

# **RICE PESTICIDES MONITORING IN THE SACRAMENTO VALLEY, 1995**

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**ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM**

**STATE OF CALIFORNIA  
Environmental Protection Agency  
Department of Pesticide Regulation  
Environmental Monitoring and Pest Management Branch  
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## EXECUTIVE SUMMARY

### **“Rice Pesticides Monitoring in the Sacramento Valley, 1995”**

Environmental Monitoring and Pest Management Branch  
Department of Pesticide Regulation

#### **PURPOSE**

California is one of the largest rice producers in the United States and has consistently maintained the highest yield per hectare in the nation. Critical to this high yield in rice production is the use of pesticides to control weeds and insect damage. Of the pesticides used in rice production, the herbicides molinate and thiobencarb and the insecticides carbofuran, methyl parathion, and malathion are regularly used in the Sacramento Valley. Because the major agricultural drains in the Sacramento Valley's rice-producing regions are tributaries of the Sacramento River and these pesticides have a potential to cause aquatic toxicity, their use in rice production is of concern.

In response to fish kills that occurred in the late 1970's and early 1980's a monitoring program of rice discharge water was developed. Since 1980, various sites have been evaluated annually for the presence of pesticides used in rice production. In 1990, the Central Valley Regional Water Quality Control Board (CVRWQCB) and the Department of Pesticide Regulation (DPR) established performance goals for the two herbicides and three insecticides used in rice production. Performance goals are target concentrations developed to protect the beneficial uses of surface water in the state from rice pesticide contamination and provide a level by which compliance with a monitoring program could be measured. Data from the annual monitoring program is used to verify compliance with performance goals and to identify any need for programmatic changes to future monitoring efforts.

#### **STUDY METHOD**

The monitoring program documented in this report measured concentrations of molinate, thiobencarb, carbofuran, methyl parathion, and malathion. In addition, basic water quality parameters and discharge were recorded. Sampling was

conducted at four sites, one on the Colusa Basin Drain, one on Butte Slough, and two downstream on the Sacramento River. The sampling sites on the Colusa Basin Drain and Butte Slough are in immediate proximity to Sacramento's rice growing region. The sampling was conducted by several entities. The Colusa Basin Drain was sampled by the Department of Pesticide Regulation (DPR), Butte Slough and the Sacramento River at Village Marina by the California Rice Industry Association (CRIA), and Sacramento's Raw Water Intake on the Sacramento River by the City of Sacramento. Additionally, acute toxicity tests were performed by the California Department of Fish and Game (DFG) on samples collected from the Colusa Basin Drain. Data were used to verify compliance with performance goals and narrative toxicity objectives, and to identify the need for any programmatic changes to future monitoring efforts.

## RESULTS

The results of this monitoring program are reported in the following areas: environmental measurements, pesticide concentrations, pesticide mass transport, and aquatic toxicity. Basic environmental parameters were measured *in situ* and examined in a historical context. Pesticide mass transport (concentration x discharge volume) was estimated for those pesticides detected in the Sacramento River and compared to similar data from previous years. Toxicity test results were examined with respect to pesticide residues present in these samples.

### Environmental Measurements:

The CVRWQCB has set the water quality criteria for pH as a range of values from 6.5 to 8.5. Measured pH values at Butte Slough and from the Sacramento River at Village Marina were atypically low on a number of sampling dates. The cause of the low measurements is unclear, but additional attention should be given to pH measurements at these sites during future monitoring programs to identify any potential trend towards more acidic conditions.

Dissolved oxygen (DO) fell below the criterion for fish spawning habitat of 7.0 milligram (mg) per liter (L) on 9 of 20 occasions at the Colusa Basin Drain, 14 of 15 occasions at Butte Slough and the Sacramento River at Village Marina. There was variability in the DO measurements and discrepancy in the data between this year's monitoring and 1993. To address this issue different DO equipment is recommended during future monitoring programs.

### Pesticide Concentrations:

The Colusa Basin Drain sampling resulted in the following detections: molinate ranging from 2.8 to 25 microgram (ug) per liter (L) which exceeded the performance goal of 10 ug/L, 9 of 20 occasions (45%); thiobencarb ranging from 0 to 3.5 ug/L which exceeded the performance goal of 1.5 ug/L, 4 of 20 occasions (20%); carbofuran ranging from 0.39 to 0.70 ug/L which exceeded the performance goal of 0.40 ug/L, 5 of 20 occasions (25%); methyl parathion with three detections all below the performance goal of 0.13 ug/L; and malathion with two detections below the performance goal of 0.10 ug/L.

Butte Slough sampling resulted in the following detections: molinate ranging from 2.1 to 8.5 ug/L which is below the performance goal of 10 ug/L; thiobencarb with two detections below the performance goal of 1.5 ug/L; carbofuran with four detections ranging from 0.37 to 0.57 ug/L one of which exceeded the performance goal of 0.4 ug/L, 2 of 16 occasions (16%); methyl parathion with one detection of 0.19 ug/L which exceeded the performance goal of 0.13 ug/L; and malathion with one detection of 0.64 ug/L which exceeded the performance goal of 0.10 ug/L.

The Sacramento River at Village Marina sampling resulted in no detections of pesticides. The Sacramento River at the Raw Water Intake sampling resulted in the following detections; molinate with two detections of 0.12 ug/L and 0.16 ug/L which are both below the performance goal of 10 ug/L.

### Pesticide Mass Transport

To calculate the mass transport of pesticide in the Sacramento River, the pesticide concentration at a specific site is multiplied by the discharge at that site, summed over the monitoring period, and compared to monitoring programs from previous years. This method therefore takes into account variability in concentrations and discharge from year to year. Based on the two molinate detections at the Sacramento River Raw Water Intake site and their concentrations, the molinate transported in the Sacramento River during the 1995 monitoring period was 231 kilograms (kg).

In comparison, the mass of molinate transported was 109 kg in 1994 and 2,007 kg in 1993. Prior to 1991, molinate mass was consistently above 2,000 kg. No thiobencarb has been detected in the River since 1990. These data illustrate a marked decrease in rice herbicide mass transport in the Sacramento River.

### Aquatic Toxicity:

Another method for evaluating the success of the rice program is the use of aquatic toxicity test results. Toxicity tests were performed on one sample per week from the Colusa Basin Drain during the first seven weeks of the monitoring period, which corresponded to high water discharges from rice fields. These tests used bioassays (96-hour exposure tests) performed with *Ceriodaphnia dubia* in accordance with U.S. Environmental Protection Agency guidelines.

It was determined that significant mortality occurred in one sample, collected on May 30. Of the five rice pesticides analyzed in the May 30 sample, only molinate and thiobencarb were detected. It was determined that the levels of the pesticides detected were not at a concentration to cause the toxicity found in the sample. Water quality data did not indicate any specific situation that could be considered harmful to the test organism. Consequently, a definitive conclusion on the source of the toxicity can not be drawn with the available data.


### CONCLUSIONS

Environmental parameters (pH and DO) measured at the western Sacramento Valley monitoring site, Colusa Basin Drain, were consistent with measurements from prior years. The same parameters measured at the eastern Valley monitoring site, Butte Slough, and the Sacramento River at Village Marina, were not typical and consistently fell outside the State's water quality criteria. The cause of the resultant atypical values remains undetermined but may have been the result of equipment malfunction. It was recommended to the California Rice Industry Association that different equipment be used and that additional attention be paid to future water quality measurements at those sites.

Pesticides used in the production of rice were detected in both the Colusa Basin Drain and Butte Slough. Possible sources of contamination are thought to include: legal, scheduled releases of water from rice fields; legal emergency releases of water from the rice fields to prevent damage to the crop; and potentially illegal releases of rice water not approved by the county agricultural commissioners; illegal aerial drift of pesticides from applications; and seepage through levees surrounding rice fields. Herbicide residues measured in water from the western Sacramento Valley were detected throughout the monitoring period at levels exceeding performance goals. Specifically, molinate and thiobencarb exceeded their performance goals in 45 and 20 percent of the samples collected,

respectively. Carbofuran detections exceeded the performance goal in 25 percent of the samples collected. No pesticides were detected in the Sacramento River at Village Marina and two molinate detections were found in samples from the Sacramento River Raw Water Intake.

Acute aquatic toxicity occurred in one of eight samples collected at the Colusa Basin Drain during the monitoring period. The toxic event did not appear to be attributable to any of the five rice pesticides, however, no final determination could be made because of lacking toxicological data. In general, rice pesticide residues from the west Valley were higher in concentration and more persistent than those from the east Valley or the Sacramento River. It is difficult to predict from year to year what pesticide levels will be found in the waterways of the Sacramento Valley due to factors mentioned above. Therefore, continued yearly monitoring is recommended during the rice growing season to verify compliance with narrative toxicity criteria and numerical performance goals.

Approved:  Date: 2-28-98  
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