



# Department of Pesticide Regulation



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## MEMORANDUM

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SUBJECT: PRELIMINARY RESULTS OF PESTICIDE ANALYSIS AND ACUTE TOXICITY TESTING OF MONTHLY SURFACE WATER MONITORING FOR THE RED IMPORTED FIRE ANT PROJECT IN ORANGE COUNTY, DECEMBER 2000 (STUDY 183)

### SUMMARY

During December 2000, surface water samples were collected from ten sites in Orange County, California. Water samples showed no detects of hydramethylnon, pyriproxyfen, dimethoate, and methidathion. Bifenthrin was detected at two commercial nursery sites from 0.127 to 0.139 parts per billion (ppb). Fenoxycarb was detected from one commercial nursery site at 0.414 ppb. Chlorpyrifos was detected in three samples ranging from 0.055 to 0.071 ppb. Toxicity was tested at San Diego Creek at Campus Drive, an integrated site. This site was significantly toxic (100% mortality) to *Ceriodaphnia dubia* in the water collected. At a nursery site, a filter strip planted with *Canna* has been added to the drainage to mitigate offsite movement of insecticides and nitrates. Bifenthrin and chlorpyrifos were detected in all samples with a general trend of declining concentrations as the water passed through the filter strip.

### SCOPE OF THIS MEMORANDUM

This memorandum reports results of water sampling conducted by the Department of Pesticide Regulation (DPR), under interagency agreement with the California Department of Food and Agriculture (CDFA), for the Red Imported Fire Ant (RIFA) control project. Data included here are from the December 5 and 6, 2000 monitoring, and encompass results from both chemical analyses and aquatic biotoxicity testing. This memorandum summarizes results for bifenthrin, fenoxycarb, hydramethylnon, pyriproxyfen, and five organophosphorus insecticides: chlorpyrifos, diazinon, dimethoate, malathion, and methidathion. Only bifenthrin, fenoxycarb, hydramethylnon, pyriproxyfen, and chlorpyrifos are used in the RIFA control program. The other four organophosphates are in our multiresidue analytical method and are included in this report to assist in the interpretation of the toxicity results. Acute toxicity results using



*Ceriodaphnia dubia* are also included. An in-depth interpretation of data is not included here, but will be provided in the final report when the 2000 pesticide use report becomes available.

Reports of the monthly surface water sampling events will continue through the conclusion of the study. This memo is the sixteenth in the monthly sampling series. You can request previous sampling results memos by calling the number above or you may view or download them from DPR's website at <[www.cdpr.ca.gov/docs/rifa](http://www.cdpr.ca.gov/docs/rifa)>.

## MATERIALS AND METHODS

### Sample and Data Collection

On December 5 and 6, 2000, surface water samples were collected at ten sites within the Orange County treatment area (Table 1 and Figure 1) including one rinse blank. Site G was sampled at the outflow of the vegetative filter strip (see mitigation sampling). Toxicity samples were collected at site E. This sampling event did not coincide with measurable rainfall.

Table 1. Sampling site descriptions in Orange County, California

Site #	Description	Coordinates
A	Bolsa Chica Channel at Westminster Ave.	N 33°45'35", W 118°02'36"
B	East Garden Grove Channel at Gothard St.	N 33°43'03", W 117°59'59"
C	Westcliff Park	N 33°37'24", W 117°54'02"
D	Bonita Creek at San Diego Creek	N 33°39'03", W 117°51'49"
E	San Diego Creek at Campus Dr.	N 33°39'18", W 117°50'44"
F	Hines at Weir	N 33°42'30", W 117°44'19"
G	El Modeno Gardens	N 33°42'43", W 117°44'16"
H	Marshburn Slough at Irvine Blvd.	N 33°41'45", W 117°44'02"
I	San Juan Creek at Stonehill Dr.	N 33°28'31", W 117°40'43"
J	Arroyo Trabuco at Oso Parkway	N 33°35'06", W 117°38'09"

All water samples were collected at center channel using a 10-liter stainless steel bucket and divided into one-liter amber sample bottles using a Geotech® 10-port splitter. Samples designated for organophosphate chemical analysis were preserved by acidification with 3N hydrochloric acid to a pH between 3.0 and 3.5. Because diazinon rapidly degrades under acidic conditions, it was analyzed from a separate, un-acidified sample. Samples designated for toxicity testing were delivered to the testing laboratory within 36 hours of collection. All samples were stored on wet ice or in a 4° C refrigerator until transported to the appropriate laboratory for analysis.

## **Mitigation Sampling**

In addition to the monthly surface water samples being collected at sites throughout Orange County, mitigation samples are being collected at el modeno Gardens (site G) from a concrete lined ditch approximately 160 yards long, three and a half feet deep, and four to six feet wide. The filter strip consists of six successive settling basins planted with *Canna x 'Tropicana'* with additional unplanted basins at either end. Water samples are collected at the inlet and outlet of the filter strip. Rodamine dye was added to water at the inflow of the filter strip immediately after sampling. The purpose of the dye is to ensure that the same parcel of water is sampled at the inflow and the outflow of the filter strip. Water at the outflow is then sampled just prior to the dye exiting the filter strip. During the December 5 and 6, 2000 sampling, water samples were taken once per day approximately twenty hours apart. At the time of this sampling *Canna* had been planted throughout the filter strip. On December 6, 2000 a settling pond installed before the water enters the filter strip was being cleaned out and rebuilt with very little water exiting the pond and entering the filter strip.

Water samples are collected and transported using the technique described previously.

## **Toxicity Tests**

Acute toxicity testing was conducted by the Department of Fish and Game (DFG) Aquatic Toxicity Laboratory following current U.S. Environmental Protection Agency (U.S. EPA) procedures using a cladoceran, *Ceriodaphnia dubia*, (U.S. EPA, 1993). Acute toxicity was determined using a 96-hour, static-renewal bioassay in undiluted sample water. Data were reported as percent mortality.

## **Environmental Measurements**

Water quality parameters measured *in situ* included temperature, pH, electrical conductivity (EC), and dissolved oxygen (DO). Water pH was measured using an IQ Scientific Instruments® (model IQ 150) pH meter. EC, water temperature, and DO were measured using an YSI® multi parameter meter (model 85). Additionally, the DFG Aquatic Toxicity Laboratory measured alkalinity, hardness, and ammonia on the samples to be tested for toxicity. Totals of alkalinity and hardness were measured with a Hach7 titration kit. Ammonia was determined using an Orion® 95-12 ammonia selective electrode attached to an Orion® specific ion meter (model 290A).

## **Insecticide Analyses**

All water samples were analyzed for bifenthrin, fenoxycarb, hydramethylnon, pyriproxyfen, chlorpyrifos, diazinon, dimethoate, malathion, and methidathion. The CDFCA Center for

Analytical Chemistry performed all analyses using gas chromatography and a flame photometric detector for the five organophosphorus insecticides; a high performance liquid chromatography and a ultra violet detector for fenoxycarb, hydramethylnon, and pyriproxyfen; and gas chromatography with an electron capture detector confirmed with a mass selective detector for bifenthrin. The reporting limit (reliable detection levels) for chlorpyrifos and diazinon is 0.04 ppb, 0.1 ppb for fenoxycarb and pyriproxyfen, 0.2 ppb for hydramethylnon, and 0.05 ppb for the other insecticides.

## **RESULTS and DISCUSSIONS**

### **Insecticide Concentrations**

Of the nine insecticides analyzed, only chlorpyrifos, bifenthrin, fenoxycarb, hydramethylnon, and pyriproxyfen were allowed use in nurseries for treatment of fire ants to comply with U.S. Department of Agriculture's quarantine requirements. All of the organophosphorus insecticides listed are registered for uses in commercial agriculture, nurseries, golf courses or parks for the control of other insect pests. Malathion, diazinon, and chlorpyrifos are widely available for homeowner use.

Table 2. Insecticide concentrations and acute toxicity in monthly surface water samples, December 2000, Orange County, California.

Site	Concentration in pbb									% Acute Mortality <sup>1</sup>
	bifenthrin	fenoxycarb	hydramethylnon	pyriproxyfen	chlorpyrifos	diazinon	dimethoate	malathion	methidathion	<i>C. dubia</i>
A	ND <sup>2</sup>	ND	ND	ND	ND	0.14	ND	ND	ND	NS <sup>3</sup>
B	ND	ND	ND	ND	ND	0.098	ND	ND	ND	NS
C	ND	ND	ND	ND	0.064	0.326	ND	0.106	ND	NS
D	ND	ND	ND	ND	ND	0.186	ND	ND	ND	NS
E	ND	ND	ND	ND	0.055	0.1	ND	ND	ND	100/0
F	0.139	ND	ND	ND	ND	ND	ND	ND	ND	NS
G	See Table 3.									NS
H	ND	0.41	ND	ND	ND	0.185	ND	1.01	ND	NS
I	ND	ND	ND	ND	ND	0.083	ND	ND	ND	NS
J	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS
RB	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS

<sup>1</sup> Two numbers are reported for each toxicity test. The first number is the result from the sample; the second from the corresponding control.

<sup>2</sup> ND = none detected at the reporting limit for that chemical.

<sup>3</sup> NS = not sampled

Table 3. Insecticide concentrations in mitigation samples, December 2000, Orange County, California.

Location	Concentration in ppb								
	bifenthrin	fenoxycarb	hydramethylnon	pyriproxyfen	chlorpyrifos	diazinon	dimethoate	malathion	methidathion
<u>Surface Water Samples</u>									
Filter strip inflow I <sup>1</sup>	0.142	ND <sup>2</sup>	ND	ND	0.214	0.077	ND	0.086	ND
Filter strip outflow I <sup>3</sup>	0.127	ND	ND	ND	0.071	0.075	ND	0.071	ND
Filter strip inflow II	0.111	ND	ND	ND	0.222	ND	ND	ND	ND
Filter strip outflow II <sup>3</sup>	0.57	ND	ND	ND	0.069	ND	ND	ND	ND

<sup>1</sup> Two sets of filter strip samples were taken; first set of data is from first sampling.

<sup>2</sup> ND = none detected at the reporting limit for that chemical.

<sup>3</sup> Sample site G.

### Toxicity Data

Toxicity samples were taken from one integrated site within the treatment area. Sample from site E was acutely toxic to *C. dubia* causing 100 % mortality (Table 2). Site E drains an integrated site and had detections of chlorpyrifos and diazinon below the LC<sub>50</sub>'s for *C. dubia* (Table 4).

Table 4. LC<sub>50</sub>'s of insecticides (ppb) for three aquatic species.<sup>1</sup>

Pesticide	Rainbow trout	<i>D. magna</i>	<i>C. dubia</i>
Bifenthrin	0.15	1.6	0.078 <sup>2</sup>
Chlorpyrifos	10	0.1	0.13 <sup>3</sup>
Diazinon	3200	0.96	0.51 <sup>4</sup>
Dimethoate	8500	2500	NA
Fenoxycarb	1600	400	NA
Hydramethylnon	160	1140	NA
Malathion	68	1.0	1.14 <sup>5</sup> - 2.12 <sup>6</sup>
Methidathion	10.5	7.2	2.2
Pyriproxyfen	>325	400	NA

<sup>1</sup> Data from CDPR, 2000.

<sup>2</sup> Data from CDFG, 2000.

<sup>3</sup> Data from Menconi and Paul, 1994

<sup>4</sup> Data from Menconi and Cox, 1994

<sup>5</sup> Data from Nelson and Roline, 1998

<sup>6</sup> Data from Ankley et al., 1991

### Environmental Measurements

Table 5 presents the data for DO, temperature, pH, and EC. Ammonia, alkalinity, and hardness are only reported for site E since these measurements are taken with the toxicity tests. The California Regional Water Quality Control Board, Water Quality Control Plan, Santa Ana River Basin (1995), and the Water Quality Control Plan, San Diego Basin (1994), list the following water quality guidelines as acceptable: water temperature no higher than 78°F (25.5°C), pH between 6.5 and 8.5, and DO above 5.0 mg/L. The Santa Ana River Basin plan determines ammonia levels to be dependent upon water temperature and pH, while the San Diego Basin plan states that ammonia levels shall not exceed 0.025 mg/L. The plans do not provide an acceptable range for EC, alkalinity, or hardness. The pH at sites C, F, and filter inflow II were above the maximum guideline.

Table 5. Water quality measurements at sampling sites, December 2000, Orange County, California.

Site	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Electroconductivity (µS/cm)	Ammonia mg/L	Alkalinity mg/L CaCO <sub>3</sub>	Hardness mg/L CaCO <sub>3</sub>
A	12.5	7.6	5.80	2289	NR	NR	NR
B	13.6	7.6	6.21	1516	NR	NR	NR
C	17.9	9.3	NT	565	NR	NR	NR
D	12.1	7.87	8.45	3302	NR	NR	NR
E	14.8	7.9	10.47	2992	0.17	280	772
F	16.0	8.6	12.0	1800	NR	NR	NR
G	17.3	7.9	9.51	2250	NR	NR	NR
H	14.6	7.9	9.04	1352	NR	NR	NR
I	19.3	8.1	11.77	2557	NR	NR	NR
J	16.1	7.7	8.67	960	NR	NR	NR
Filter strip inflow I	15.1	7.8	9.64	2260	NR	NR	NR
Filter strip outflow I	17.3	7.9	9.51	2250	NR	NR	NR
Filter strip inflow II	11.0	8.6	9.45	885	NR	NR	NR
Filter strip outflow II	13.4	7.7	9.20	1493	NR	NR	NR

NT= Not taken

NR= No reading available

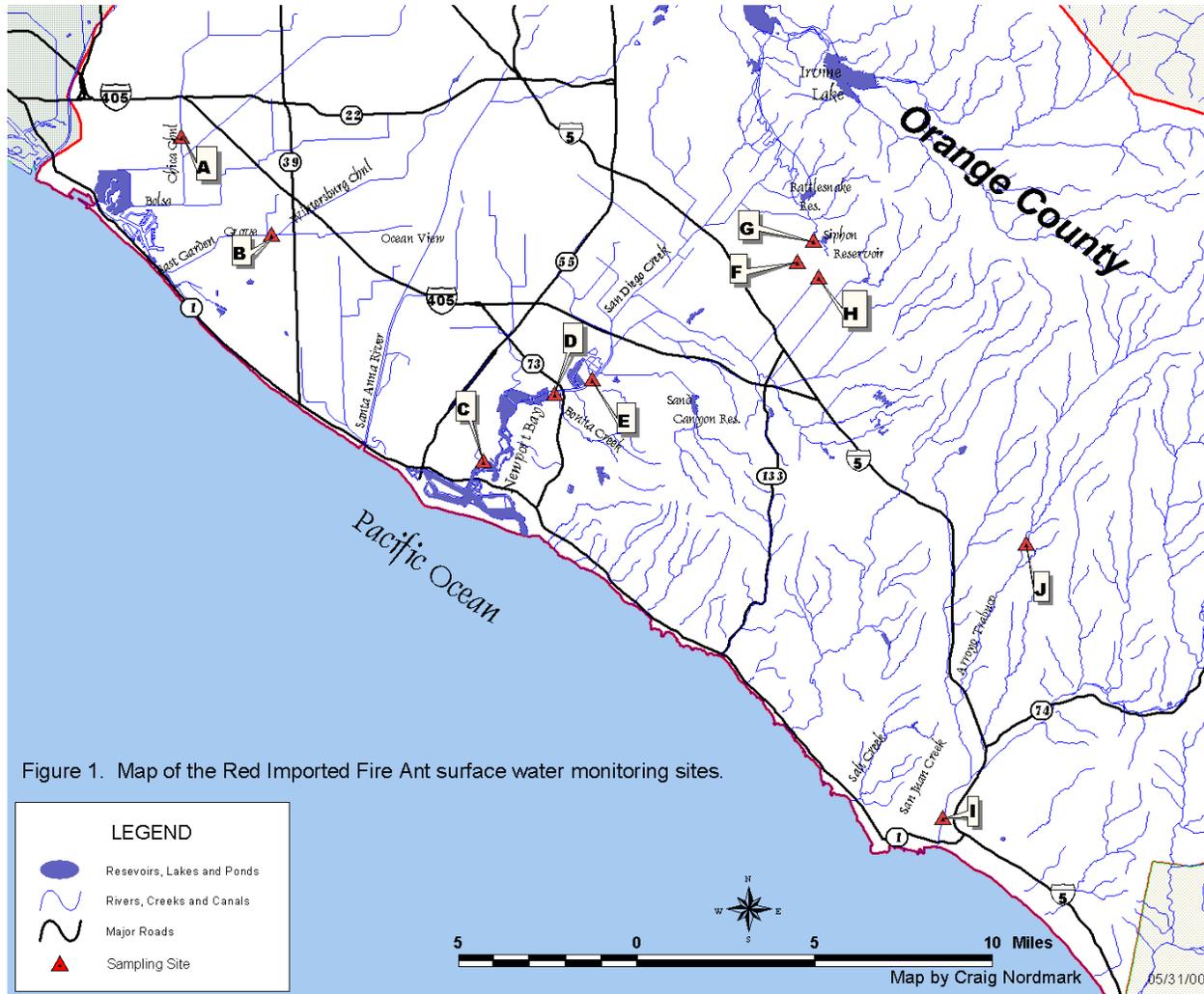


Figure 1. Map of the Red Imported Fire Ant surface water monitoring sites.

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