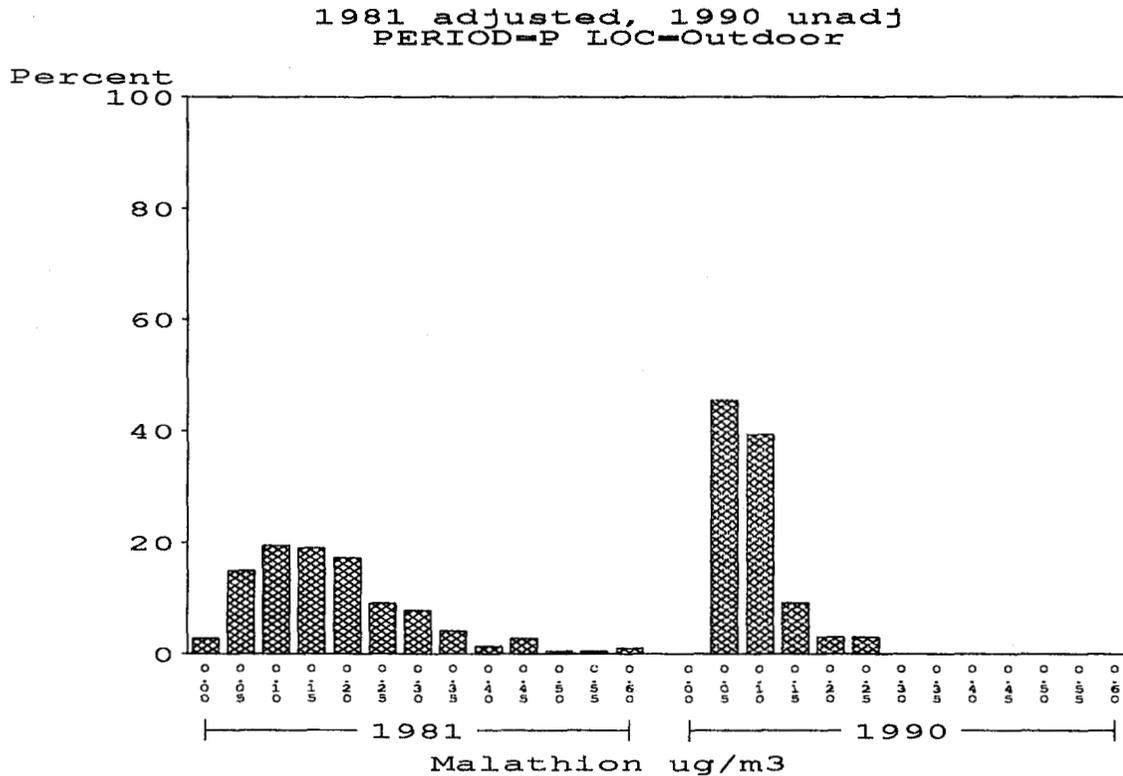
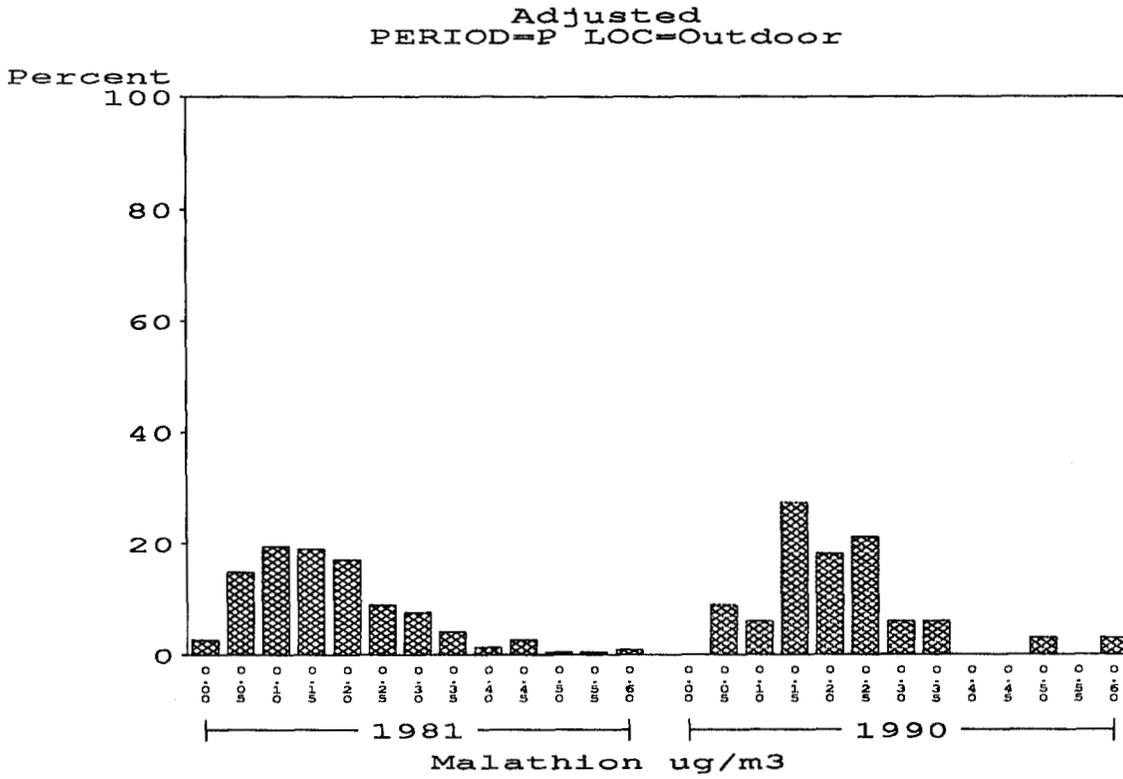


Figure E-8. Comparison of 1981 and 1990 Medfly outdoor 2nd post-spray period (F) malathion air concentrations.

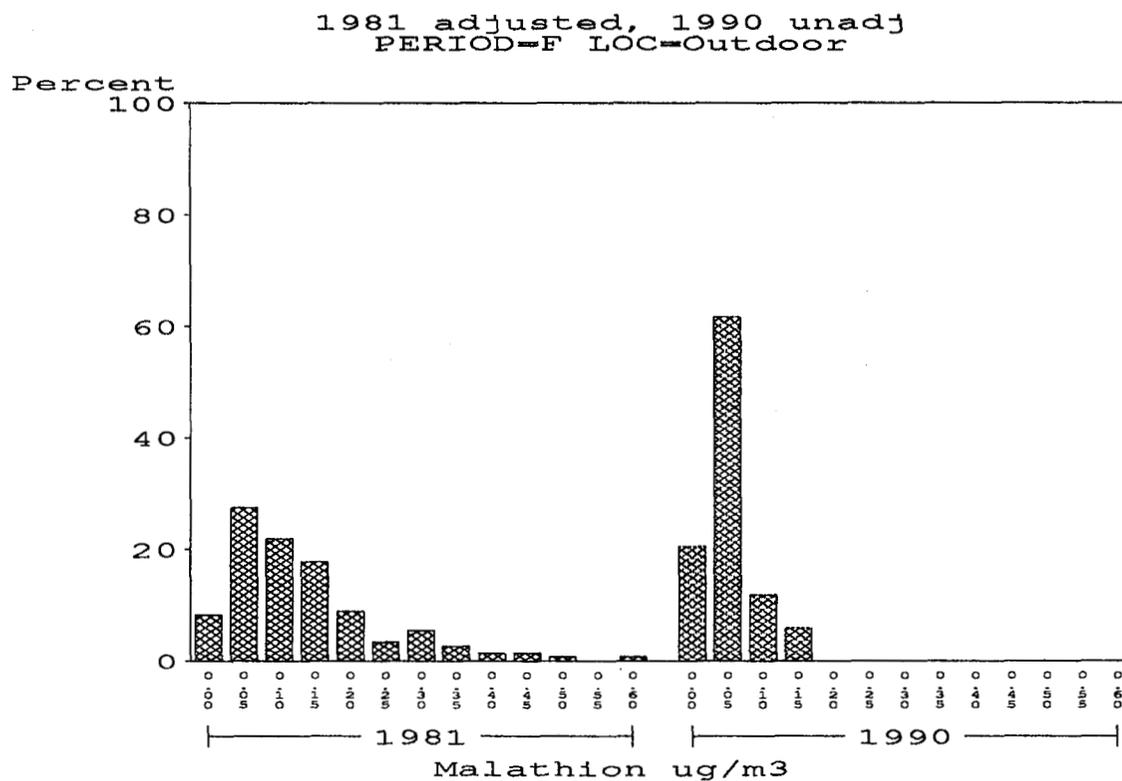
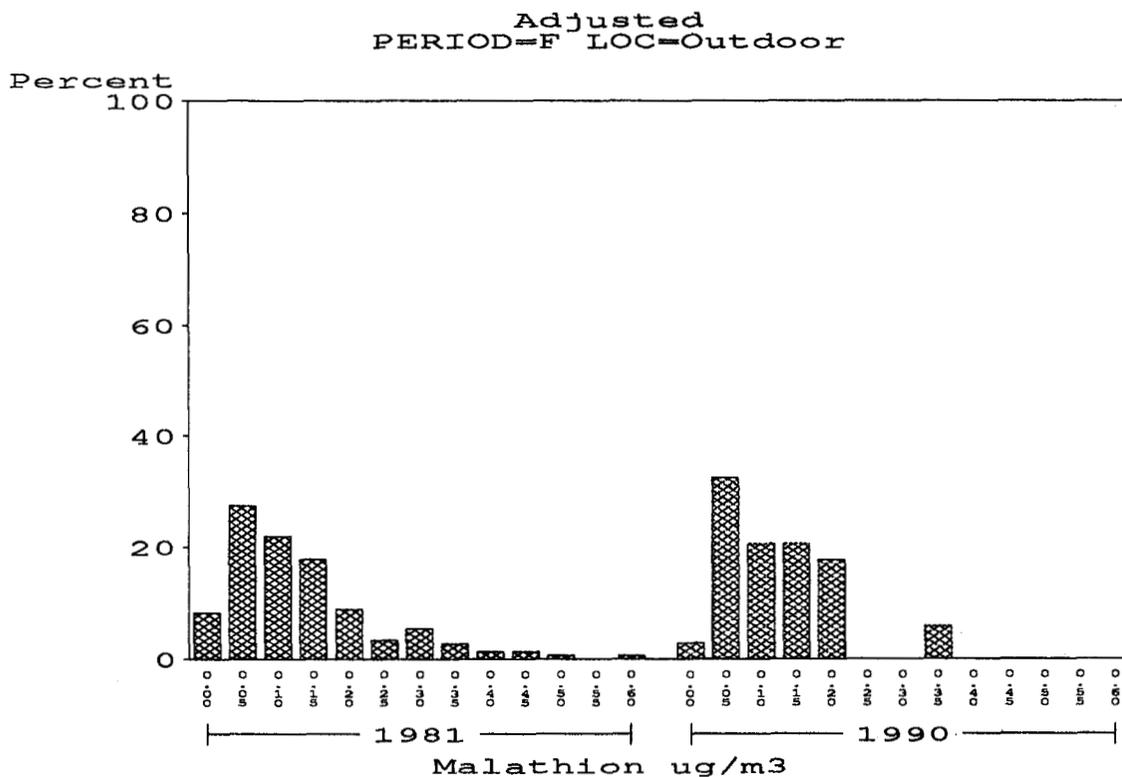


Figure E-10. Comparison of 1981 and 1990 Medfly outdoor background (B) malaaxon air concentrations.

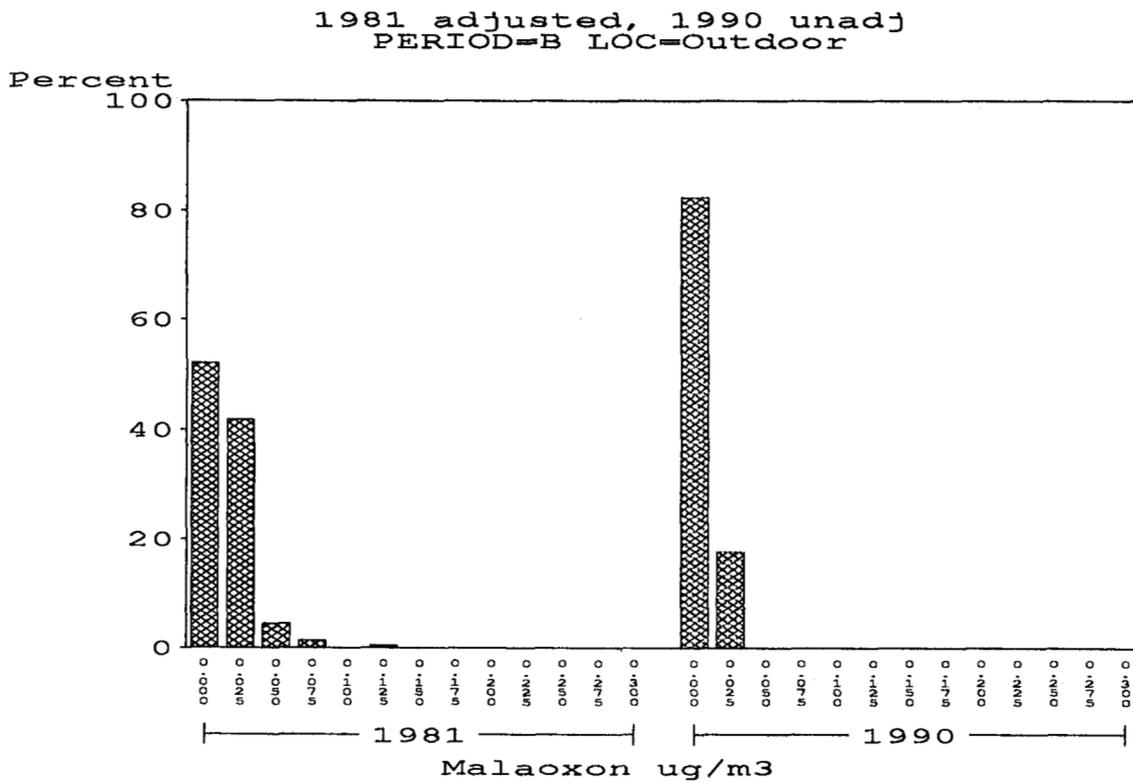
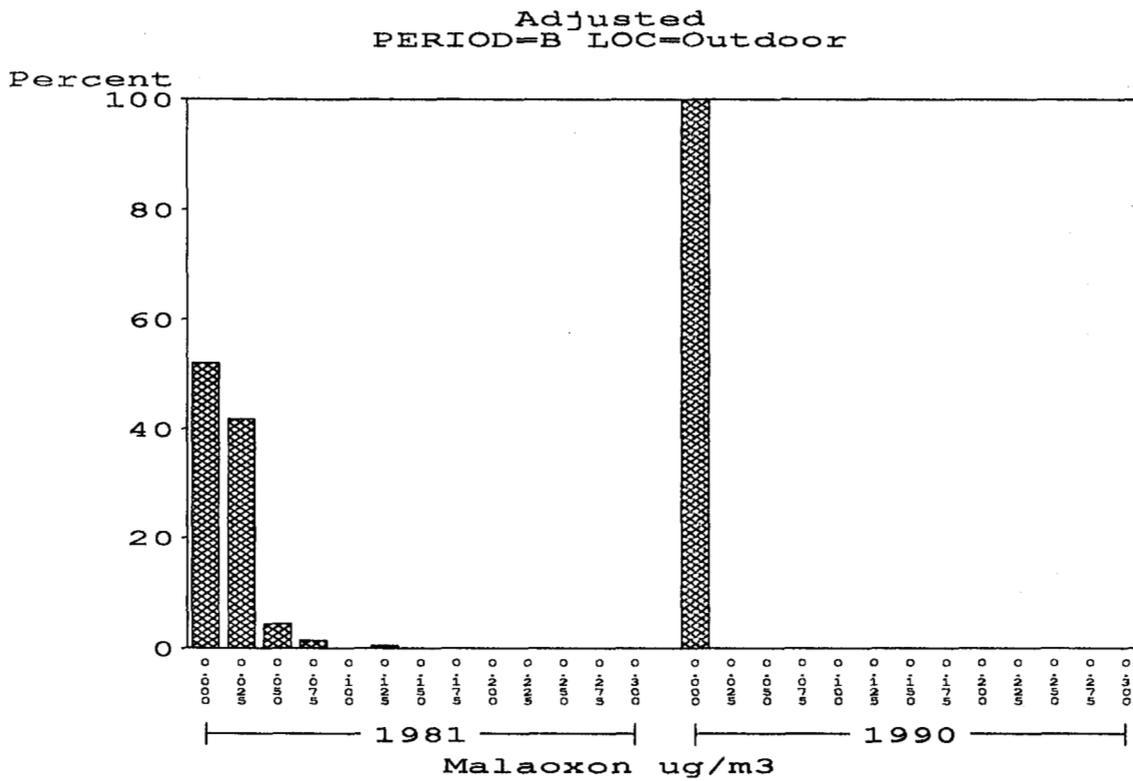


Figure E-11. Comparison of 1981 and 1990 Medfly indoor spray period (S) malaoxon air concentrations.

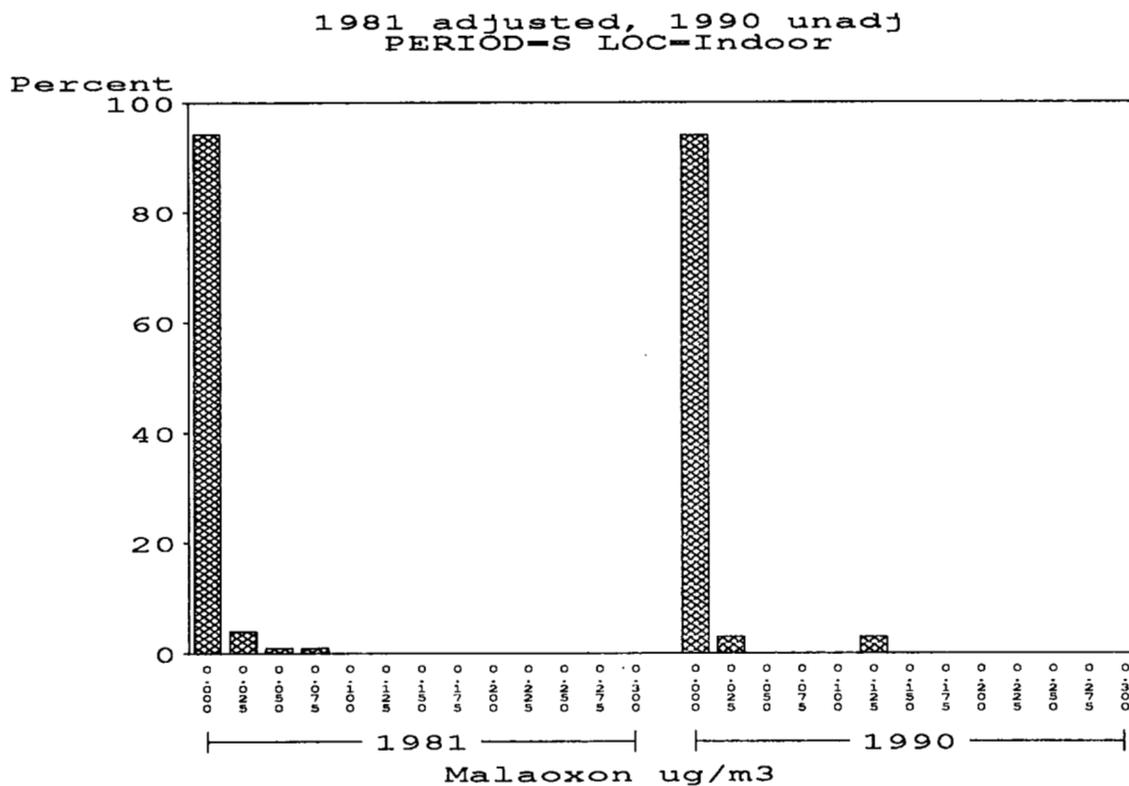
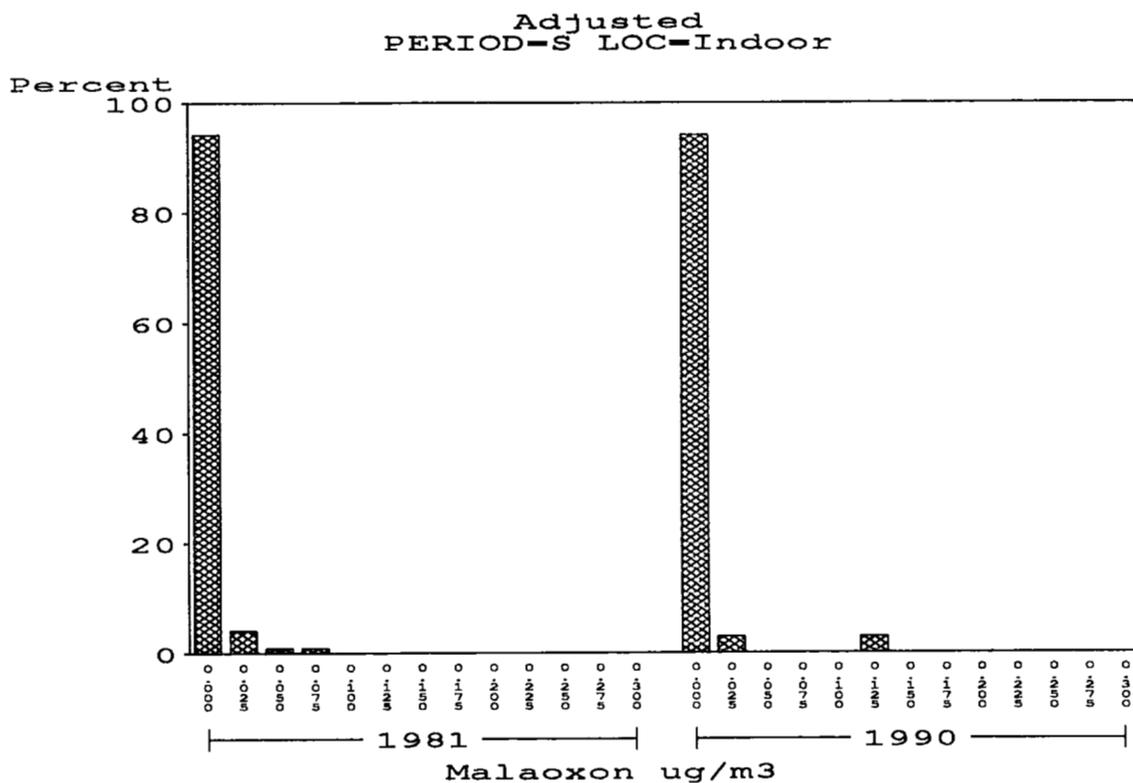


Figure E-17. Comparison of 1981 and 1990 Medfly background (B) total (malathion + malaoxon) air concentrations.

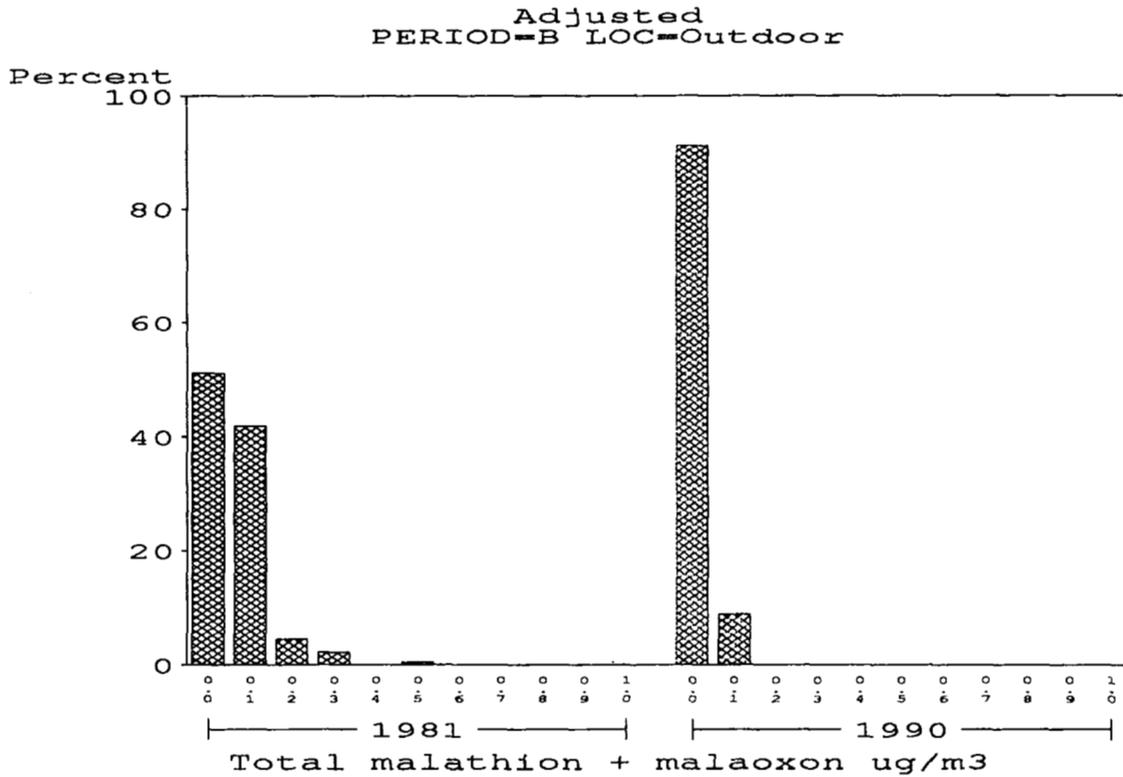
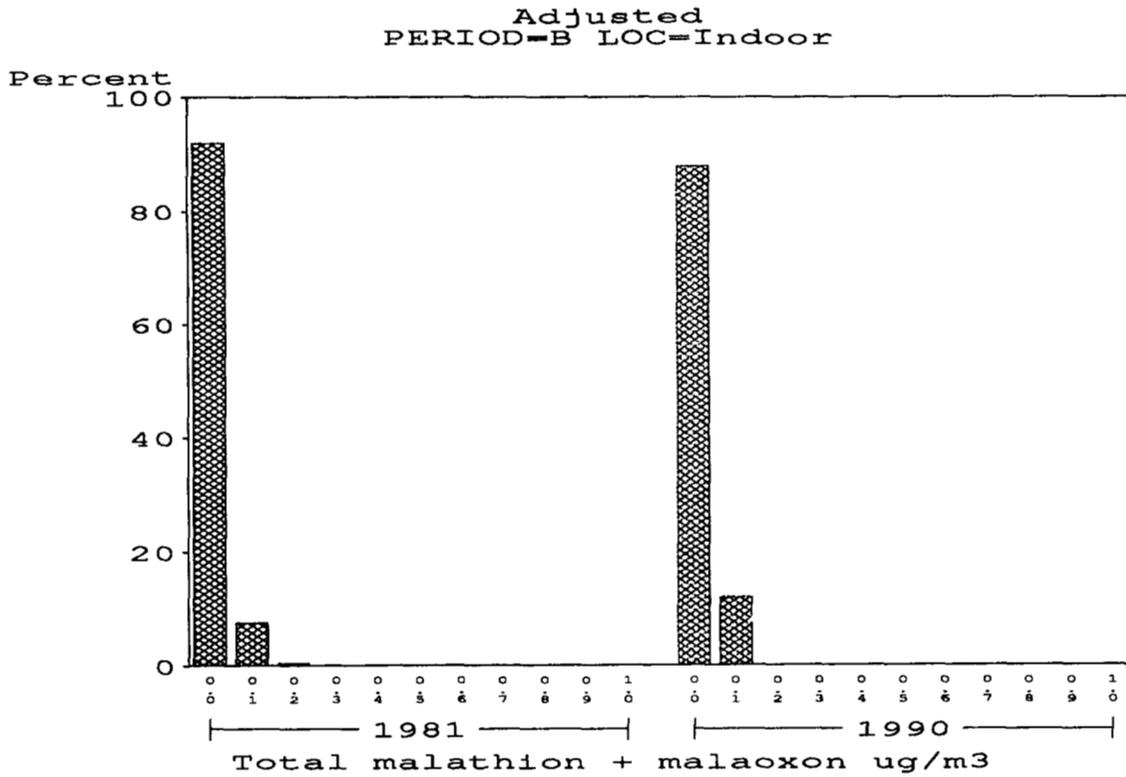


Figure E-18. Comparison of 1981 and 1990 Medfly spray period (S) total (malathion + malaoxon) air concentrations.

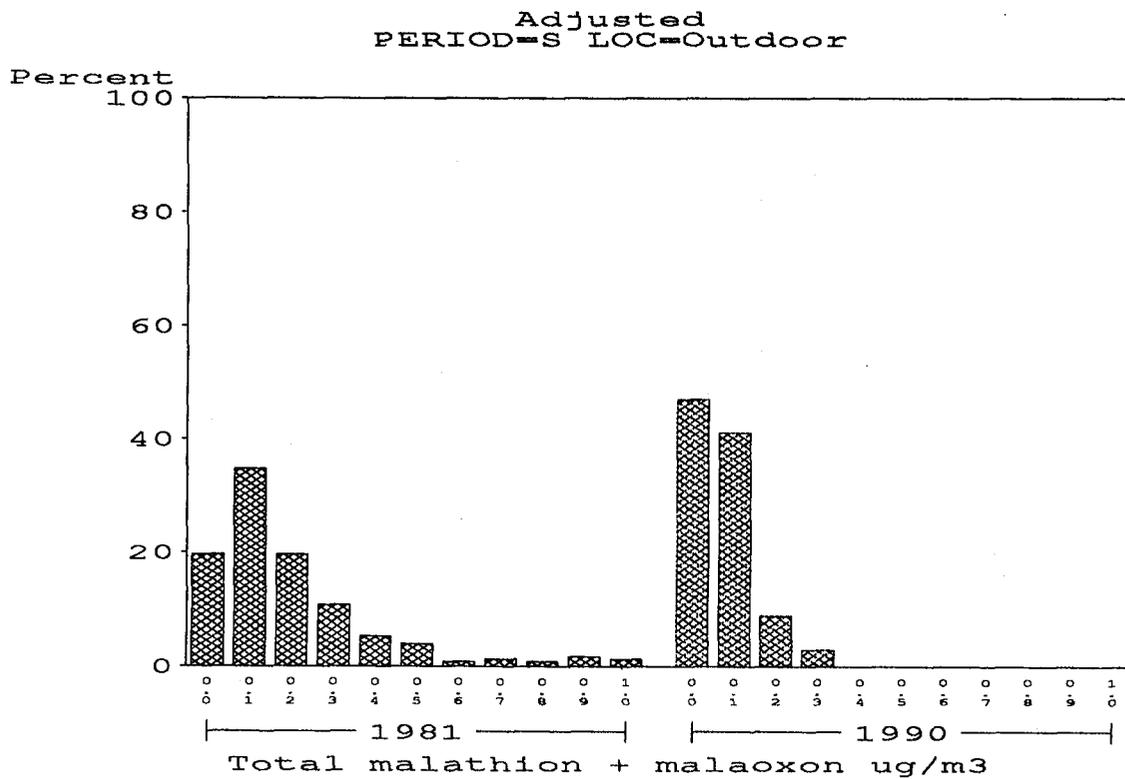
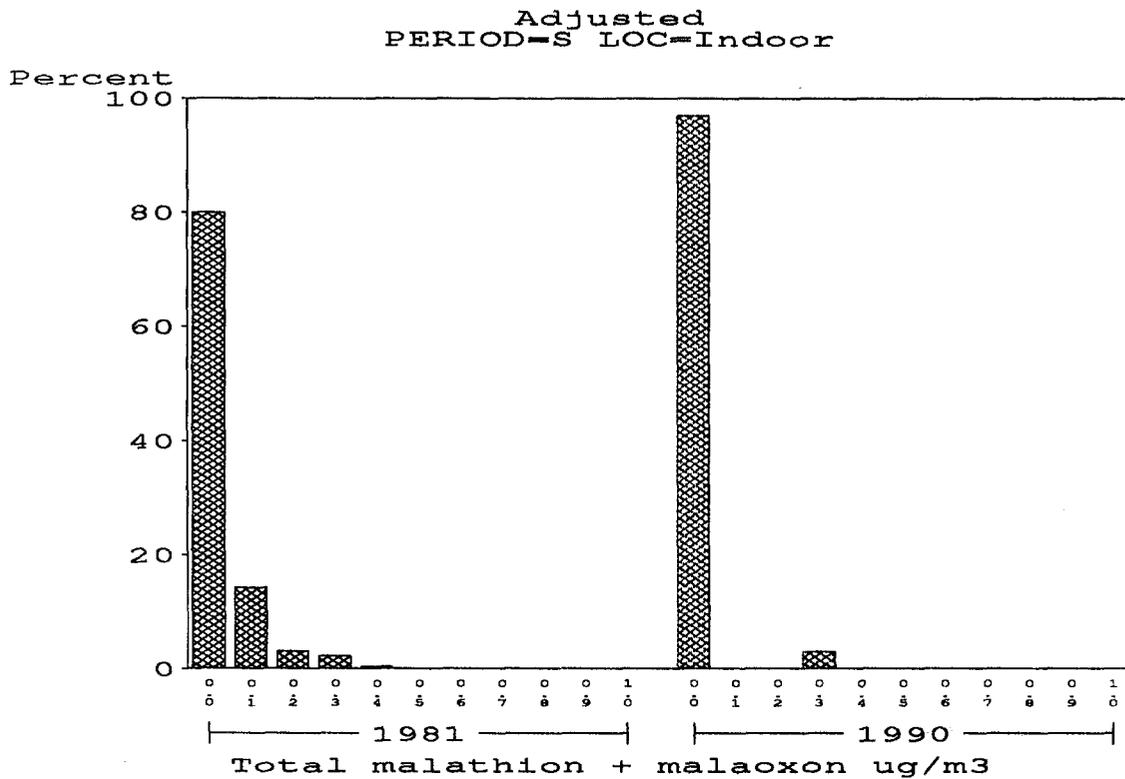


Figure E-19. Comparison of 1981 and 1990 Medfly 1st post-spray period (P) total (malathion + malaoxon) air concentrations.

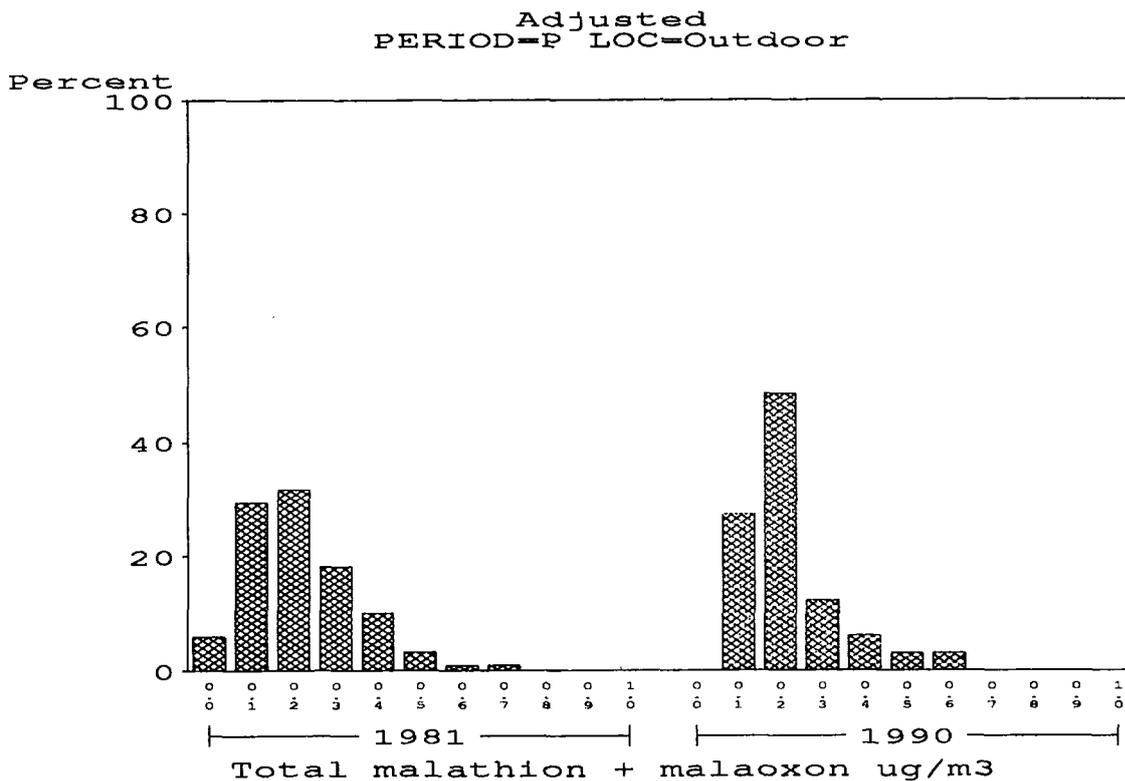
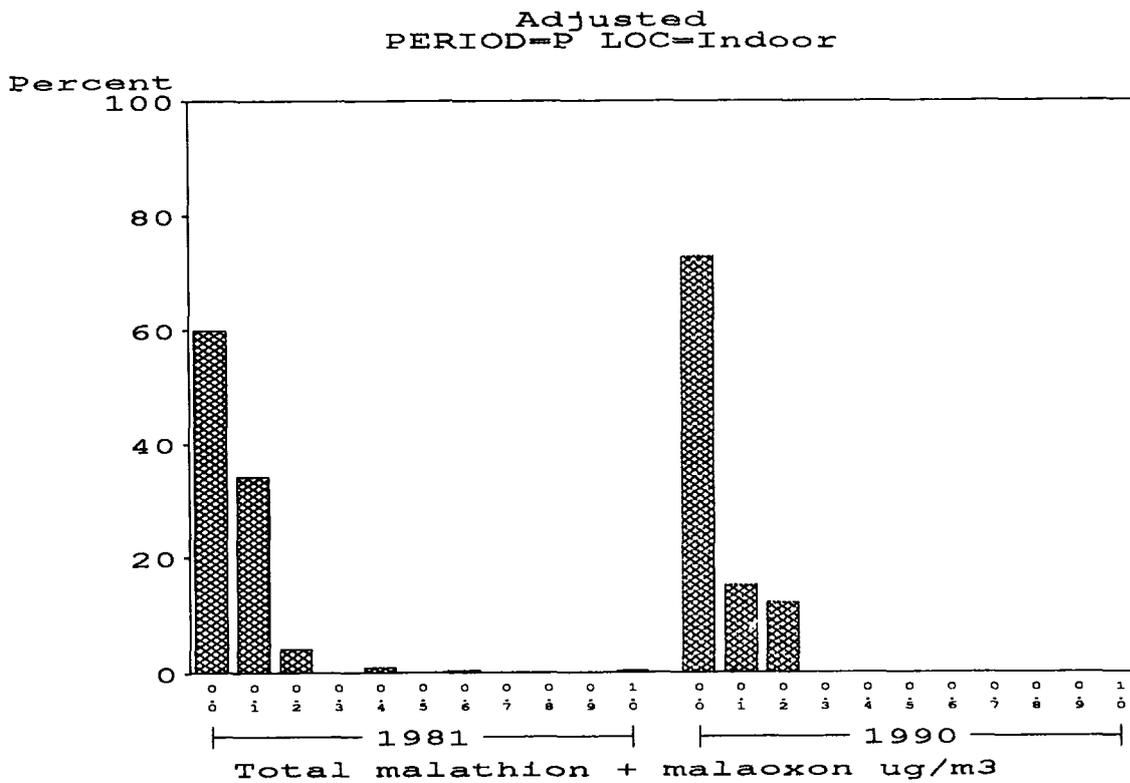


Figure E-20. Comparison of 1981 and 1990 Medfly 2nd post-spray period (F) total (malathion + malaoxon) air concentrations.

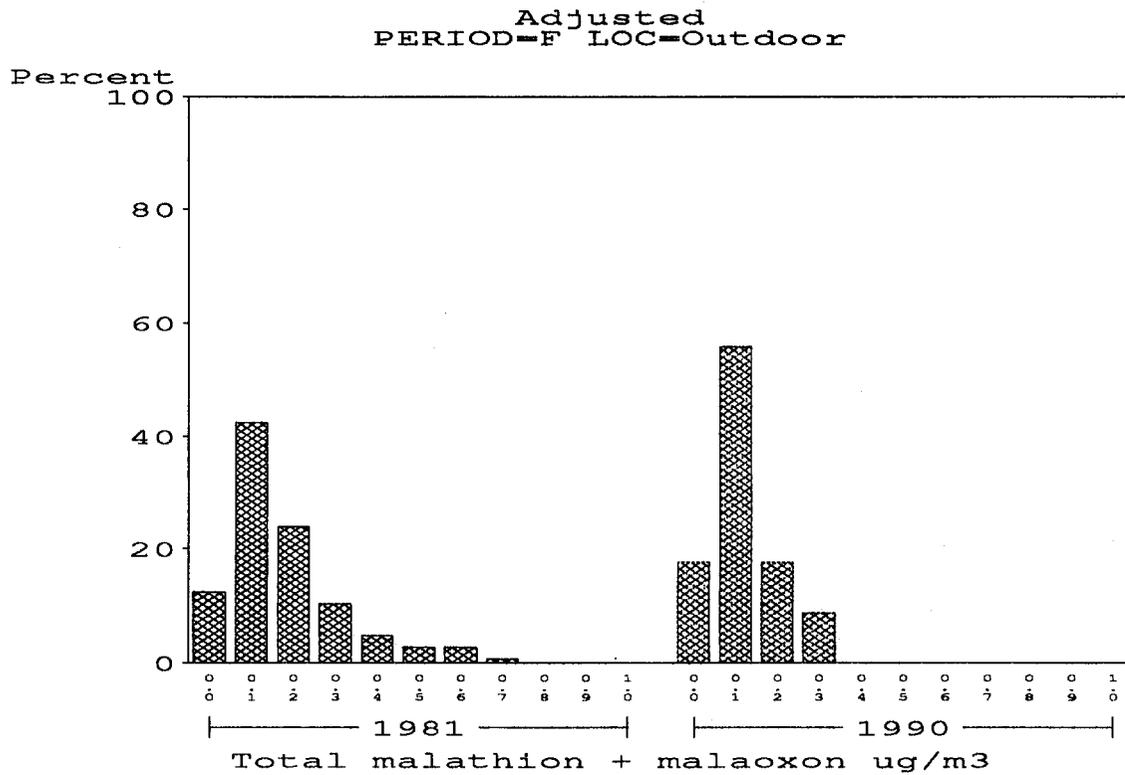
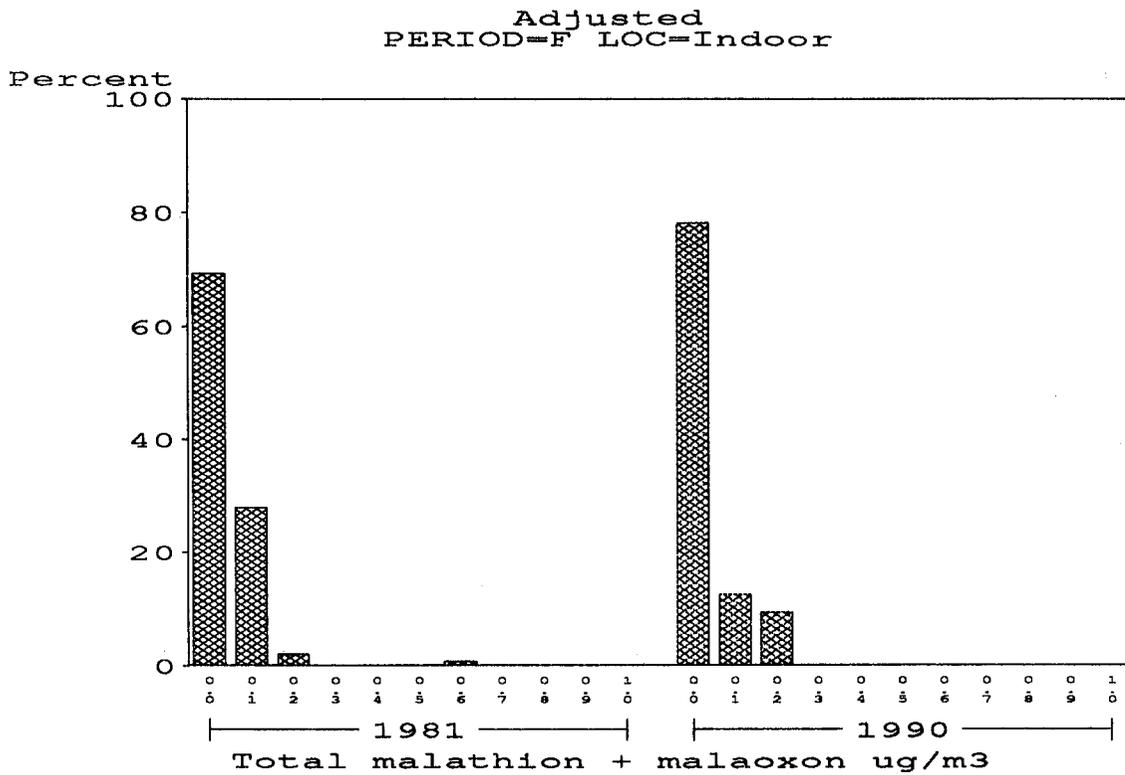


Figure E-21. Statistical comparison of 1981 and 1990 Medfly malathion and malaoxon background (B) air concentration distributions. The 1981 distributions are represented by the lines at 33%. Non-significant (NS) and significant (**, $p < .01$) differences are indicated.

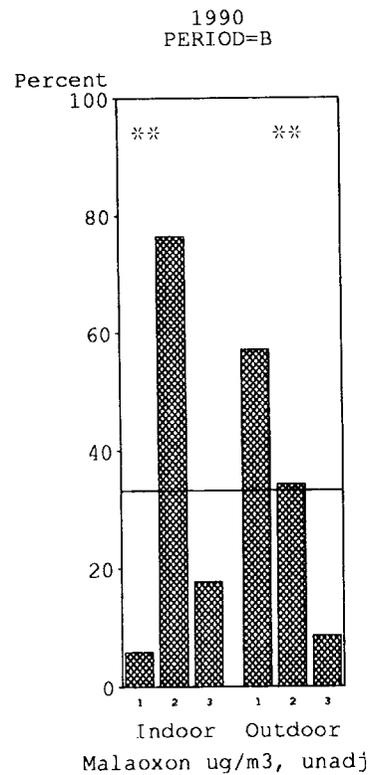
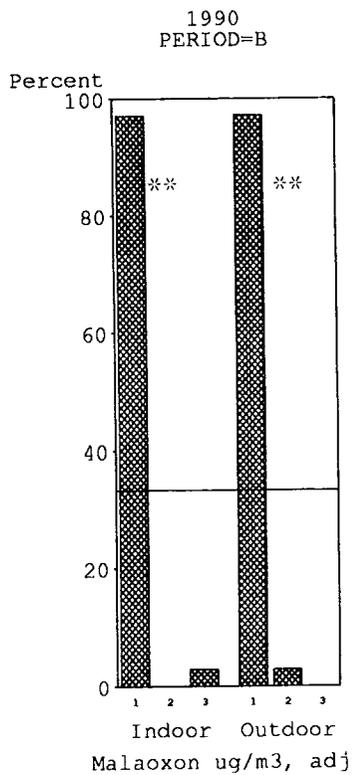
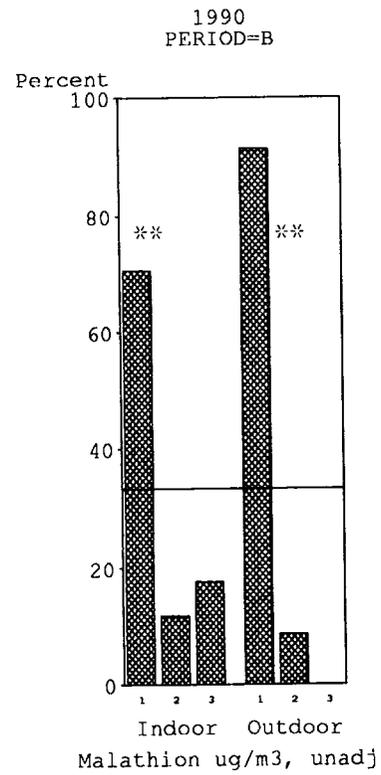
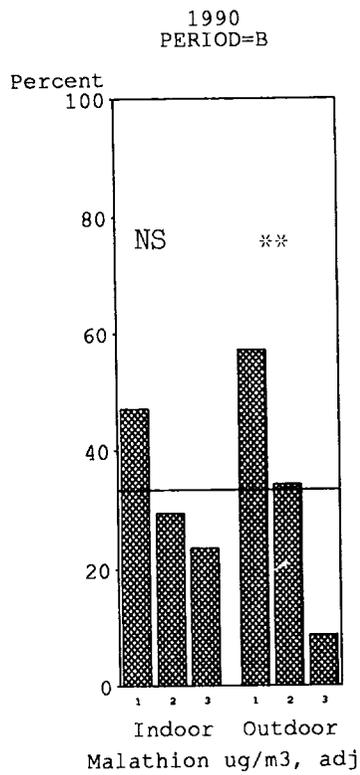


Figure E-22. Statistical comparison of 1981 and 1990 Medfly malathion and malaoxon spray period (S) air concentration distributions. The 1981 distributions are by the lines at 33%. Non-significant (NS) and significant (**, $p < .01$) differences are indicated.

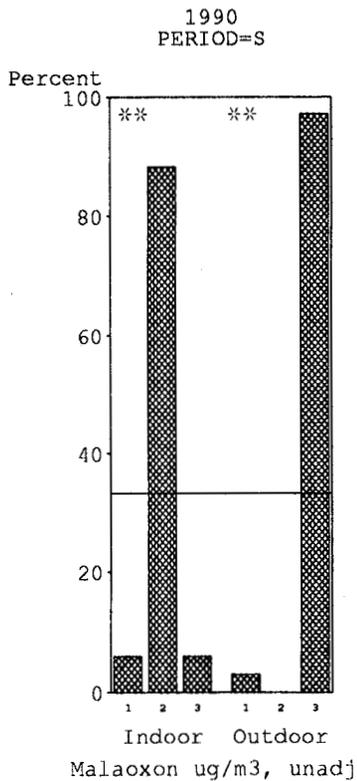
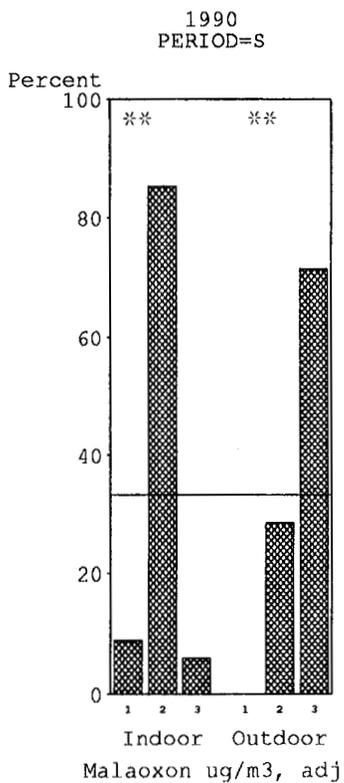
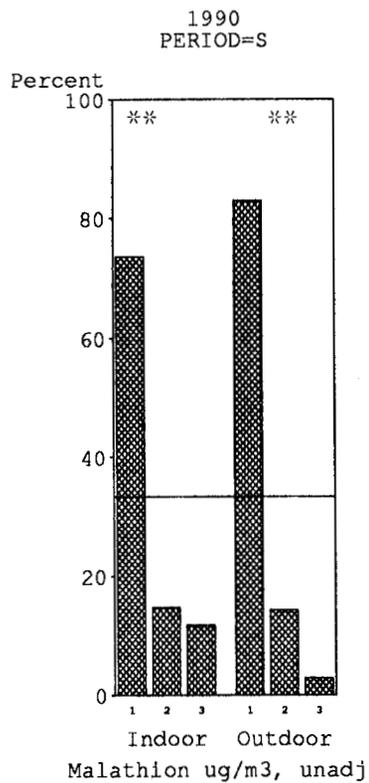
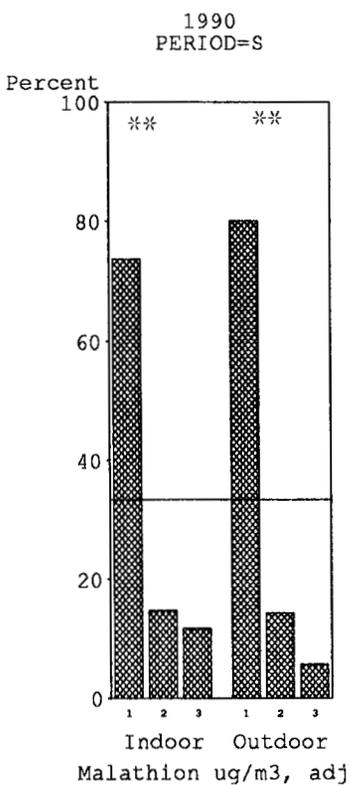


Figure E-23. Statistical comparison of 1981 and 1990 Medfly malathion and malaoxon 1st post-spray period (P) air concentration distributions. The 1981 distributions are represented by the lines at 33%. Non-significant (NS) and significant (**, $p < .01$) differences are indicated.

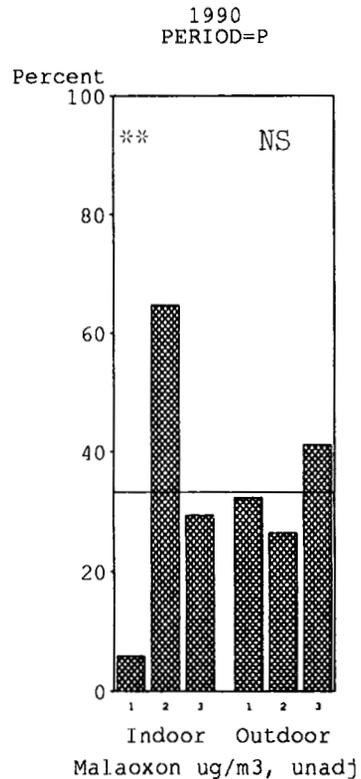
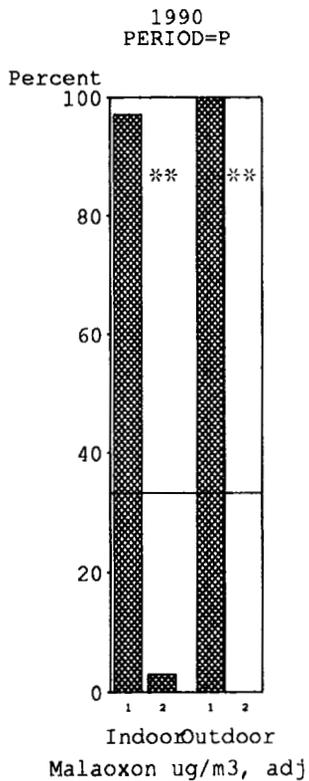
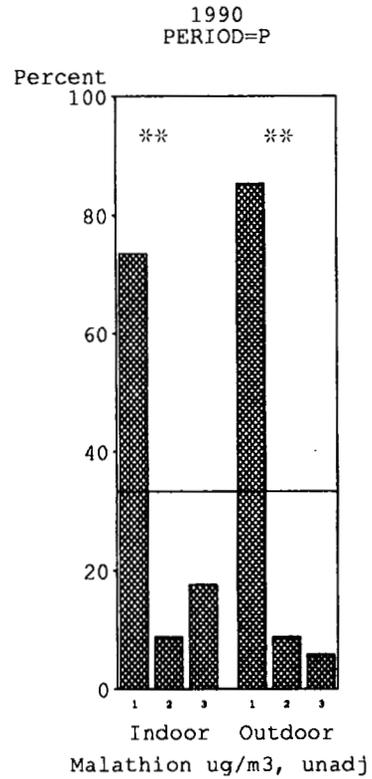
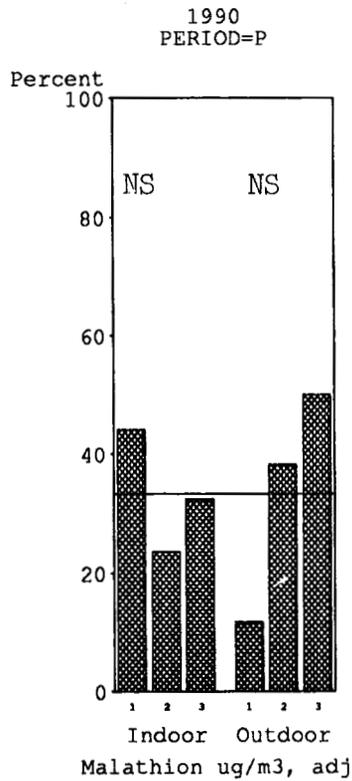


Figure E-24. Statistical comparison of 1981 and 1990 Medfly malathion and malaoxon 2nd post-spray period (F) air concentration distributions. The 1981 distributions are represented by the lines at 33%. Non-significant (NS) and significant (**, $p < .01$) differences are indicated.

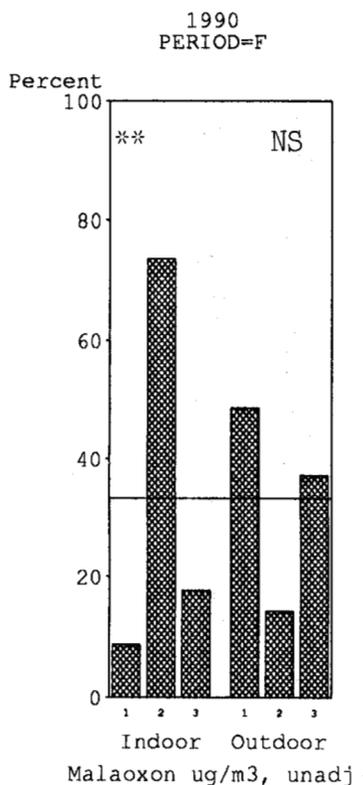
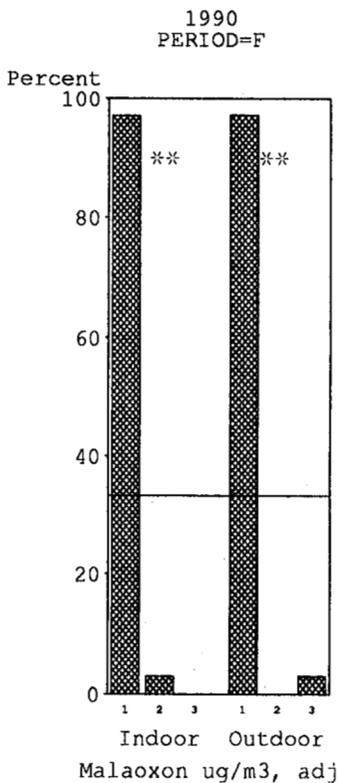
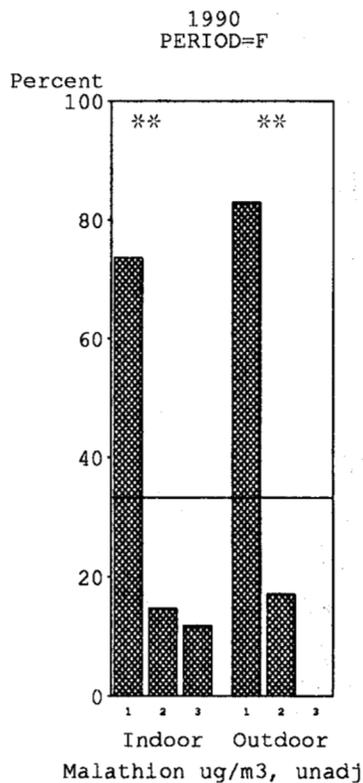
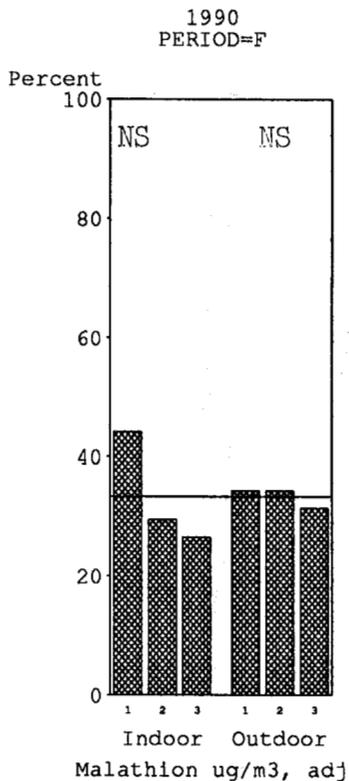


Figure E-25. Statistical comparison of 1981 and 1990 Medfly total (malathion + malaoxon) background (B) and spray (S) period air concentration distributions. The 1981 distributions are represented by the lines at 33%. Non-significant (NS) and significant (**, $p < .01$) differences are indicated.

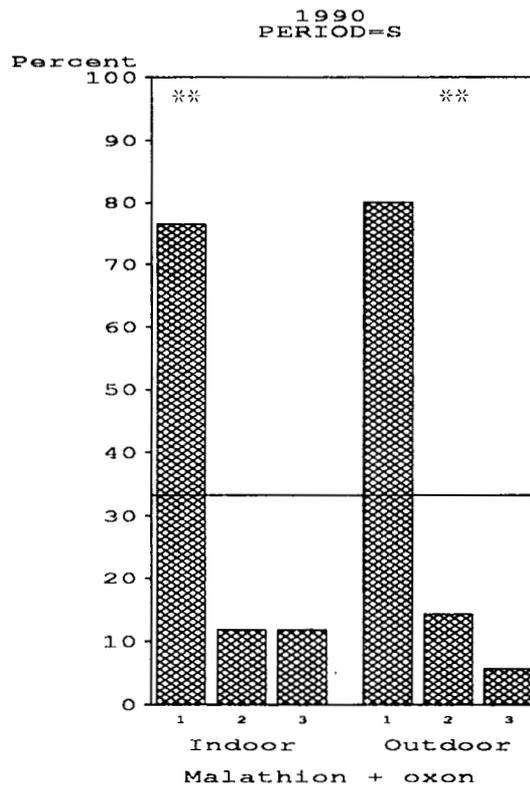
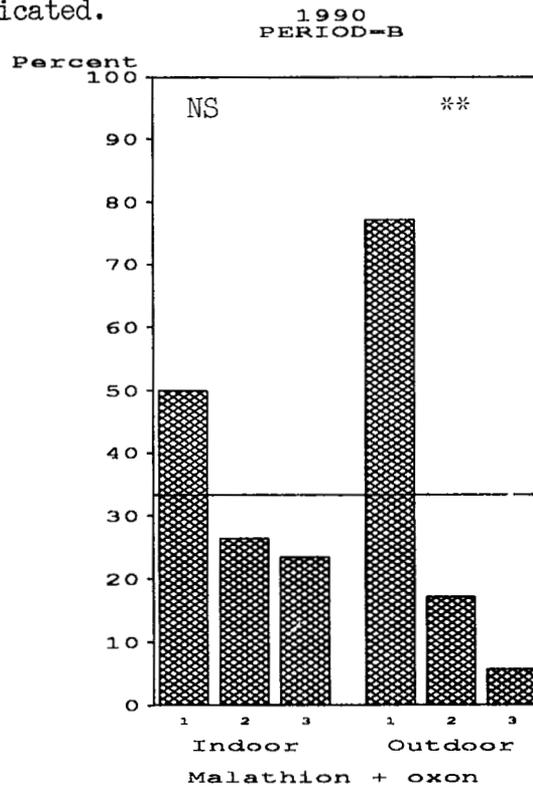


Figure E-26. Statistical comparison of 1981 and 1990 Medfly total (malathion + malaaxon) 1st post-spray (P) and 2nd post-spray (F) period air concentration distributions. The 1981 distributions are represented by the lines at 33%. Non-significant (NS) and significant (**, p<.01) differences are indicated.

