Occurrence of Aquatic Toxicity and Dormant-Spray Pesticide Detections in the Sacramento River Watershed, Winter 1996-97

BY

C.E. Nordmark, K.P. Bennett, H. Feng, J. Hernandez, and P. Lee

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Environmental Protection Agency
Department of Pesticide Regulation
Environmental Monitoring and Pest Management Branch
Environmental Hazards Assessment Program
1020 N Street, Sacramento, California 958143624

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EXECUTIVE SUMMARY
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BACKGROUND

In the past, winter surveys conducted by the Regional Water Quality Control Board (RWQCB) and the U.S. Geological Survey found dormant spray residues in the Sacramento River watershed. Dormant sprays include organophosphate pesticides that are sprayed on dormant fruit and nut trees to control overwintering pests. State and federal laws prohibit discharge of substances that make rivers toxic because the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters are a primary goal. The State Water Quality Control Board and the RWQCBs have established a narrative water quality objective designed to prevent aquatic toxicity. If the objective is exceeded the Department of Pesticide Regulation (DPR) may need to impose restrictions on the use of dormant sprays. Consequently, DPR established the Dormant Spray Water Quality Program.

Through its Dormant Spray Water Quality Program, DPR seeks to prevent aquatic toxicity from residues of organophosphate pesticides (primarily diazinon, chlorpyrifos [Lorsban] and methidathion [Supracide]) in the Sacramento and San Joaquin Rivers. Monitoring data gathered by DPR will verify compliance with water quality standards.

PURPOSE

DPR's dormant spray pesticide study was developed to identify the levels of dormant spray residues present in the Sacramento River watershed, and their relationship to the water quality objective for toxicity.

STUDY METHODS

Sacramento River watershed samples were collected to determine both the acute and chronic toxicity of the water to the water flea *Ceriodaphnia dubia (C. dubia).* Acute toxicity monitoring was done along the Sutter Bypass at Karnak Pumping Station or the alternate Kirkville Road site; chronic toxicity monitoring was performed on the right bank of the Sacramento River at the water intake for the West Sacramento Water Treatment Plant at Bryte. Acute toxicity tests were performed twice per week; chronic testing was conducted weekly.

Background sampling for dormant spray residues was conducted during the week of December 2, 1996, before the start of the dormant spray season. Sampling continued through March 7, 1997, when no additional dormant spray applications were reported.

In addition to toxicity tests, surface water samples were analyzed for chlorpyrifos, diazinon, dimethoate (Cygon), fonofos, malathion, methidathion, methyl parathion, phosmet, carbaryl and carbofuran. These pesticides were chosen for analysis based upon historical records which indicated they had been used during the dormant spray season in the Central Valley study area, previous detections in the watershed, and the availability of analytical methods. Pesticide analysis of water samples was performed by the California Department of Food and Agriculture Center for Analytical Chemistry.

Acute toxicity testing was conducted by the Department of Fish and Game's (DFG) Aquatic Toxicity Lab following current U.S. Environmental Protection Agency (U.S. EPA) procedures using *C. dubia.* Acute toxicity was determined using a 96-hour bioassay of undiluted sample water. Chronic toxicity was determined using a 7-day bioassay of undiluted sample water with C. *dubia* and followed current U.S. EPA guidelines.

RESULTS

The results of this monitoring program include environmental measurements, pesticide use information, pesticide detections in surface water, pesticide transport information, and aquatic toxicity. Interpretation of the results presented in this study should include consideration of events which marked this as an unusual winter spray season: diversion of flows from the

Sacramento River, Sutter Bypass and Feather River into the Yolo Bypass, severe flooding, and a large levee break along the Sutter Bypass in late January.

During January and February of 1997, 52,500 pounds of diazinon and 35,700 pounds of methidathion were applied to the study area. This represents a 32 percent decrease in the use of diazinon and a 27 percent decrease in the use of methidathion over the previous two years. Because dormant sprays are generally applied by ground rigs in clear weather, this decrease was attributable to ground saturation and inclement weather which prohibited growers from entering their orchards to manage overwintering pests.

Sutter Bypass--Acute Toxicity Monitoring Sites

Diazinon was detected in seven of the 16 samples collected at the Sutter Bypass sites. Detected concentrations ranged from 0.040 to 0.086 micrograms per liter (ug/L). Methidathion was detected in one out of 16 samples at a level of 0.071 ug/L.

Acute toxicity tests on water collected from the Sutter Bypass site revealed there was no significant acute toxicity in any of the samples. Percent survival of the C. *dubia* test animals ranged from 85 to 100 percent survival in the collected water; corresponding control survival ranged from 90-100 percent. Pesticides were not detected in the sample with the lowest percent survival.

Sacramento River--Chronic Toxicity Monitoring Site

Diazinon was detected in four of the 24 samples collected from the Sacramento River at Bryte. Detected concentrations ranged from 0.061 to 0.065 ug/L. Methidathion was detected in one out of 24 samples at 0.056 ug/L.

No chronic toxicity was reported in any of the samples collected at Bryte. No chronic toxicity sample or control had less than 90 percent survival.

General Results

Diazinon was detected in 11 out of 40 samples taken from the Bryte and Sutter Bypass sites; none of the sample detections exceeded 0.086 ug/L.

Diazinon detections can be broken into two distinct pulses, one in late January and one in late February. The initial diazinon detections appear to be related to storm runoff episodes. Diazinon was the most heavily used and frequently detected pesticide.

The estimated mass of diazinon transported through the Sutter Bypass was 127 pounds. Diazinon loading in the Sacramento River was estimated to be 202 pounds for the period January 23 to February 1. Methidathion mass loading was calculated from a single detection on January 27; methidathion loading in the Sutter bypass and the Sacramento River was estimated to be 58 and 42 pounds, respectively.

CONCLUSIONS

During the winter of 1996-97, the waters of the Sutter Bypass and the Sacramento River at Bryte were non-toxic to the water flea C. *dubia.* Diazinon and methidathion, the two major dormant spray pesticides used in the study area, were detected at concentrations lower than those found in previous studies. This reduction is believed to be the result of two conditions which made this season exceptional: the unusually heavy rains and rapid snow melt which elevated discharge from the Sacramento River watershed and diluted pesticide residues, and the ground saturation in the study area which made it difficult for farmers to access fields and thus reduced the amount of dormant spray pesticides applied. Mass loading is possibly understated because unusually high river levels probably diluted pesticide residues to a point below detection.

DPR's approach to addressing dormant spray water quality was to establish a Dormant Spray Water Quality Program. Through this program, DPR seeks to prevent aquatic toxicity by relying on growers to adopt voluntary practices which reduce the movement of dormant spray pesticides to surface water. Adjustments to mixing and loading practices, application techniques, orchard floor management, and other integrated pest management practices can reduce the impact of dormant sprays.

DPR will evaluate the success of the voluntary efforts toward achieving water quality compliance by using standard toxicity tests. DPR may impose regulatory measures at any time, depending upon the assessment of the monitoring results. As long as

progress continues toward compliance with the water quality standard, regulations will be unnecessary.

A thorough evaluation of the Dormant Spray Water Quality Program will occur within the next five years. If the evaluation concludes that aquatic toxicity from dormant sprays is an ongoing problem, DPR will impose regulatory controls to reduce dormant spray residues to acceptable levels.

Branch Chief

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Date