MONITORING OF THE 1983 GYPSY MOTH ERADICATION GROUND SPRAY PROGRAM IN SIX CALIFORNIA COUNTIES

by

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ACKNOWLEDGMENTS

We are indebted to the following people for their assistance in establishing monitoring sites for the groundspray program:

Alameda County -	Michael Greene, Agricultural Commissioner Earl Whitaker, Deputy Commissioner Eric Lauritzer, Agricultural Biologist
Contra Costa County -	John de Fremery, Agricultural Commissioner Robert Cruickshank, Deputy Commissioner
Los Angeles County -	Paul Engler, Agricultural Commissioner Bob Donley, Depty Commissioner
Marin County -	William Blackwell, Agricultural Commissioner Philip Economon, Assistant Commissioner
San Mateo County -	George Ginilo, Agricultural Commissioner
Santa Clara County -	Steven Gilmour, Agricultural Inspector

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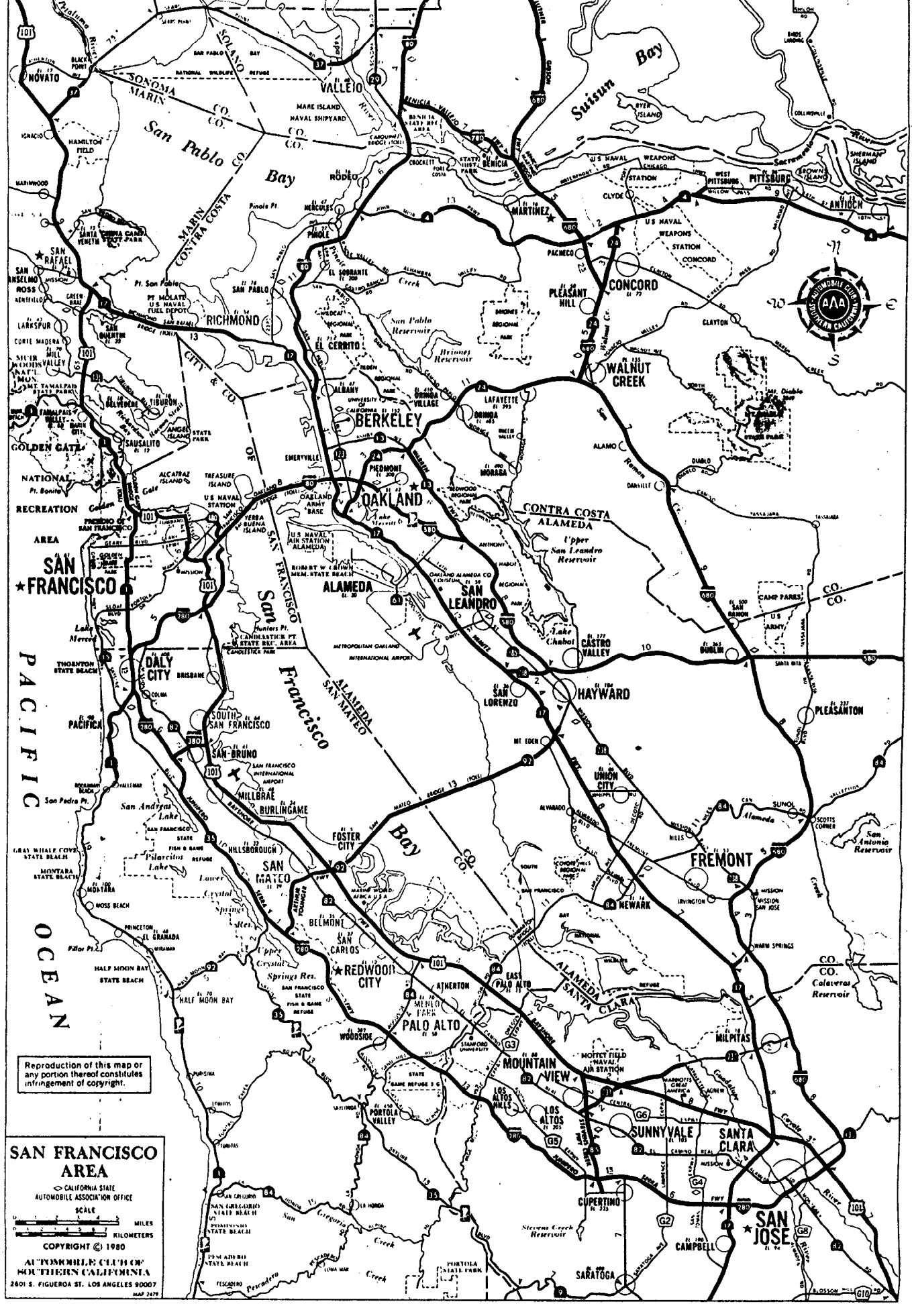
I. INTRODUCTION

The Environmental Hazards Assessment Program (EHAP), California Department of Food and Agriculture (CDFA) was requested to monitor the gypsy moth ground spray program conducted in the spring of 1983 to establish that carbaryl residues remained within the ranges previously documented in 1982 in Santa Barbara, California (Neher, L. A., R. T. Segawa, R. J. Oshima. 1982. Monitoring of the 1982 gypsy moth eradication ground spray program in Santa Barbara County. California Dept. of Food and Agriculture, Sacramento. 50 pp.). This 1982 environmental monitoring data had been reviewed by the CDFA medical coordinator, the California Department of Health Services, the Santa Barbara County Health Department and the Medical Advisory Committee.

Monitoring of air and natural bodies of water for the presence or absence of carbaryl (the insecticide used in the ground spray program) was conducted in the treatment areas within Alameda, Los Angeles, Marin, San Mateo and Santa Clara counties (see next page for map of bay area counties).

Permission to set up and operate air monitoring equipment was obtained from owners of private residences in each treatment area. The best site was selected based on ease of access, availability of electricity, and presence of suitable host foliage. Water monitoring took place following periods of rainfall to establish that carbaryl levels in creeks draining treatment areas did not exceed those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documented in 1982 in Santa Barbara.

A more intensive monitoring program was carried out in Contra Costa County where a truck mounted mist blower as well as hydraulic sprayers was to be used in the pesticide applications. Truck mounted mist blower applications had not been quantitatively characterized previously. Samples were collected to monitor pesticide residue on fallout cards, turf, tree foliage and soil in addition to the air and water samples during the mistblower treatment.

A detailed description of monitoring activities in each county is presented in the pages that follow.

II. PESTICIDE FORMULATION AND APPLICATION

The Sevin 80SP (80% active ingredient: carbaryl (1-napthyl-N-methylcarbamate) formulation contained 20% (wt.) diatomaceous earth and was mixed to a working concentration of 1.25 lb/100 gallons water; equivalent to 0.125% active ingredient or 1250 ppm. All mixing was done directly in each of the 100 to 500 gallon tanks mounted on hydraulic ground spray trucks and kept under constant agitation during application. Buffer was added to the spray tanks as necessary to maintain a pH of approximately 6.5.

III. GENERAL MATERIALS AND METHODS

A. Sample Security

Each sample collected was accompanied by a chain of custody form (Appendix I) documenting the sequence of transfers from sample medium preparation through chemical analysis. Every individual who handled the sample was required to sign and date the form, acknowledging receipt and relinquishment of the sample.

B. Tank Sampling

The spray mixture was sampled directly from the spray nozzle at application time and collected in 500 ml amber glass bottles with Teflon lined caps. The sample was immmediately packed in wet ice and kept on ice or refrigerated until analysis.

C. Water Sampling

Water samples were collected to measure the levels of carbaryl in rain runoff. Replicated water samples were collected in 1 liter amber glass bottles, filled to capacity, and sealed with Teflon lined caps. The samples were packed in wet ice and kept on ice or refrigerated until analysis.

D. Air Sampling

High-Volume (HiVol) air samplers, utilizing an adsorbant

macroreticular resin bed (XAD-2) and an electronic flow controller operating at a flow rate of 30 cubic feet per minute, were used to collect air samples at selected locations in the spray zones. At each site a background air sample was taken for a 6 hour period before the spray. Another sample was collected during the spraying of the property and lasted the duration of the spray plus 1/2 hour. A final sample was collected for a 6 hour period after the application.

All HiVol samples were immediately stored on dry ice following collection and were kept frozen during shipment and prior to analysis.

E. Chemical Analyses

All chemical analyses were performed by the Chemistry Laboratory Services Unit of the California Department of Food and Agriculture at the main laboratory in Sacramento. The extraction and analytical methods used in this study are the same as those previously documented for Santa Barara County in 1982.

IV. MONITORING PROCEDURES AND RESULTS FOR EACH COUNTY

A. ALAMEDA COUNTY

The treatment area encompassed a 2 square mile area within the city of Pleasanton. A single residence was selected from within this area for monitoring carbaryl levels in the air and for the collection of a tank sample; both samples were collected on 1 April when the first carbaryl application was made.

The area to be sprayed drained into two water ways, the Pleasanton Canal and Arroyo del Valle creek. Replicate water samples were collected from the Arroyo del Valle on 15 March, approximatey 2 weeks before the first spray. The Pleasanton Canal was dry at the time this background sample was collected. On 23 April rainwater runoff samples were collected at upstream and downstream sites on both water ways following the first rainfall.

RESULTS

The duplicate tank samples had a pH value of 6.0 and a mean carbaryl concentration of 0.096%, approximately 77% of the theoretical concetration.

Levels of Carbaryl in the background, spray and postspray air samples (Table 1) fell within the range of values documented for the 1982 Santa Barbara spray program.

Table 1. Concentrations of carbaryl, expressed as time weighted averages, in air samples collected outside of a residence in Pleasanton.

Sampling period	Date	Time	Carbaryl ug/m^3	Carbaryl ppb
Background	3/31	2400-0600	N.D.[a/]	N.D.
Spray	4/1	1005-1126	2.33	0.058
Post Spray	4/1	1126-1725	0.95	0.023

a/ N.D. = None detected.
Minimum detectable level = 4 ug/sample.

Table 2. Concentrations of carbaryl in water samples collected in Alameda County.

Location	Sampling period	Date	Carbaryl (ppb) Upstream	Carbaryl (ppb) Downstream
Pleasanton Canal	Background	[a/] – [b/]	-	-
	Post rain	4/23	9.9 [c/]	20.0
Arroyo del Valle Cr.	Background	3/15	-	N.D.[d/]
	Post rain	4/23	N.D.	N.D.

a/ The Pleasanton Canal was dry at the time background samples were to be collected.

b/ No sample was collected.

c/ Each value represents a mean of replicated samples.

d/ N.D. = None detected. Minimum detectable level = 0.25 ppb.

No carbaryl was detected in pre or post spray water samples collected from Arroyo del Valle Creek (Table 2). Both upstream and downstream samples from the Pleasanton Canal contained carbaryl (Table 2). However, the upstream sample had to be taken from a site within the spray area because the upstream portion of the canal was underground.

B. CONTRA COSTA COUNTY

An area approximately 1/4 mile in diameter in the city of Clayton was scheduled to be sprayed in 1983. Two different methods were used to apply carbaryl in Clayton due to the topography of the treatment area. Most of the area consisted of residential properties. These were treated using hydraulic spray rigs similar to those used in other counties. However, because hydraulic spray rig applications were extensively monitored both in the 1982 eradication program and in the other counties, no monitoring was conducted in Contra Costa County. Resources were diverted to an intensified monitoring of truck mounted mist blower applications to quantitatively characterize the spray residues.

The second method of application was used on a small creek (Mt. Diablo Creek) surrounded by dense foliage including some prime host material, that ran through the middle of the area to be sprayed. A mist blower (FMC #100 H) equipped with #8 nozzles was used to treat foliage surrounding the creek. This provided adequate coverage of carbaryl while minimizing the amounts of it that entered the creek. Because of the unique nature of this application, extensive environmental monitoring was conducted.

MATERIALS AND METHODS

AIR SAMPLES

Thirteen sampling sites were established to characterize airborne carbaryl concentrations. Two sites were inside private residences adjacent to the mistblower treatment area, five were outside (immediately adjacent to the treatment area), and six were located approximately 250 ft from the treatment area (Fig. 1). Background, spray and postspray samples were taken at all sites on 7 and 8 April. A tank sample was taken after the spray application was completed.

LEAF SAMPLES

Replicate leaf samples were collected from a tree near the creek. Spray samples were collected after the spray application and postspray samples were collected every other day after treatment through the third spray. Methods used for sample collection and analysis were previously documented for the 1982 Gypsy Moth Program in Santa Barbara.

SOIL SAMPLES

Replicate soil samples were collected beneath the tree selected for foliage sampling. In addition to the background and spray samples, soil samples were collected 1, 3, and 6 days after application.

TURF SAMPLES

A study was conducted to determine the amounts of dislodgable carbaryl

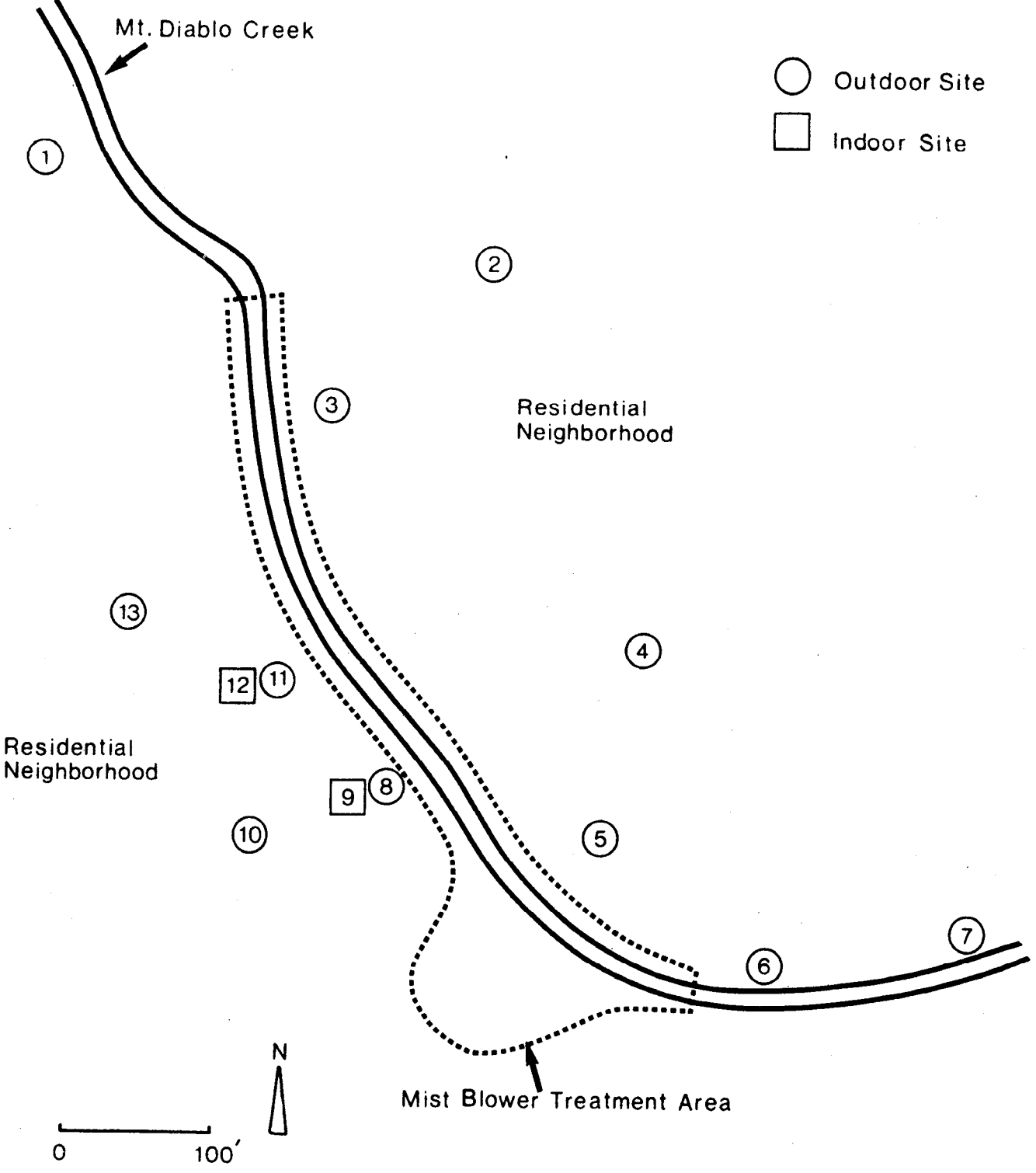

Figure 1. Locations of air monitoring sites for the mistblower application. The spray rig was driven along the east bank and spray was directed towards the west bank.

residue that occurred on turf after the mistblower treatment. Ten, 1 square ft sections of sod were placed in the treatment area prior to spraying. Replicate samples were collected and placed in 1 gallon glass jars and stored immediately on wet ice using the same timetable that was used for the soil samples.

FALLOUT SAMPLES

Plastic-backed absorbent paper sheets, 1 square foot in area, were used to determine the amount of carbaryl that impacted horizontal surfaces in the spray area. These were placed adjacent to air samplers at all 11 outdoor sites. An additional sheet was also placed at the turf sampling site. The sheets were collected 1/2 hour after spraying ceased and frozen immediately on dry ice.

WATER SAMPLES

Replicate water samples were collected from Mt. Diablo Creek both upstream and downstream of the treatment area. Background, spray and rain runoff samples were collected at the appropriate times. Additionally, background and postspray water samples were taken from a private swimming pool located adjacent to an area that was sprayed.

RESULTS

AIR SAMPLES

Tank samples taken from the mistblower applicator had a carbaryl concentration of 0.56% (wt:wt) which is only 45% of the theoretical concentration. Therefore, the magnitude of residues documented for this application were probably not typical of an application made with the proper concentration of pesticide.

Concentrations of carbaryl detected in air samples are presented in Table 1. When compared to air sample results from other counties, these results showed that lower concentrations were found in the mistblower treated area than in the hydraulic spray treated areas; this would hold true even if concentrations were doubled to account for the low tank concentration. Background air samples (outdoor) contained detectable carbaryl residues that were undoubtedly due to a hydraulic spray application made 4 hours prior to sampling. Indoor background air samples were not taken due to the noise created by the air samplers. Air sample sites located adjacent to the spray area contained slightly higher concentrations than sites outside the spray area. Only one of the two indoor sites had detectable residues.

Postspray samples were collected for only 2 hours instead of 6 because hydraulic spraying was begun. Results for these samples showed that higher concentrations were present in sites outside the spray area than in those adjacent to the spray area. This trend was opposite that for the spray samples and was due to increased drift from the higher wind speed that occurred during this sampling period (Fig. 2).

Table 1. Concentrations of carbaryl in air during a mistblower application in Clayton.

		Carbaryl (ug/m^3)		
		Background	Spray	Postspray
Location[a/]	Time:[b/]	1930-2400	0805-1210	1210-1400
Adjacent				
3		0.169	0.206	0.326
5		0.099	0.433	0.237
6		N.D.[c/]	0.125	0.111
8		0.007	0.540	0.029
11		N.D.	0.508	0.035
$\bar{x}$		0.055	0.362	0.148
Outside				
1		0.021	0.034	N.D.
2		0.104	0.243	0.340
4		0.121	0.244	0.443
7		N.D.	0.103	0.062
10		1.22	0.429	0.375
13		0.107	0.232	0.224
$\bar{x}$		0.079	0.214	0.241
Indoor				
9		N.S.[d/]	N.D.	N.D.
12		N.S.	0.033	N.D.
$\bar{x}$			0.017	N.D.

a/ Refer to Figure 1 for locations.

b/ Time expressed as military time for April 7-8, 1983.

c/ N.D. = None detected. Minimum detectable level = 3 ug per sample.

d/ N.S. = Not sampled.

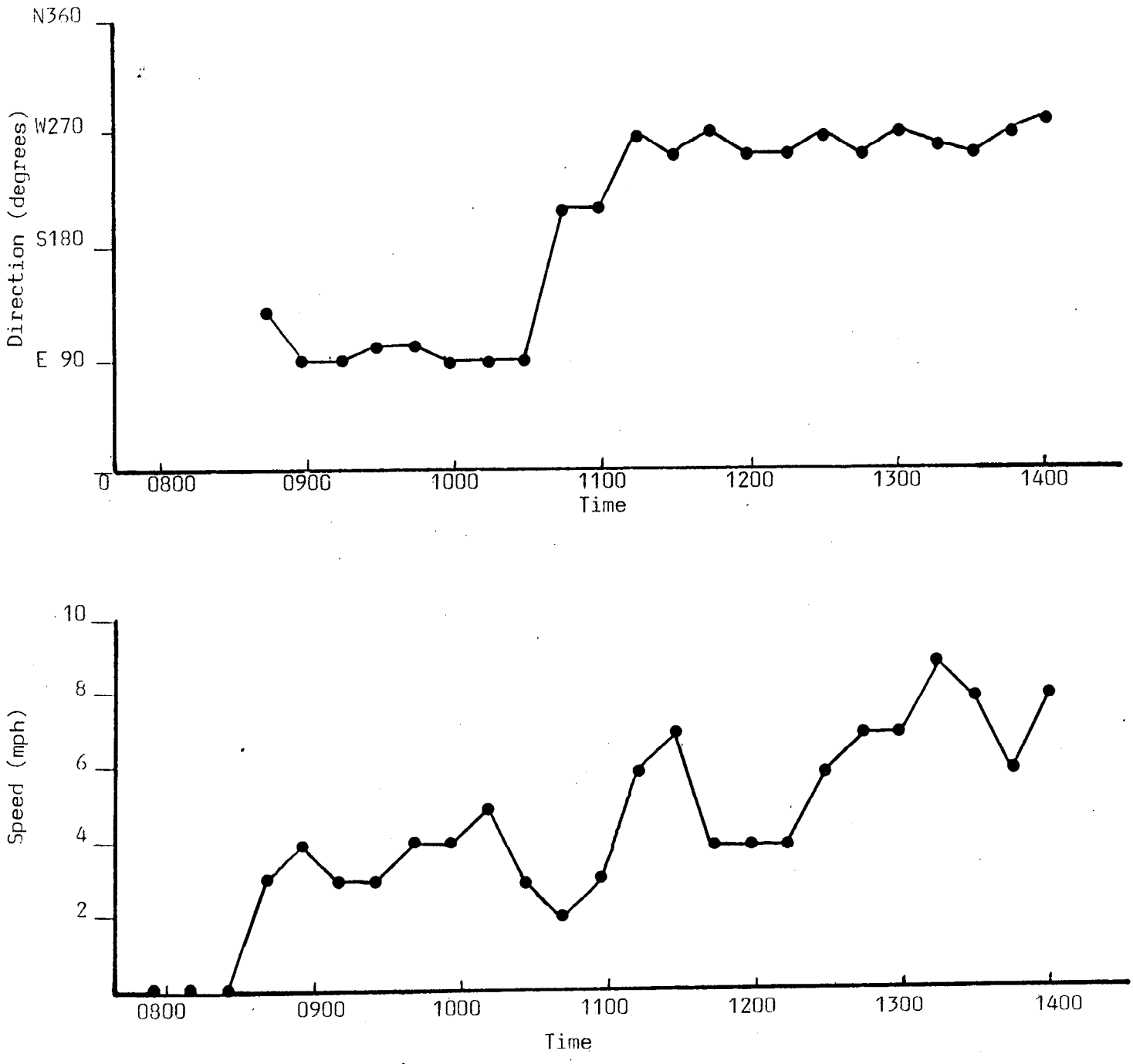

Figure 2. Wind speed and direction during the mistblower treatment. Actual spraying occurred between 0800 and 1200.

A comparison of the results for the eastern and western sites shows a variation with wind direction.

During the spray that occurred when the wind was from the east, the sites on the western side of the treatment area had higher carbaryl concentrations. An opposite trend was observed for the postspray samples taken when the wind shifted 180 degrees. Mist blowers produce a smaller droplet size distribution than hydraulic sprayers and are therefore influenced to a greater extent by wind speed and direction.

LEAF SAMPLES

There was little or no decline in dislodgable carbaryl residues on leaves over a 21 day period (Table 2,Fig. 3). These results agree with those documented for the Santa Barbara gypsy moth spray program. However, although no decline was seen, neither was there a buildup of carbaryl residues from the first to the second or third spray applications. The low tank concentration of the first spray was not a factor since the concentration for the second spray was 0.144%, slightly greater than the desired concentration.

No substantiated explanation has been determined for the lack of carbaryl degradation. Investigations made after the Santa Barbara spray program was completed revealed a possible error in the pH of the tank mixtures. All tank samples from the 1983 spray program had a pH in the desired range between 6.2 and 6.5. Another hypothesis put forth in the Santa Barbara report that the carbaryl was trapped in

Table 2. Degradation of carbaryl in leaves, soil and turf collected from the mistblower treatment area in Clayton.

Sampling Period	Carbaryl concentration		
	Leaves (ug/cm^2)	Soil (ppm)	Turf (ug/ft^2)
Background	0.003	N.D.[a/]	N.D.
Spray (4/8)	3.34	0.12	298
1 day post spray	3.27	0.19	285
3	2.86	0.24	300
5	3.82	-	-
6	-	3.20	50
7	4.60		
9	3.84		
11	4.17		
13	1.84		
Spray (4/21)			
2	2.93		
4	3.08		
6	2.90		
8	1.93		
10	1.74		
12	2.49		
Spray (5/3)			
6	3.98		
13	0.76		
21	3.04		

a/ N.D. = None detected.

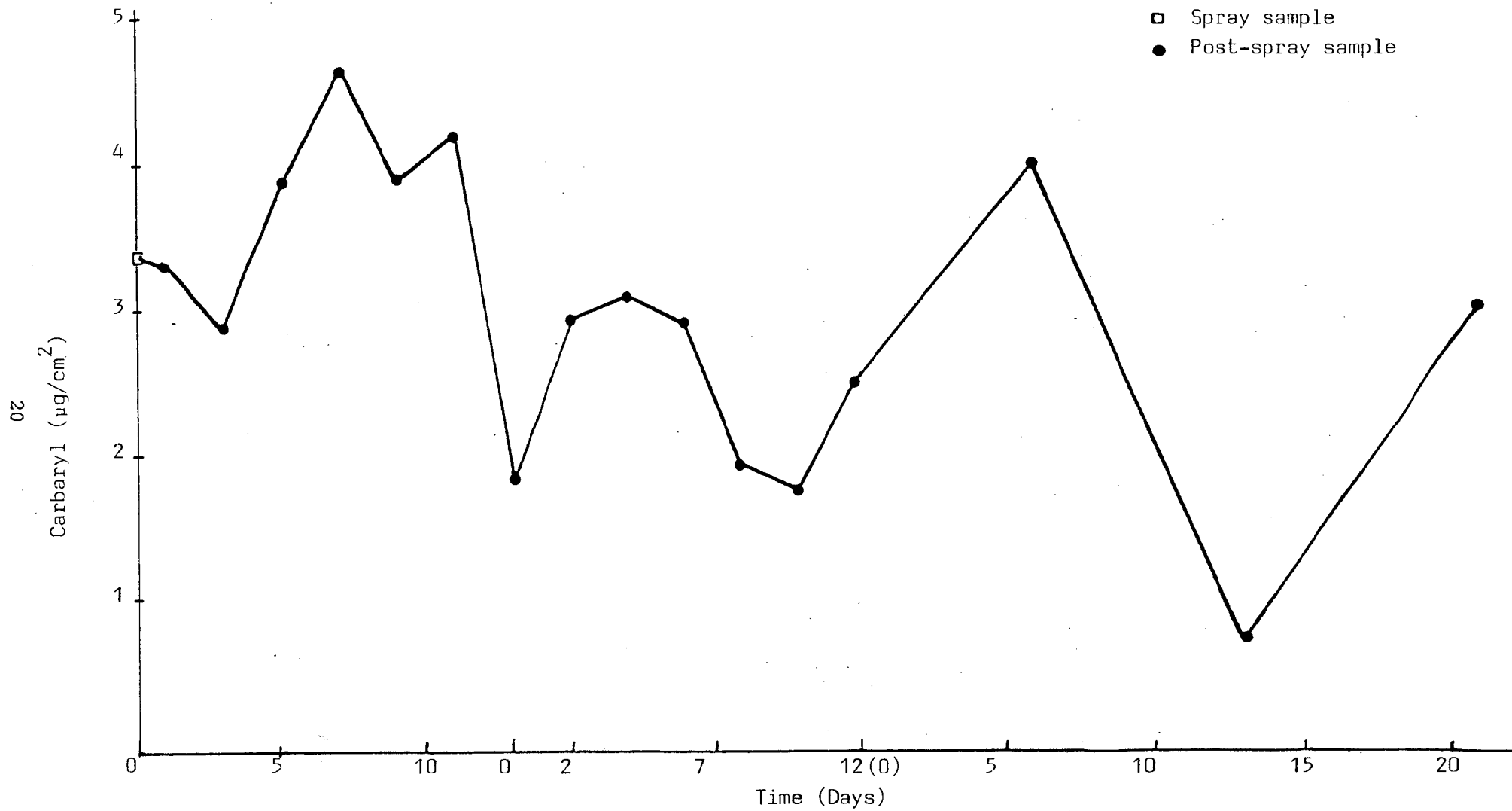

Figure 3. Carbaryl degradation on leaves from the mistblower treatment area.

diatomaceous earth particles remains unproven as does the biological activity of aged carbaryl.

SOIL SAMPLES

Analyses of soil samples showed that carbaryl concentrations increased over time (Table 2). This was not surprising since most of the residue was a result of excess spray dripping off treated foliage rather than from a direct spray application.

TURF SAMPLES

Concentrations of dislodgable carbaryl residues from turf declined after the third day (Table 2). Higher than expected concentrations probably resulted from the placement of turf sections directly beneath the mistblower spray.

FALLOUT SAMPLES

The results of fallout sampling (Table 3) showed that, as expected, much higher concentrations of carbaryl occurred at the sites adjacent to the spray area than at the sites outside the spray area. A comparison of the fallout sheet and the adjacent turf piece showed that a much greater concentration occurred on the fallout sheet. This was probably due to differences in extraction efficiency and penetration of the carbaryl into soil and leaves.

Table 3. Concentrations of carbaryl collected on fallout sheets during the first mistblower application in Clayton.

Sample location	Carbaryl (ug/ft)^2
Adjacent	100[a/] (N.D.[b/] - 350)
Outside	2.8[c/] (N.D. - 11)
Turf	3100[d/]

a/ Mean and range of values from five sites located adjacent to the spray area.

b/ N.D. = None detected. Minimum detectable level = 3 ug/ft^2.

c/ Mean and range of values from six sites located approximately 250 ft. outside the spray area.

d/ Value from a turf site located inside the spray area and beneath a sprayed tree.

Table 4. Concentrations of carbaryl in water samples collected during the first mistblower application in Clayton.

	Carbaryl (ppb)		
	Creek		
Sampling period	Upstream	Downstream	Pool[a/]
Background	N.D.[b/]	N.D.	N.D.
Spray[c/]	N.D.	31[d/]	
Post spray[e/]	Not applicable because of flow		3.8

a/ Backyard swimming pool adjacent to spray area.
b/ N.D. = None detectable. Minimum detectable level = 0.5 ppb.
c/ Spray samples were collected 20 min. after spraying started.
d/ All values are the mean of two replicate samples.
e/ Post spray samples were collected 45 min. after spraying was stopped.

WATER SAMPLES

Analytical results for water samples taken during the mistblower treatment showed the presence of low carbaryl concentrations in the creek and in an uncovered pool adjacent to the treatment area (Table 4). These concentrations would be expected to drop rapidly to non detectable levels due to the dilution factors downstream of the creek and in the lower depths of the pool. Rain runoff samples collected on 23 April showed only 1.8 ppb carbaryl downstream of the treatment area.

DISCUSSION

The mist blower application can be generally characterized as producing adequate leaf residue for efficacy with lower mass deposition on soil surfaces. This is of prime importance when minimizing carbaryl deposition in bodies of water. The mistblower produces low air residues at locations adjacent to an application area but is sensitive to the wind distribution of measurable drift outside of the treatment area. This application method should therefore only be considered during periods of low air movement.

C. LOS ANGELES COUNTY

A 1/4 square mile area of Westlake Village, a community located 35 miles north of Los Angeles City, was sheduled for ground spray treatments in March and April, 1983. An air monitoring site was set up outside of a private residence centrally located within the treatment area. A background air sample was collected on 21 March and spray and postspray samples were collected on 23 March. Once spraying was completed a tank sample was also taken.

Drainage from an 18 square mile area fed into a 157 acre reservoir. It was populated with bluegill, bass and catfish; a portion of the shoreline was included in the treatment area. Water samples were collected at the shoreline adjacent to a treated property.

RESULTS

Concentrations of carbaryl detected in background, spray and post spray air samples fell within the range of values documented for the Santa Barbara gypsy moth spray program in 1982 (Table 1). The tank sample concentration was 88% of the theoretical concentration of carbaryl.

No carbaryl was detected in any of the water samples collected from the reservoir located in Westlake Village (Table 2).

Table 1. Concentrations of carbaryl, expressed as time weighted averages, in air samples collected outside of a residence in Westlake Village.

Sampling period	Date	Time	Carbaryl ug/m^3	Carbaryl ppb
Background	3/21	1100-1700	N.D.[a/]	N.D.
Spray	3/23	1030-1122	0.91	0.022
Post Spray	3/23	1124-1724	0.34	0.009

a/ N.D. = None detected.
Minimum detectable level = 3 ug/m or ppb.

Table 2. Concentrations of carbaryl in water samples collected in Westlake Village, Los Angeles County.

Sampling period	Date	Carbaryl (ppb)
Background	3/16	N.D.[a/]
Spray	3/30	N.D.
Post rain	4/19	N.D.

a/ N.D. = None detected. Minimum detectable level = 0.5 ppb.

D. MARIN COUNTY

Two separate areas within the city of Novato were designated for ground spraying. In one of the areas, consisting of 46 properties on approximately 40 acres, a single residence was selected as a site to monitor carbaryl levels in the air. Background air samples were collected on the night of 11 April and the spray and postspray air samples were taken on 12 April. A tank sample was taken after the spraying was completed.

The treatment area was drained by a small seasonal creek that emptied into a stock pond approximately 100 yards outside of the treatment area. Water was sampled from the drainage creek and stock pond a total of four times between 18 April and 5 May. These samples were taken to determine whether or not carbaryl was accumulating in the pond.

The creek originated within the treatmnent area, draining a hillside portion of it, and thus no upstream sample could be taken. Further, no background samples were taken because there was no water in the stream before the spray application. Downstream samples were taken just outside of the treatment area, also at the inlet where the creek entered the pond, and at the edge of the pond 30 ft from the inlet. The last water samples were collected on 5 May. At that time a sediment sample and a water sample taken 250 ft from the inlet were also collected.

RESULTS

Concentrations of carbaryl in air samples were within or below the ranges previously documented in the Santa Barbara ground spray program (Table 1). Samples taken from the spray tank were 97% of the theoretical concentration of carbaryl.

Results for the rain runoff sampling are presented in Table 2. Concentrations of carbaryl increased steadily in the downstream sampling site and concentrations at the inlet to the pond were also much greater on the last sampling date than on the first. Since no carbaryl was detected in the pond sediment, and water concentrations declined steadily despite relatively high intake values, it was unlikely that carbaryl accumulated in the pond.

Table 1. Concentrations of carbaryl, expressed as time weighted averages, in air samples collected outside of a residence in Novato.

Sampling period	Date	Time	Carbaryl ug/m³/	Carbaryl ppb
Background	4/11	1838-2338	0.04	0.001
Spray	4/12	0830-0934	0.13	0.003
Post Spray	4/12	0936-1436	0.04	0.001

Table 2. Concentrations of carbaryl in water samples collected in Novato, Marin County.

		Carbaryl (ppb)[a]			
		Drainage	Pond		
Sample type	Date	Downstream	Inlet	Location 2[b]	Location 3[c]
Water	4/18	155	-	N.D.[d]	-
	4/23	220	163	42	-
	4/30	-	8.3	3.7	-
	5/5	265	295	0.4	N.D.
Sediment	5/5	-	-	N.D.[e]	-

a/ Each value represents a mean of repliacted samples.
b/ 30 feet from inlet.
c/ 250 feet from inlet.
d/ N.D. = None detected. Minimum detectable level = 0.5 ppb.
e/ N.D. = None detected. Minimum detectable level = 100 ppb.

E. SAN MATEO COUNTY

Portions of San Mateo City and North Fair Oaks were included in areas to receive groundspray treatments with carbaryl. A private residence in San Mateo was selected as the air monitoring site. Background air samples were collected on the night of 30 March and again on the morning of 31 March; spray and postspray samples were taken after the last background sample. A tank sample was taken after spraying was completed.

Verification of drainage patterns for San Mateo was obtained from the San Mateo Public Works Office. Part of the drainage system included an open canal which ran through the treatment area. The upstream portion of the canal was covered approximately one-third of the way into the spray zone. The remainder of the canal was open and downstream samples were taken just outside the zone boundary, near Laurie Meadows Dr. An upstream sample was taken some distance from the spray zone, near the end of Otay Ave. Foliage on and overhanging the canal right-of-way was treated separately as one operation. Additional water samples were taken at the upstream and downstream sites before, during and after this spray.

The North Fair Oaks area does not have a well developed storm drain system. Drainage for this area, as determined by the San Mateo Flood Control Office, is along the Atherton Creek channel. Water draining from Menlo Park, Fair Oaks and Redwood City is collected at a pumping

station in Redwood City. Access to this downstream facility was not available at appropriate sampling times. Thus, no data on carbaryl levels in water was obtained for downstream locations in this treatment area. However, upstream samples were collected from an open canal at the intersection of Marsh and Middlefield Rds. A background sample was collected on 22 March and postspray samples were taken on 2 April and on 22 April.

RESULTS

No carbaryl was detected in background air samples taken outside a residence in San Mateo city (Table 1). Concentrations found in spray and postspray air samples were well within the range documented for the 1982 Gypsy Moth spray program in Santa Barbara. The tank sample contained 117.6% of the theoretical concentration of carbaryl.

No carbaryl was detected in the background and first post rain water samples collected upstream in the Atherton Channel (Table 2). A low concentration, well within the range documented in Santa Barbara, was found in the water collected in the last post rain sample. Carbaryl was also detected in the background water sample collected from Laurel Creek. However, no additional positive samples were detected until the last post rain sample. These concentrations were also within levels found in Santa Barbara.

Table 1. Concentrations of carbaryl, expressed as time weighted averages, in air samples collected outside of a residence in San Mateo City.

Sampling period	Date	Time	Carbaryl ug/m^3	Carbaryl ppb
Background	3/30	1830-2345	N.D.[a/]	N.D.
	3/31	0521-0830	N.D.	N.D.
Spray	3/31	0900-0935	1.14	0.028
Post Spray	3/31	0940-1540	0.15	0.004

a/ N.D. = None detected.
Minimum detectable level = 3 ug/sample.

Table 2. Concentrations of carbaryl in water samples collected in San Mateo County.

Location	Sampling period	Date	Carbaryl (ppb)[a/] Upstream	Downstream
North Fair Oaks				
Atherton Channel	Background	3/22	N.D.[b/]	-
	Post rain	4/2	N.D.	-
	Post rain	4/23	1.4	-
San Mateo City				
Laurel Creek[c/]	Background	3/22	-	4.7
	Post rain	4/2	N.D.	N.D.
	Spray	4/7	N.D.	N.D.
	Post rain	4/23	0.7	3.2

a/ Mean of replicated samples.

b/ N.D. = None detected.
Minimum detectable level = 3 ug/sample

c/ Trees along creek were sprayed. Water samples were taken before, during and after application.

F. SANTA CLARA COUNTY

Groundspray treatments were scheduled for three separate areas that included Campbell, Los Altos and Palo Alto. A private residence in Palo Alto was selected as the site for air monitoring. A background air sample was collected on 3 April, the night before the pesticide application. Air samples covering the treatment and post treatment periods were collected on 4 April and a tank sample was also taken after spraying was completed.

Upstream and downstream sampling locations were established for creeks that drained each of the treatment areas. EHAP staff received assistance from the Santa Clara Irrigation District and the Palo Alto Public Works Office in determining the drainage patterns and sampling locations. Adobe Creek drained the Palo Alto and the Los Altos treatment areas, the Campbell area was drained by San Tomas Aquino Creek, and Dry Creek also drained the Palo Alto area.

Background water samples were collected from the downstream locations on 22 March; rainfall runoff samples were collected from the upstream and downstream locations on 2 April and again on 23 April.

RESULTS

The concentrations of carbaryl in air samples taken during the background and spray periods fell within the range documented for the

1982 Gypsy Moth program in Santa Barbara (Table 1). However, concentrations in the postspray samples were comparable but slightly higher than levels found in Santa Barbara. The tank sample contained 58.6% of the theoretical concentration of carbaryl.

No carbaryl was found in water samples collected from the portion of Adobe Creek that ran through Palo Alto (Table 2). Further, of all the samples collected from Adobe Creek in Los Altos, only one of the samples collected downstream on 23 April contained carbaryl, and at a very low concentration.

Water collected from Dry Creek, which also drained the Palo Alto treatment area, contained no carbaryl until the final sampling on 23 April. This was also true for San Tomas Aquino Creek which drained the Campbell treatment area. Carbaryl concentrations were comparable to those documented in the Santa Barbara treatments in 1982.

Table 1. Concentrations of carbaryl, expressed as time weighted averages, in air samples collected outside of a residence in Palo Alto.

Sampling period	Date	Time	Carbaryl	
			ug/m^3	ppb
Background	4/3	1800-2336	N.D.[a/]	N.D.
Spray	4/4	0853-0940	9.02	0.223
Post Spray	4/4	0945-1530	0.44	0.011

a/ N.D. = None detected.
Minimum detectable level = 3 ug/sample.

Table 2. Concentrations of carbaryl in water samples collected in Santa Clara County.

Location	Sampling period	Date	Carbaryl (ppb) [a/] Upstream	Downstream
Campbell				
San Tomas Aquino Creek	Background	3/22	-	N.D. [b/]
	Post rain	4/2	N.D.	N.D.
	Post rain	4/23	2.2	2.8
Los Altos				
Adobe Creek	Background	3/22	-	N.D.
	Post rain	4/2	N.D.	N.D.
	Post rain	4/23	N.D.	0.3 [c/]
Palo Alto				
Adobe Creek	Background	3/22	-	N.D.
	Post rain	4/2	N.D.	N.D.
	Post rain	4/23	N.D.	N.D.
Dry Creek	Background	3/22	-	N.D.
	Post rain	4/2	N.D.	N.D.
	Post rain	4/23	0.8	1.2

a/ Mean of replicated samples.

b/ N.D. = None detected.
Minimum detectable level = 3 ug/sample.

c/ This value, 0.3 ppb, is less than the minimum detectable level because it is the mean of two samples with carbaryl concentrations of 0.6 ppb and 0.0 ppb (none detected).

PROTOCOL FOR MONITORING OF THE 1983 GYPSY MOTH ERADICATION GROUND SPRAY PROGRAM

I. Objective

To monitor the environmental levels of the pesticides applied during the 1983 gypsy moth eradication program.

II. Personnel

The monitoring of the gypsy moth eradication ground spray program will be conducted by personnel in the Environmental Hazards Assessment Program (EHAP) under the overall supervision of Ronald J. Oshima. All inquiries regarding the progress and/or results of any facet of the monitoring program should be directed to Ron Oshima in Sacramento (phone 916-322-2395 or ATSS 492-2395).

Tom Mischke - Responsible for selection of sampling methodology, field storage and transport of collected samples, and liaison to CDFA Chemistry Laboratory Services. Questions concerning all aspects of the chemical analysis of collected samples should be directed to him (phone 916-322-2395 or ATSS 492-2395).

Monitoring in affected counties will be assigned to specific EHAP personnel. The following individuals will be responsible for liaison with state, county, and local officials involved with the local eradication program.

San Mateo Co. - Muffet Wilkerson

Alameda Co. - Joe Franz

Marin Co. - Roger Sava

Contra Costa Co. - Randy Segawa

Santa Clara Co. - Fran Zalkin

Los Angeles Co. - Dave Duncan

III. Study Timetable

Field monitoring will coincide with the implementation of the gypsy moth eradication efforts on an area by area basis. A single treatment will be monitored in each selected area to

insure that pesticide levels remain in the ranges previously documented in Santa Barbara, 1982.

IV. General Monitoring Plan

Monitoring will be implemented in each county but limited to 6 of the 9 infestation areas currently under consideration for the gypsy moth eradication ground spray program . Monitoring treatment areas within San Mateo, Alameda, Santa Clara, and Los Angeles counties will attempt to quantify the presence or absence of detectable pesticide concentrations in air and natural bodies of water. One private residence, whose property is being sprayed will be selected as a sample site within each treatment area.

Air will be sampled by high volume air samplers(HV). HV's utilizing an adsorbant resin bed and electronic flow controllers, will operate at a flow rate of 30 cubic feet per minute (CFM). Samples will be collected from outside the residence during each of the following periods: 6 hr. background, spray plus 1/2 hr., and for 6 hrs post spray. (4 x 2 x 3 = 24)

Monitoring in the two remaining counties is described in the Intensive Monitoring Section.

V. Sensitive Sites

a) Duplicate water samples will be drawn once from any exposed public drinking water reservoirs or treatment plants located within the treatment area prior to pesticide release and again immediately following pesticide release in the area.

b) Duplicate water samples will be drawn once from any stream or creek flowing through a treatment area. These will include a background sample downstream of the treatment area and post spray samples from downstream and upstream of the treatment areas.

c) Duplicate runoff samples will be drawn above and below the treatment area following the first significant rainfall. These samples will be collected from the streams, creeks and/or drainage systems draining the treatment area.

d) Duplicate water samples will be drawn from a maximum of two swimming pools chosen from within the treatment areas designated for intensive monitoring. Background and post spray periods will be sampled at each pool site.
(2 x 2 x 2 = 8 samples)

VI. Intensive Monitoring Areas
Area I.

Truck mounted mist blowers are under consideration for use in the gypsy moth eradication program. In the event that mist blowers are used within the Clayton eradication area, (Contra Costa Co.) more intensive monitoring will be done to define the environmental impact of this procedure.

a) A maximum of 14 high volume (HV) air samplers will be employed to characterize pesticide levels in air. Samples will be taken during the following periods: 6 hr background, spray plus 1/2 hr., and 6 hr. post spray.(max. 14 x 3 = 42)

b) At each of the above outside HV air sampler sites a 1 square foot plastic backed absorbant fallout card along with a 4"x5" Kromekote card will be employed to measure mass deposition and particle size respectively during the spray period. (max.12 samples).

e) Turf samples will be taken at one treatment property to quantify the concentration of pesticide deposition on grass. Two 1 square foot samples will be taken at each of the following times: background, immediately upon completion of a spray, 24 hours post spray, 72 hrs post spray, and 6 days post spray. (2x5= 10 samples).

f) Tree foliage - to determine pesticide levels over time on tree foliage, a host tree will be chosen at one treatment property immediately adjacent to the mist blower treatment area. Duplicate samples consisting of a minimum 20-30 leaves will be taken during each of the following periods: background, spray, and every other day up to the third spray. Additional samples will be taken on later dates if deemed necessary.(2 x 10 = 20)

g) Soil samples will be taken from the surface of the soil at one property adjacent to the treatment area to quantify the concentration of pesticide present. Duplicate samples will be collected at each of the following times: background, spray, 24 hrs post spray, 72 hours post spray, and 6 days post spray. (2x5= 10 samples).

Area II

Mist blowers are also under consideration for use in an area composed of rough terrain with a dense canopy located near Novato

(Marin Co.).

a) A maximum of 12 high volume (HV) air samplers will be employed to characterize pesticide concentrations in air. Samples will be taken during each of the following periods: 6 hr. background, spray plus 1/2 hr., and 6 hr. post spray.

VII. Tank samples will be collected during or following all monitored applications.

VIII. Handling and Storage of samples

All sampling media and containers will be prepared and pre-numbered at the California Department of Food and Agriculture Laboratories in Sacramento. Each device or container will be shipped to the sampling sites with an accompanying Chain of Custody Record. The Chain of Custody Record will be filled out by all parties handling or storing the sampling media or sample containers from the time they leave the Sacramento CDFA lab until they are returned to the lab for analysis. The Chain of Custody Record also contains an internal chain of custody record for use by the laboratory.

All samples will be collecteed by EHAP personnel, sealed in glass containers and stored in the following manner until and during transport to the CDFA laboratory in Sacramento.

On dry ice (-70C)
air samples
foliage samples
soil samples

On Ice (4C)
tank samples
water samples

IX Analysis of Samples

All samples will be analyzed by CDFA Chemistry Laboratory Services in Sacramento. Quality control duplicate samples will be analyzed by CDFA and another approved laboratory. Approximately ten percent of the total number of each type of sample collected will have duplicate analysis performed as part of the quality control program. Brief details of the analytical methods for each type of sample are available if requested.

Monitoring of the 1983 Gypsy Moth Eradication

Ground Spray Program in Six California Counties

January, 1983

E R R A T U M

Page 5 - The theoretical tank concentration should be 0.12% (wt/wt) instead of 0.125%.

The percentage of the theoretical tank concentration in field samples should be adjusted. The percentages should be 3% greater than those given on pages 8, 15, 24, 27, 30 and 33.

Pages 9, 25,28,31 and 34 - The carbaryl air concentrations listed in ppb are incorrect. For the correct air concentrations in ppb (vol/vol) multiply the corresponding concentration in $\mu g/m^3$ by 0.121.

STATE OF CALIFORNIA
DEPARTMENT OF FOOD
AND AGRICULTURE

CHAIN OF CUSTODY RECORD
(Use ball point pen only)

ENVIRON. MONITOR. & PEST MGMT.
ENVIRON. HAZARDS ASSESSMENT
1220 N STREET, ROOM A-149
SACRAMENTO, CA. 95814

Study #	Sample #	Date On: Mo	Day	Yr	Time On	Date Off: Mo	Day	Yr	Time Off	Person Collecting	Key Location: Area	Site	Key: Period	Spray	Key: Sample type
- - 1 9				8 3				8 3							
1 2 3 4	5 6 7 8	9 10	11 12	13 14	15 16 17 18	19 20	21 22	23 24	25 26 27 28	29 30	31 32 33	34 35	36	37	38 39 40

Replicate #	Companion #	pH		Carbaryl	Units		Chemist	Lab #	Sample status
41 42 43 44	45 46 47 48	49 50 51 52	53 54 55	56 57 58 59 60	61	62 63 64 65 66 67 68 69 70 71 72 73	74 75	76 77 78 79	80

Partner: Location:

Remarks, other chemicals, etc.

Lab Results: Save leaves

Carbaryl

Chemist: Date:

Relinquished for Lab by: (Signature)	Date/Time

Received by: (Signature)	Relinquished by: (Signature)	Date/Time
Received by: (Signature)	Relinquished by: (Signature)	Date/Time
Received by: (Signature)	Relinquished by: (Signature)	Date/Time
Received by: (Signature)	Relinquished by: (Signature)	Date/Time
Received for Laboratory by: (Signature)	Date/Time	Lab #

K E Y

Area:
- CA=Campbell
- CL=Clayton
- MP=Menlo Park
- NO=Novato
- PA=Palo Alto
- PL=Pleasanton
- SM=San Mateo
- WE=Westlake

Period:
- B=background
- S=spray
- P=post spray

Sample type:
- FAL=CDFA Fallout
- HIV=Hi-vol
- LEA=Leaves
- SOI=Soil
- TAN=Tank
- TUR=Turf
- UCD=UCD Fallout
- WAT=Water

Sample status:
- B=Bad
- S=special
- P=priority

Distribution: Original & One Copy Accompanies Shipment, copy to Coordinator Field Files.