



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,
AUGUST 2000 (STUDY 183)

SUMMARY

During August 2000, surface water samples were collected from eight sites in Orange County, California. At one site a filter strip was added to the waterway as part of a mitigation study so samples were collected at the inflow and outflow to the filter strip. At the time of this sampling, plants had been planted in approximately one quarter of the filter strip. Samples showed no detects of fenoxycarb, hydramethylnon, pyriproxyfen, and chlorpyrifos. The following chemicals were detected in respective number of sites: diazinon (8), malathion (2), dimethoate (1), and fonofos (1). There were two detections of bifenthrin with concentrations of 0.283 and 0.238 parts per billion (ppb) at the inflow and outflow of the filter strip, respectively. Toxicity was tested at the San Diego Creek, an integrated site. This site was not significantly toxic to *Ceriodaphnia dubia* in the water collected.

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 August 1 and 2, 2000 monitoring, and encompass results from both chemical analyses and aquatic biotoxicity testing. This memorandum summarizes results for bifenthrin, fenoxycarb, hydramethylnon, pyriproxyfen, and eight organophosphorus insecticides: chlorpyrifos, diazinon, dimethoate, fonofos, malathion, methidathion, methyl parathion, and phosmet. Only bifenthrin, fenoxycarb, hydramethylnon, pyriproxyfen, and chlorpyrifos are used



in the RIFA control program. The other seven 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 twelfth 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>.

MATERIALS AND METHODS

Sample and Data Collection

On August 1 and 2, 2000, surface water samples were collected at eight sites within the Orange County treatment area (Table 1 and Figure 1) and one rinse blank. Sites F and H were not sampled because of insufficient water. G was sampled at two different points on the waterway. A 160-yard filter strip was added to the waterway as part of a mitigation study at a commercial nursery so samples were collected at the inflow (site G1) and outflow (site G2) to the filter strip. At the time of this sampling, *Canna x 'Tropicana'* plants had been planted in approximately one quarter of the filter strip. Toxicity samples were only 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	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 1-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.

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, fonofos, malathion, methidathion, methyl parathion, and phosmet. The CDFA Center for Analytical Chemistry performed all analysis using gas chromatography and a flame photometric detector for the eight 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

A total of ten samples were analyzed for the eight organophosphorus insecticides, bifenthrin and the three RIFA insecticide baits (Table 2). Diazinon was detected in seven samples and ranged from 0.07 to 0.263 ppb. Dimethoate and fonofos were detected in one sample each with concentrations of 0.12 and 0.21 ppb, respectively. Malathion was detected in two samples with concentrations of 0.059 and 0.075 ppb. There were no detections of fenoxycarb, hydramethylnon, pyriproxyfen, chlorpyrifos, methidathion, methyl parathion, or phosmet. Sites G1 and G2 that drains a commercial nursery had detections of bifenthrin, diazinon, and malathion. Detection of bifenthrin in site G2 (0.238 ppb), outflow of the buffer strip, was slightly less than from site G1 (0.283) the inflow. Samples collected at integrated site E, in a creek downstream from site G, showed a detection of diazinon and dimethoate. Sites C and D, which mainly drain urban areas, both had detections of diazinon; site C had an additional detection of fonofos. Of the twelve insecticides tested, 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 surface water samples, August 1 and 2, 2000, Orange County, California.

Site	bifenthrin	fenoxycarb	hydamethylnon	pyriproxyfen	chlorpyrifos	diazinon	dimethoate	fonofos	malathion	methidathion	m. parathion	phosmet	<i>C. dubia</i>	% Acute Mortality
A	ND ²	ND	ND	ND	ND	0.108	ND	ND	ND	ND	ND	ND	NS ³	
B	ND	ND	ND	ND	ND	0.263	ND	ND	ND	ND	ND	ND	NS	
C	ND	ND	ND	ND	ND	0.107	ND	0.21	ND	ND	ND	ND	NS	
D	ND	ND	ND	ND	ND	0.152	ND	ND	ND	ND	ND	ND	NS	
E	ND	ND	ND	ND	ND	0.162	0.12	ND	ND	ND	ND	ND	10/0	
F	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
G1	0.283	ND	ND	ND	ND	0.086	ND	ND	0.075	ND	ND	ND	NS	
G2	0.238	ND	ND	ND	ND	0.07	ND	ND	0.059	ND	ND	ND	NS	
H	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
I	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	
J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	
RB ⁴	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	

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

² ND = none detected at the reporting limit for that chemical.

³ NS = not sampled

⁴ RB= rinse blank

Toxicity Data

Toxicity samples were taken from one integrated site within the treatment area. Sample from site E was not significantly toxic to *C. dubia* causing 10 % mortality (Table 2). Site E drains an integrated site and had a detection of diazinon below the LC₅₀ for *C. dubia* (Table 3).

Table 3. LC₅₀'s of insecticides (ppb) for three aquatic species and U.S. EPA fresh water quality criteria.

Pesticide	Rainbow trout'	<i>D. magna</i> '	<i>C. dubia</i>	Fresh Water Quality Criteria (Acute)
Bifenthrin	0.15	0.16	NA ²	NA
Chlorpyrifos	3	1.7	0.13 ³	0.083 ⁴
Diazinon	2600	0.96	0.51 ⁵	0.090 ⁶
Dimethoate	6200	4700	NA	NA
Fenoxycarb	1600	400	NA	NA
Fonofos	50	1	NA	NA
Hydramethylnon	160	1140	NA	NA
Malathion	170	1.8	1.14 ⁷ - 2.12 ⁸	NA
Methidathion	10	3	2.2 ⁹	NA
Methyl parathion	2700	7.3	NA	NA
Phosmet	230	8.5	NA	NA
Pyriproxyfen	>325 ¹⁰	400 ¹¹	NA	NA

¹ Data from Tomlin, C.D.S., 1997

² NA= Not Available

³ Data from Menconi and Paul, 1994

⁴ Data from U.S. EPA, 1994

⁵ Data from Menconi and Cox, 1994

⁶ Proposed U.S. EPA data

⁷ Data from Nelson and Roline, 1998.

⁸ Data from Ankley et al., 1991

⁹ Data from Menconi and Siepmann, 1994

¹⁰ Data from Bowman, Jane H., 1989

¹¹ Data from Burgess, David, 1989

Environmental Measurements

Table 4 presents the data for DO, temperature, pH, and EC. Ammonia, alkalinity, and hardness are reported for site E only since these measurements are taken with the toxicity tests. Water temperature ranged from 22.7 to 33.8° C; DO ranged from 6.71 to 16.3 mg/L; pH ranged between 8.1 to 10.2; EC ranged from 890 to 3300 µS/cm; ammonia was 0.06 mg/L NH₃; alkalinity was 180 mg/L CaCO₃; and hardness was 650 mg/L CaCO₃. 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: DO above 5.0 mg/L, pH between 6.5 and 8.5, and water temperature no higher than 78°F (25.5°C). 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

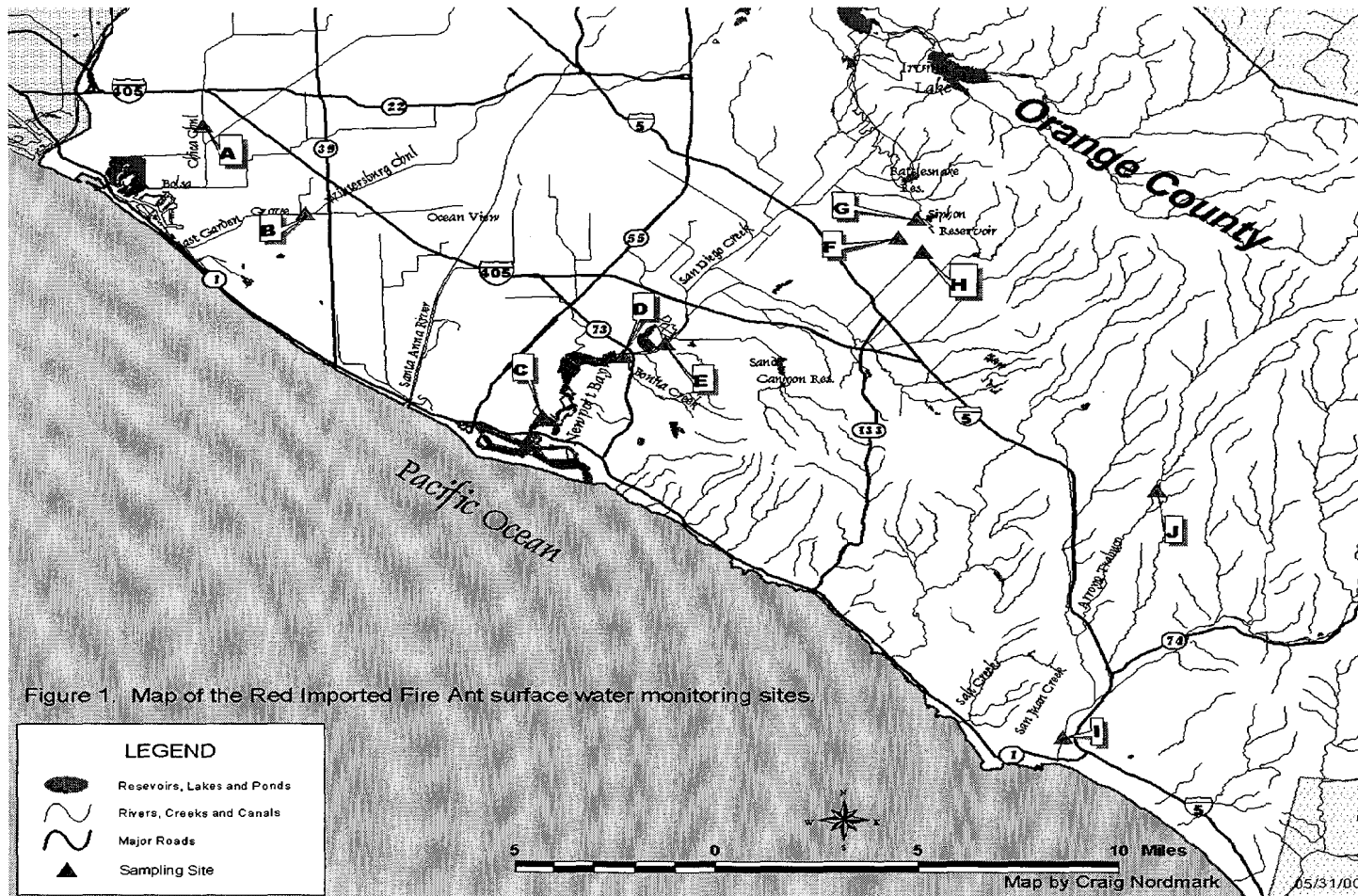
levels shall not exceed 0.025 mg/L. The plans do not provide an acceptable range for EC, alkalinity, or hardness. The pH at sites A, B, C, and E were above the maximum guideline as were the water temperatures at sites A, B, C, and E.

Table 4. Water quality measurements at sampling sites, August 2000, Orange County, California.

Site	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Electroconductivity (µS/cm)	Ammonia mg/L	Alkalinity mg/L CaCO ₃	Hardness mg/L CaCO ₃
A	27.8	8.7	13.8	2099	NR	NR	NR
B	26.7	8.7	13.9	1180	NR	NR	NR
C	33.8	10.2	14.37	890	NR	NR	NR
D	22.1	8.3	6.71	3300	NR	NR	NR
E	27.6	8.6	16.3	2878	0.06	780	650
F	NS	NS	NS	NS	NS	NS	NS
G1	23.2	8.3	NS	2300	NR	NR	NR
G2	24.9	8.2	7.21	2312	NR	NR	NR
H	NS	NS	NS	NS	NS	NS	NS
I	25.3	8.4	16.3	2878	NR	NR	NR
J	22.7	8.1	9.22	945	NR	NR	NR

NS= Not taken, no water in the drain.

NR= No reading available



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John Sanders
October 5, 2000
Page 10

Precipitation data obtained from The University of California Statewide Integrated Pest Management Project, California Weather Databases. www.ipm.ucdavis.edu/WEATHER/