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Document Title: Study 187 Protocol: Evaluation and Prevention of Offsite Movement of Hexazinone and Diuron From An Alfalfa Field

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# Study 187: Evaluation and Prevention of Offsite Movement of Hexazinone and Diuron From An Alfalfa Field

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## I. Introduction

Residues of the pre-emergent herbicides, hexazinone and diuron, have been detected in ground water sampled at two sites near the city of Tracy, CA. The dominant agriculture in this area is forage and row crops with alfalfa grown in rotation with corn and beans. Hexazinone is used only on alfalfa whereas diuron is used on alfalfa and for other agricultural uses. Applications of both herbicides are made in the dormant season in December and January to control existing winter weeds and to prevent subsequent weed germination. The detection sites were in close proximity (within one-quarter mile) of commercial alfalfa stands.

Upon inspection of the area, we determined that one potential pathway for residue movement to ground water is the use of holding ponds. Runoff from rainfall and irrigation is collected in large basins or holding ponds located at the end of each field unit. Because the application timing of pre-emergent herbicides corresponds to typical rainfall events, there is a high potential for herbicide offsite movement to the ponds in runoff. The collected water is then available for evaporation, percolation, or reuse during the current or subsequent irrigation event using an irrigation return system. These basins may be deep enough to expose the standing water table below and act as a direct conduit for pesticides to reach ground water aquifers.

In addition, the soils are vertisols which are cracking clay soils. Visual inspection of the dried soils indicated large contiguous cracks which could also serve as a conduit to ground water within the field.

II. Objectives

1. Measure the mass distribution of hexazinone and diuron in the field soil and vegetation, the runoff water, and in the sediment and water in the holding pond.
2. Evaluate the effect of a surfactant on the offsite movement of hexazinone and diuron.

III. Personnel

This project is a cooperative effort between the California Department of Pesticide Regulation (DPR) and the University of California (UC). The responsibility for site preparation and sampling will be shared between personnel from both of these organizations. Study personnel from the Environmental Hazards Assessment Program in the Environmental Monitoring and Pest Management Branch of the DPR include:

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| Project Leader: | John Troiano |
| Field Coordinator: | Joe Marade |
| Senior Scientist: | Frank Spurlock |
| Chemist: | Center for Analytical Chemistry, CDFA |
| Agency/Public Contact: | Mark Pepple |

Questions concerning this monitoring program should be directed to Mark Pepple at (916) 324-4086 and FAX (916) 324-4088.

IV. Study Plan

This study will be conducted in an alfalfa field located near Tracy, California. A random complete block design will be utilized.

Treatments will be tested with the following formulations and rates:

| | Pounds a.i. / acre |
|---|---|
| Hexazinone/diuron | 0.5 lbs and 1.5 lbs respectively |
| Hexazinone/diuron/spray adjuvant | 0.5 lbs and 1.5 lbs and adjuvant |

Each application will be applied to an alfalfa check having an approximate dimension of 26 feet by 1100 feet and each treatment will be replicated in four alfalfa checks. Each of the alfalfa checks will be equally subdivided into thirds (approximately 26 feet by 366 feet) and represent the upper (head), middle, and lower (tail) sample area of the alfalfa check. The end of the check located closest to the irrigation water source will be identified as the head of the check.

V. Media Sampled and Itinerary

A. Kimbie sheets (one square foot in area) will be placed on the soil surface and collected immediately after each application to document the deposition of pesticide on each alfalfa field check. Each sheet will be mounted on a piece of cardboard to prevent direct contact with the soil surface. A kimbie sheet will be placed in each third (upper, middle, and lower sample area) of the four replicated checks to measure deposition.

B. Soil and sediment samples will be collected before the application and post-application after the first two winter rainfall events and again after the first irrigation.

Each check will be divided into thirds as described above and labeled the upper, middle, and lower sample areas. Within each sample area, a soil sample will be collected at each of five different depths measured from the soil surface. These five depths are 0-3 inches, 5-7 inches, 11-13 inches, 23-25 inches, and 35-37 inches. Each sample will be a composite of three cores collected at the same depth increment along a 45° transect running ten feet in length. These samples will be collected within the upper, middle, and lower sample area for each of the four replicate checks.

In addition, soil samples will be taken from the end of the field check where water is collected and conveyed to the holding pond. Samples will also be collected from the bottom of the holding pond and partitioned into sediment and soil as appropriate. These samples will be collected in the same fashion described above for the checks.

The 0-3 inch soil sample will be collected and composited from the three cores. Then, for each corresponding segment layer, a 2-inch diameter auger bit will be used to extract soil to the appropriate depth for the sample. A smaller diameter fixed volume sampling bit, calibrated at 60 cubic centimeters is then pressed into the center of the sample area and soil is extracted to the targeted depth. The bit containing the soil is withdrawn from the hole and cutting knives are inserted to obtain the 60 cc sample.

The soil-sampling bit will be cleaned between each sample with soapy water and rinsed twice sequentially with deionized water and methanol. The bit will be air

dried before it is reused. The excess soil removed from the bit will be collected in a bucket and removed from the field. Non-contaminated soil will be used to refill the sample hole. The sample hole will be plugged at the surface with a mixture of soil and bentonite. The sample hole will be identified with a flag not made of metal wire to prevent damage to any harvesting equipment during or after the completion of the project.

The three subsamples will be placed directly into a glass jar, mixed, and then the jar lid will be sealed. The samples will be placed on dry ice until arrival at a storage facility and will remain frozen until analysis. The jar will be labeled with a unique study number and accompanied with a chain of custody.

At the time of analysis, portion of each soil sample will be used to determine percent moisture for soil sample.

Bulk density will be calculated based upon the percent moisture and the known volume of soil for each soil sample.

C. Vegetation samples may need to be taken as part of the mass balance if there is an appreciable amount of growth during the dormant period. Pre-application samples will be collected for background information. The alfalfa plants will be collected from an area encompassing each of the soil sampling areas. Additional samples will be collected post application after the first two winter rainfall events and after the first irrigation if necessary.

   The vegetation will be placed directly into a glass jar and then the jar lid will be closed tightly.The samples will be placed on wet ice until arrival at a storage facility and will remain at 38° F until analysis. Each jar will be labeled with a unique study number and accompanied with a chain of custody.

D. Water analyses will involve collection of pond water and runoff water samples. These samples will be collected before the application and post-application after the first two winter rainfall events and after the first irrigation.

1. Pond Water Sampling

Ceramic suction devices will be attached to a two-inch diameter ridged copper pipe placed upright into the center of the pond. The ceramic suction cups will be used to collect water from soil beneath the pond down to the ground water depth and water from the pond above the sediment. The pipe with cups attached was pounded into the soft soil/sediment in the pond so that the deepest cup was located just above the ground water level. This resulted in having a number of cups located in the soil profile and the remainder located above the soil and exposed to water in the pond. The cup located highest on the pipe was located level with the top of the pond berm. Each suction cup will have an independent delivery line attached to it. A vacuum pump will be used to suck water thru the line. The water will be absorbed thru the ceramic cup, transported through the delivery line , and then collected into a one-liter bottle. The delivery line will be evacuated before each sample is collected.

Background soil samples will be collected from the bottom of the pond prior to the installation of the suction devices. These samples will be collected all the way down to the depth of the ground water.

2. Runoff Collection

Two of the four replicates of each treatment will be monitored for runoff. A soil berm will be formed at the tail end of those checks to facilitate runoff collection. A collection basin (a five-gallon plastic bucket) will be installed at the lowest point inside the bermed check. A battery powered pump and float switch placed in the collection basin will move runoff water into a 1-gallon sample collection jar. Once the jar is full, the remaining water will be pumped through a water meter and then through a proportional sampling device which collects two percent of the outflow volume in a 5-gallon sampling bucket. A one-liter subsample will be collected from the 5-gallon container. This subsample represents the average concentration of hexazinone and diuron residues moving offsite for the volume indicated by the water meter.

Pond and runoff water samples will be collected into 1-liter amber glass bottles and then sealed with a Teflon®-lined cap. The water samples will be placed on wet ice until arrival at a storage facility and will remain at 38° F until analysis.

Each jar will be labeled with a unique study number and accompanied with a chain of custody.

## VI. Sampling Schedule and Number of Samples to be Collected For Each Medium

| Time/Media | Kimbies | Field Soil | Pond Sediment | Percent Moisture | Vegetation | Runoff Water | Pond Water |
|---|---|---|---|---|---|---|---|
| Background | X | 150 | 15 | 165 | 30 | X | 4 |
| Application Day | 28 | X | X | X | X | X | X |
| Post Rainfall 1 | X | 150 | 15 | 165 | 30 | TBD | TBD |
| Post Rainfall 2 | X | 150 | 15 | 165 | 30 | TBD | TBD |
| Post Irrigation | X | 150 | 15 | 165 | 30 | TBD | TBD |
| Total | 28 | 600 | 60 | 660 | 120 | TBD | TBD |

Notes: X = No samples are scheduled to be collected at this time.
TBD = To be determined.

## VII. Chemical Analysis and Quality Control

The selected laboratories will develop and validate a method for analyzing kimbie sheet, soil, sediment, vegetation, and water samples for hexazinone and diuron. The analytical method must be approved by DPR.

The analytical quality control program will include the following: A solvent blank and two matrix spikes will be analyzed with each extraction set. Results of matrix spikes must fall within established warning and control limits currently established. This study will be done in accordance with EHAP SOP QAQC001.001 (Attached).

### Data Analysis

Data collected will include (1) estimated total runoff volume from each plot, (2) estimated hexazinone, diuron, trifluralin, paraquat, and spray adjuvant concentrations detected in soil, pond water, runoff water, and sediment samples. Together these data will provide a measurement of the distribution of the pesticides on the field during the course of the study and the amount of these pesticides that move off the plots in runoff. Statistical methods such as ANOVA will be used to compare the effect of surfactant on treatment means of total hexazinone mass and total diuron mass moved offsite in runoff water.

Timetable

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|---|---|
| Sample Collection: | November 1999 – June 2000 |
| Herbicide Analysis: | January 2000 – July 2000 |
| Data Analysis: | February 2000 – August 2000 |
| Final Report: | October 2000 |