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The Resources Agency
Department of Water Resources

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THE FATE OF PESTICIDES APPLIED TO IRRIGATED AGRICULTURAL LAND

BIO-ENGINEERING ASPECTS OF AGRICULTURAL DRAINAGE

MAY 1968

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FOREWORD

For aeons man has known how to irrigate his lands to increase productivity. However, he did not recognize the need for drainage until recently. Without proper drainage, hundreds of thousands of acres of once fertile land have been forced out of production.

In 1957, the State Legislature authorized the San Joaquin Valley Drainage Investigation to solve the drainage problems of the Valley. This investigation marked the first attempt by the State to solve the complex problem of agricultural drainage on a basin-wide scale.

Several phases of the Drainage Investigation, primarily those being conducted by the Quality and Treatment Unit, are of such a nature that they merit separate publication. The results of these studies will, of course, be included in the final report of the Investigation. Details of the studies, however, are important enough to be published for distribution to other organizations and interested individuals. This bulletin is the first of a series intended to serve this purpose. Bulletins to be released in the future, as part of this series, will cover subjects such as: analyses of data pertaining to the quality of agricultural waste water treatment, studies of the ecology of several microsystems, and analyses of time-series data.

The fate of pesticides applied to irrigated agricultural land was selected as the subject for the first bulletin of the series because of the extreme concern that pesticide use in the San Joaquin Valley is causing a critical degradation of the environment. Hopefully, the conclusions presented in this report will do much to reduce this concern.

William R. Gianelli

William R. Gianelli, Director
Department of Water Resources
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April 16, 1968

ABSTRACT

The results of the first two years of a continuing study of the fate of pesticides applied to irrigated agricultural land are presented. The work was conducted on a 110-acre test plot in western Fresno County. The soil of the plot is Lethent silty clay loam, strong alkali.

By applying DDT and Lindane to one of three blocks in the plot, and measuring the chlorinated hydrocarbon pesticide content in and the quantities of the applied water, tailwater (surface runoff), tile drain effluent and soil, it was concluded that (1) the pesticide content of subsurface tile drainage effluent is not significantly greater than that of the applied water when pesticides of low solubility, such as DDT, are applied, (2) the concentration in tile drainage effluent of a more soluble pesticide, as represented in this study by Lindane, is significantly higher than that of the applied water, (3) the pesticide concentrations found in soil vary with time at a rate that is proportional to the concentration present. The rate of change is also influenced by moisture conditions of the soil environment. The nature of this variation indicates that some of the pesticides in the soil are decomposing in place, (4) effluent from tile drainage did not appear to remove an appreciable quantity of chlorinated hydrocarbonic material from the field, and (5) when considering the fate of pesticides applied to an irrigated field, more is removed through decomposition in the soil than through leaching.

INTRODUCTION

What becomes of the pesticides applied to a field?

Do they remain in the soil or are they removed in the surface runoff or tile drainage?

These questions are examples of those commonly asked of the Department of Water Resources. This report presents the results of a study conducted to provide information needed to answer them. The following conclusions are examples of those drawn from the information provided:

(1) Tile drain discharge does not remove a significant proportion of the pesticides applied to a field. (2) Considerably more pesticides remain in the soils of a field than are removed by tailwater (surface runoff) or tile drainage.

Bennett Plot

The investigation leading to this report is part of a continuing study on the Bennett Plot, a 110-acre plot of land, which is located approximately 6 miles south of Dos Palos on the east side of Russell Avenue in Western Fresno County (Figure 1). It had never been cultivated prior to September 1963. The soil of the plot is classified as Lethent silty clay loam, strong alkali.

Prior to the application of irrigation water, subsurface tile drains were installed in the plot. The drainage system was designed to make possible the determination of the leaching effectiveness of two sizes of drain tile (4" and 6" inside diameter), and of several different methods of tile installation. This was accomplished by installing seven drain lines in each of the three blocks comprising the plot. Each of the seven lines represented a different type tile or different method of installation. Blocks A and B contain lines 900 feet long, while the lines in Block C are 600 feet long. All tile lines are spaced 200 feet apart on a slope of 0.002 feet per foot.

To date, the test plot has been flooded three times: from October 5, 1963 to January 27, 1964: from July 12, 1964 to September 25, 1964: and from May 15, 1965 to September 20, 1965. Rice was grown during the third flooding and subsequently harvested.

Pesticides were applied to the soil surface of Block B prior to each flooding. No pesticides were applied to any of the other blocks. The fate of the pesticides applied to the plot was determined by measuring the concentrations of pesticides in the applied water, tailwater, tile drain discharge, and soil.

On September 23, 1963, DDT (a chlorinated hydrocarbon pesticide) and Parathion (a thiophasphate pesticide) were applied at rates of 2 and

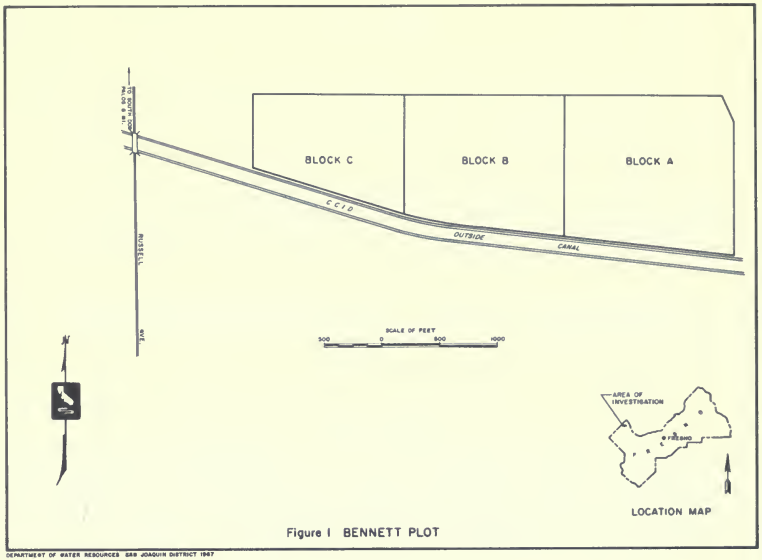

Figure 1 BENNETT PLOT

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0.1 pounds per acre, respectively. On July 9, 1964, DDT and Parathion were again applied; however, the application rates were doubled (4 and 0.2 pounds per acre, respectively). Before the third flooding, on May 6, 1965, 3.3 pounds per acre of Lindane (a chlorinated hydrocarbon pesticide) were applied. These application rates are slightly higher than the rates normally used in the area. The higher rates were used to make detection easier and to determine if increased application would result in excessively high concentrations of pesticides in the tile drainage and tailwater. The change from DDT to Lindane was made in an attempt to determine if Lindane (with a solubility approximately 100 times that of DDT) would leach through a soil column faster than DDT. The Fresno County Mosquito Abatement District applied 0.1 pounds per acre of Parathion on July 9, 1965. The Parathion application made by the abatement district was done while the plot was flooded.

The thiophasphate pesticides applied never reached the drain tiles in significant, measurable concentrations, even though they are considerably more soluble than the chlorinated hydrocarbons. In addition, they are easily broken down in the environment and consequently have a short life. Data obtained from this study and other data collected in the San Joaquin Valley substantiate this. Statistically meaningful thiophosphate data were not obtained during the course of this specific study. Therefore, this report discusses only the chlorinated hydrocarbon pesticide data, and thiophosphate pesticides are not considered further.

Sample Collection and Analysis

The backbone of any water quality investigation is the data. Without reliable data, it is impossible to meet the objectives of any program, and all effort to overcome this shortcoming will be in vain. Because of the inherent difficulties in collecting and analyzing pesticide samples, it is important to describe the techniques used. Appendix A presents a summary of the methods used to take the samples and to analyze them. It is believed that these methods provide the best data obtainable at this time.

RESULTS

The chlorinated hydrocarbon pesticide data collected to date for this program are presented in Appendix B and are summarized in the tables of this section of the report.

Table 1 presents the summary of the concentrations of chlorinated hydrocarbon pesticides found in the water applied to the plot. The tail-water (surface runoff) and tile drain effluent pesticide concentrations are presented in Tables 2 and 3. The results of the soil pesticide analyses are summarized in Table 4. Figure 2 graphically illustrates soil pesticide concentrations in Block C and is presented to assist in the comprehension of the results of these analyses. No special significance should be attached to the particular example selected.

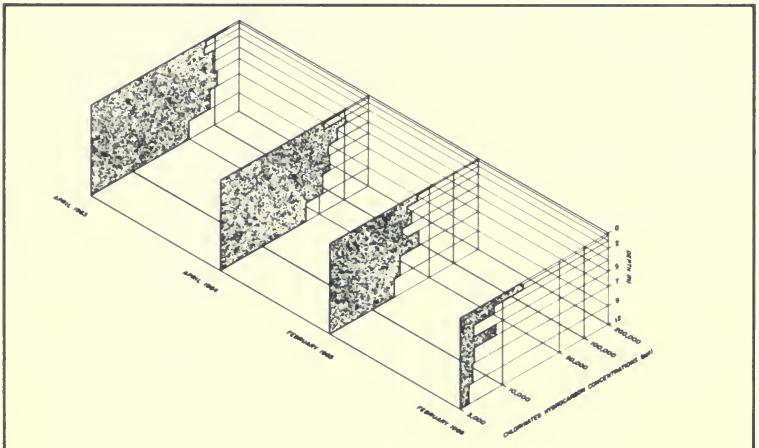

Figure 2. SUMMATION OF
IDENTIFIED CHLORINATED HYDROCARBONS vs DEPTH
FOR BLOCK C OF BENNETT PLOT

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The average chlorinated hydrocarbon pesticide concentrations for the applied water, tailwater, and tile drain effluent are presented in Table 5. The concentrations listed are the averages for the summation of identified chlorinated hydrocarbon pesticides detected in the various samples.

Table 6 presents the water balance for the three leachings at the plot. Approximate evaporation and evapotranspiration rates for the general area in which the study was conducted were derived from Department Land and Water Use records.

TABLE 1

CHLORINATED HYDROCARBON PESTICIDES IN WATER APPLIED
TO BENNETT PLOT, FRESNO COUNTY
OCTOBER 1963 to SEPTEMBER 1965

Pesticides	Times Detected	Concentrations, in parts per trillion		
		Average	Maximum	Minimum
Chlordane	1	100	100	100
DDE	2	25	30	20
DDD and/or DDT	13	88	220	40
Dieldrin	2	13	15	10
Heptachlor Epoxide	4	15	20	10
Lindane	3	15	20	10
No. of Analyses	14			

TABLE 2

CHLORINATED HYDROCARBON PESTICIDES IN TAILWATER (SURFACE RUNOFF)
FROM BENNETT PLOT, FRESNO COUNTY

Concentrations in Parts per Trillion

Pesticide	BLOCK A						BLOCK B						BLOCK C					
	1st leaching		2nd leaching		3rd leaching		1st leaching		2nd leaching		3rd leaching		1st leaching		2nd leaching		3rd leaching	
	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.
Aldrin	No Sample Taken		0	—	0	—	1	40	0	—	0	—	0	—	No Sample Taken		0	—
BHC			1	30	1	20	1	30	0	—	0	—	1	30			3	45
Chlordane			0	—	0	—	0	—	0	—	0	—	0	—			0	—
DDD and/or DDT			1	35	9	62	1	330	4	670	15	151	1	90			8	81
DDE			0	—	0	—	1	70	4	232	2	12	1	20			2	15
Dieldrin			0	—	0	—	0	—	0	—	0	—	0	—			0	—
Heptachlor			0	—	0	—	0	—	0	—	0	—	0	—			0	—
Heptachlor Epoxide			0	—	0	—	0	—	4	44	0	—	0	—			3	12
Lindane			0	—	6	215	0	—	0	—	15	9230	0	—			2	55
Toxaphene			1	80	0	—	1	250	0	—	0	—	0	—			0	—
Number of Analyses			1		9		1		4		15		1				8	

TABLE 3

CHLORINATED HYDROCARBON PESTICIDES IN TILE DRAIN EFFLUENT
FROM BENNETT PLOT, FRESNO COUNTY

Concentrations in Parts per Trillion

Pesticide	BLOCK A						BLOCK B						BLOCK C					
	1st leaching		2nd leaching		3rd leaching		1st leaching		2nd leaching		3rd leaching		1st leaching		2nd leaching		3rd leaching	
	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.	Times tested	Ave. conc.
Aldrin	1	20	0	—	0	—	0	—	0	—	0	—	0	—	0	—	0	—
BHC	3	173	1	40	3	42	3	167	0	—	0	—	2	25	1	20	0	—
Chlordane	2	50	0	—	0	—	1	50	0	—	0	—	1	100	0	—	0	—
DDD and/or DDT	2	262	9	43	13	76	6	118	13	45	26	71	4	91	9	45	19	95
DDE	2	60	0	—	0	—	5	37	4	12	9	14	3	53	1	10	4	14
Dieldrin	0	—	0	—	0	—	0	—	0	—	1	35	2	12	0	—	2	22
Heptachlor	0	—	0	—	0	—	1	115	0	—	0	—	1	40	0	—	0	—
Heptachlor Epoxide	0	—	2	18	7	15	1	15	2	12	7	15	2	60	1	10	7	20
Lindane	0	—	2	8	2	20	1	30	3	10	26	834	1	20	0	—	7	21
Toxaphene	1	50	2	175	1	550	1	500	2	50	0	—	2	100	0	—	0	—
Number of Analyses	12		9		13		15		13		26		14		9		19	

TABLE 4

CHLORINATED HYDROCARBON PESTICIDES IN SOIL FROM
BENNETT PLOT, FRESNO COUNTY

	Block A	Block B	Block C
Sample 1[1]			
Avg. Concentration[2]	71,200	61,900	84,000
$\bar{Y}$[3]	5.4	6.2	5.5
Sample 2[1]			
Avg. Concentration	64,400	69,700	60,900
$\bar{Y}$	6.3	3.1	5.1
Sample 3[1]			
Avg. Concentration	44,000	111,600	27,200
$\bar{Y}$	4.9	2.1	5.4
Sample 4[1]			
Avg. Concentration	3,500	40,200	6,200
$\bar{Y}$	4.8	1.7	4.6

1/ Sample 1 taken April 1963, before first leaching and known pesticide application.
Sample 2 taken April 1964, after first leaching: October 5, 1963 - January 27, 1964.
Sample 3 taken February 1965, after second leaching: July 12 - September 25, 1964.
Sample 4 taken February 1966, after third leaching: May 15 - September 20, 1965.

2/ Average concentration, in parts per trillion.

3/ Centroidal Depth, in feet, equals distance from soil surface to center of mass of the pesticides in the soil.

TABLE 5

SUMMARY OF CHLORINATED HYDROCARBON PESTICIDES
IN WATERS APPLIED TO OR REMOVED FROM
BENNETT PLOT, FRESNO COUNTY

	Avg. Concentrations, in parts per trillion		
	1st Leaching	2nd Leaching	3rd Leaching
Applied Water	127	N.S.[1]	95
Tailwater			
Block A	N.S.	145	208
Block B	720	946	9,390
Block C	140	N.S.	120
Tile Drain Effluent			
Block A	167	92	139
Block B	232	61	916
Block C	135	49	115

1/ N.S. = No Sample Taken

TABLE 6

WATER BALANCE FOR THE FIRST THREE LEACHINGS
OF BENNETT PLOT, FRESNO COUNTY

	Gross Application	Tailwater	Tile Drainage	Losses[1]
First Leaching				
Acre-Ft./Acre	3.15	0.50	1.14	1.51[2]
Percent of Applied		15.9	36.2	47.9
Second Leaching				
Acre-Ft./Acre	4.71	0.40	1.19	3.12[3]
Percent of Applied		8.5	25.3	66.2
Third Leaching				
Acre-Ft./Acre	12.41	2.66	2.23	7.52[4]
Percent of Applied		21.4	17.9	60.7

1/ Losses due to deep percolation, evaporation, evapotranspiration, changes in soil storage, etc.
2/ Estimated evaporative loss for period of first leaching 0.52 Acre-Ft./Acre.
3/ Estimated evaporative loss for period of second leaching 1.79 Acre-Ft./Acre.
4/ Estimated evapotranspiration for rice during period of ponding 3.09 Acre-Ft./Acre.

DISCUSSION

The chlorinated hydrocarbon pesticide data, presented in Appendix B and Tables 1, 2, and 3, have been analyzed using standard statistical techniques ("Student's T" and "F" tests) to a 5 percent level of significance. These techniques were used to determine if there were statistically significant differences between the pesticide concentrations related to the various blocks for the different leaching periods. Tile drain effluent data were normalized by converting the measured concentrations to pounds of pesticide drained per day per acre of land in the particular block. The soil extract results were analyzed by calculating the mean concentrations and the depth to the center of mass of the pesticide in the soil (the centroidal depth). These depths were calculated for the various individual components as well as for the sum of identified chlorinated hydrocarbon pesticides.

Water Samples

Prior to the third leaching there was no statistically significant difference between the pesticide concentrations of the applied water and that of the tile drain effluents for any of the blocks or that of the tailwaters from blocks A or C. However, the results of the third leachings were considerably different from those prior to that time. The Lindane applied to block B was definitely more soluble than the DDT previously used. It resulted in a statistically significant increase in the tile drainage effluent pesticide content of block B.

The greater pesticide load carried by the block B tile drain effluent during the third leaching was primarily due to the transport of material applied prior to the third leaching and in part due to that applied prior to the second leaching. The more soluble Lindane used prior to the third leaching appeared to reach "equilibrium" with the soil and being leached out within one leaching. However, the DDT, applied prior to the second leaching, did not "break through" until the third one. Of course, the difference in the quantity of water applied for the second leaching and that applied for the third may be as responsible for this as the differences in solubility.

Leaching is the removal of a soluble material from a solid by a liquid. It is the reverse of absorption and dependent on the concentrations of the soluble material (in this case pesticides) in the liquid and on the solid. From this work, it appears that the concentration of pesticides in the leachate, the water, is inconsequential in comparison to that in the solid, the soil. Even though the water is in contact with the soil for an extended period of time, the concentration of leached pesticide did not approach saturation in the water. This can be seen by comparing the concentrations of pesticides found in the tile drain effluent to published pesticide solubilities. It is also apparent from the results of the analyses of the soil samples.

Soil Samples

By observing the variation of centroidal depth with time for each of the three blocks, it is readily seen that the strong affinity of pesticides for particulate matter is more important than its solubility in water. If the solubility of pesticides in water were the controlling factor, the water passing through the soil would reach saturation. This would result in a smaller fraction of pesticides being removed from the deeper soils than from those closer to the surface. Under these conditions, the centroid of mass would move downward with time. It did not; therefore, this study reaffirms the belief that pesticides have a strong affinity toward particulate matter and are only leached with great difficulty.

The depths to the centroids of mass (Y's on Table 4) for the different soil samples from blocks A and C do not have any significant trend with time. That is, each successive leaching did not cause a drastic change in the location of the center of mass of the pesticides in the soil. The results from block B indicate an ever decreasing centroidal depth.

The lack of a significant trend in the centroidal depths, for blocks A and C, indicates that the material being lost is removed from the increments of depth in a manner that is related to the concentration of pesticide in the increment. With a given quantity of water passed through the soil column, the same percentage of material present is removed from each increment. If the quantity of water passed through the soil column is increased, the percentage removed is increased by the same amount for all depths. However, the increase in the quantity of pesticides removed does not appear to be related linearly to the quantity of water. Two phenomena that are undoubtedly involved are leaching and degradation. The non-linearity, previously mentioned, indicates that leaching is probably not as significant as degradation.

The degradation of pesticides has been shown, in laboratory studies of the movement of pesticides through soils, to be of significance. It may be either chemical or biological in nature. However, it is not possible from results of this study to quantatively separate the significance of leaching, degradation by biological actions, and degradation by chemical reactions.

The decreasing centroidal depth in block B is a result of increased chlorinated hydrocarbon pesticide concentrations in the upper layers of the soil due to application of material to this block. The disproportionately high average concentration found for the third soil sample of block B is due to the large dose of DDT (4 pounds per acre) applied prior to the second leaching. This large dose caused a concentration of nearly three parts per million in the top two inches of the third sample. This application definitely caused an increase in the concentrations of pesticides found at all levels in the soil column. However, the pesticide load carried by the tile drain effluent of block B did not increase significantly (statistically speaking) until the third leaching. This is due to the previously mentioned affinity of pesticides for particulate matter.

The first soil samples, from all three blocks, taken prior to any known pesticide application, contained fairly high concentrations of chlorinated hydrocarbons. The actual cause of these initial concentrations is unknown, but is probably due to overspray from adjacent fields, pesticide transported by seepage, etc.

Mass Balance

In an attempt to quantitatively determine the fate of applied pesticides, a mass balance was made for the Lindane used on Block B. The tailwater and the tile drain effluents were considered as the only modes of removal and the soil mass as a sink. By doing the mass balance for Lindane, it was possible to eliminate the problems introduced by background concentrations. The soil samples taken prior to application did not contain Lindane in detectable concentrations.

Of the Lindane applied, it was possible to account for less than three percent. Of the Lindane that could be accounted for, approximately 95 percent (2.74 percent of that applied) remained in the soil mass after the leaching, 4 percent (0.12 percent of that applied) was removed in the tailwater, and less than 1 percent (less than 0.02 percent of that applied) was removed in the tile drain effluent. The unaccountable portion (97% of that applied) was possibly lost because of application technique, degradation, seepage to adjacent areas, removal with the rice crop and inaccuracies in sampling and detection methods.

From the fact that pesticide concentrations in the tile drain effluents seldom exceeded the concentrations in the applied water and the results of the mass balance, it appears that degradation possibly account for the removal of more pesticides than does leaching.

CONCLUSIONS

The following conclusions have been reached as a result of this study:

1. The pesticide content of subsurface tile drainage effluent is not significantly greater than that of the applied water when pesticides of low solubility, such as DDT, are applied.

2. The concentration in tile drainage effluent of a more soluble pesticide, as represented in this study by Lindane, is significantly higher than that of the applied water.

3. The pesticide concentrations found in soil vary with time at a rate that is proportional to the concentration present. The rate of change is also influenced by moisture conditions of the soil environment. The nature of this variation indicates that some of the pesticides in the soil are decomposing in place.

4. Effluent from tile drainage did not appear to remove an appreciable quantity of chlorinated hydrocarbonic material from the field.

5. When considering the fate of pesticides applied to an irrigated field, more is removed through decomposition in the soil than through leaching.

Appendix A

SAMPLE COLLECTION AND ANALYTICAL TECHNIQUES

This report is based on the results of two hundred and seventy-seven pesticide analyses. Of the total; 14 samples of applied water, 39 samples of tailwater, 130 samples of tile drain effluent, and 94 soil samples were analyzed. The samples of water (applied, tail, and tile) were taken at such times and in such a way that it is possible to compare the concentrations of pesticide associated with the block receiving direct application (block B) and that caused by overspray, etc. (blocks A and C). The tile drain samples were composites of the effluents from the seven tile lines in each block.

The 94 soil samples were collected prior to the first flooding, and since that time, they have been collected subsequent to each irrigation period. Composite samples were made for each block from soil columns taken from 14 bore holes in the block. The soil samples were combined according to depth; that is, the material comprising the top two inches from each of the 14 bore holes in block A was combined into one sample, as was the material from the two-to twelve-inch depths, the twelve-inch to two-foot depths, etc. This enables the determination of the variation of the concentration of pesticides at various depths in the soil column.

All analyses of pesticides for this program were made by Stoner Laboratories of Campbell, California, using a Dohrman Gas Chromatograph equipped with two microcoulometric detectors. One of the detectors measures chloride concentrations (i.e., chlorinated hydrocarbons) and the other measures sulfur (i.e., thiophosphates).

Pesticides were extracted from 2 gallons of the water samples with a mixed solvent of 10 percent diethyl ether and 90 percent ethyl ether. Once the pesticide was extracted, the solvent-pesticide mixture was concentrated by evaporation and injected into the chromatograph. At the Stoner Laboratory various chromatographic columns are used to separate the pesticides present. Identifications are made by comparing the retention times of the unknown materials injected with those of known standards. On occasion, materials are detected with retention times that do not compare with those of any known material. These are recorded as "unknown" in Appendix B. Concentrations of the specific pesticides identified are calculated from the quantity of chloride or sulfur detected by the microcoulometric detectors. Unknowns are expressed as DDT. In addition, a "Computed Maximum Total" chlorinated hydrocarbon pesticide (CMT) figure is calculated. The CMT is calculated assuming that all of the chloride detected was from DDT. Unknowns and background values are included in this figure.

The microcoulometric gas chromatographic technique used for this study is considered sensitive for concentrations of chlorinated hydrocarbon pesticides in water of 10 parts per trillion or more. When the quantity detected is less than 10 ppt, it is recorded as a "trace".

Soil samples were extracted using the same procedure as that used by the Federal Water Pollution Control Administration (FWPCA) on its Klamath Basin Study with a different solvent. The solvent used for the extractions for this study was made up of 25 percent acetone, 25 percent ethyl ether, and 50 percent petroleum ether with the extraction being performed four times on each sample. After extraction most of the samples were passed through a florosil column. The analyses were made on the same microcoalometric gas chromatographic equipment as that used for the water samples. However, because of various interfering compounds present in the soil extracts, thiophosphate pesticide determinations were not made on them.

Appendix B

BASIC DATA

This appendix contains the basic data used in preparing this report. In addition to the results of the analyses for chlorinated hydrocarbon pesticides, values are also given water temperature, electrical conductivity (EC), pH, and flow, whenever available.

TABLE 7

BASIC DATA - APPLIED WATER
BENNETT PLOT, FRESNO COUNTY
Concentrations in parts per trillion

Date	10-14-63	11-13-63	12-10-63	5-16-65	5-18-65	5-25-65	6-1-65
Time	1225	1230	1150	1445	1550	1750	1700
Water Temperature °F	68	62	47				
EC (umho/cm)			620	340	360	540	350
pH				7.40	7.30	7.70	7.50
Chlordane	100						
DDE	30	20		T[1/]	T	T	
DDT	150	40		100	50	220	100
Dieldrin							15
Heptachlor Epoxide		20		10	T	15	T
Lindane		20		T	T	T	10
Unknown			30				
Sum of Identified	280	100	0	110	50	235	125
Computed Max. Total	280	100	40	280	150	280	240

Date	6-7-65	6-14-65	6-21-65	7-12-65	7-29-65	8-30-65	9-13-65
Time	1935	1525	1635	1530	1530	1430	1140
Water Temperature °F							
EC (umho/cm)		300	280	330	420	420	720
pH	7.89	7.58	7.52	7.75	8.65	8.08	8.02
Chlordane							
DDE		T				T	T
DDT	50	65	50	100	80	80	65
Dieldrin			T				
Hepatchlor Epoxide					15		
Lindane	15	T				T	T
Unknown	20					T	T
Sum of Identified	65	65	50	100	95	80	75
Computed Max. Total	230	140	220	210	320	340	270

1/ T = Trace

TABLE 8

BASIC DATA-TAILWATER, BLOCK A

BENNETT PLOT, FRESNO COUNTY

Date	Time PST	Temp. °F	EC umho/cm	pH	Flow gpm	Concentrations in parts per trillion														
						Aldrin	BHC	Chlordane	DDE	DDD and/or DDT	Dieldrin	Heptachlor	Heptachlor Epoxide	Lindane	Kelthane	Simazine and/or Atrazine	Toxaphene	Unknown	Sum of Identified	Computed Maximum Total
8-17-64	1405	91	1980	8.02	35	--	30	--	--	35	--	--	--	--	--	--	80	20	145	180
5-21-65	0845	81	900	7.90	120	--	--	--	--	45	--	--	--	820	--	--	--	--	865	920
6-1-65	1345	72	1270	8.08	250	--	--	--	T[1]	65	T	--	T	170	--	--	--	--	235	270
6-14-65	1140	67	1380	8.40	85	--	--	--	T	140	T	--	--	150	--	--	--	10	290	370
6-21-65	1205	82	1420	8.61	120	--	--	--	--	55	--	--	--	90	--	--	--	--	145	150
7-12-65	1135	77	770	7.72	143	--	--	--	T	95	--	--	--	40	--	--	--	10	135	320
7-26-65	1500	83	710	8.48	200	--	--	--	--	20	--	--	--	20	--	--	--	--	40	210
8-30-65	1315	74	680	7.98	--	--	20	--	--	45	--	--	--	--	--	--	--	10	65	160
9-13-65	1145	65	780	8.04	94	--	--	--	T	55	--	--	T	T	--	--	--	10	55	210
9-28-65	1500	66	800	8.49	--	--	--	--	--	40	--	--	T	T	--	--	--	--	40	230

[1] T = Trace

TABLE 9

BASIC DATA-TILE DRAIN EFFLUENT, BLOCK A

BENNETT PLOT, FRESNO COUNTY

Date	Time PST	Temp. °F	EC umho/cm	pH	Flow gpm	Concentrations in parts per trillion														
						Aldrin	BHC	Chlordane	DDE	DDD and/or DDT	Dieldrin	Heptachlor	Heptachlor Epoxide	Lindane	Kelthane	Simazine and/or Atrazine	Toxaphene	Unknown	Sum of Identified	Computed Maximum Total
10-7-63	1240	73	--	--	0.9	--	400	--	100	500	--	--	--	--	--	--	--	--	1,000	1,000
10-28-63	0850	71	--	--	8.2	--	--	50	--	--	--	--	--	--	--	--	--	--	50	50
11-28-63	0950	61	36,000	--	8.0	20	20	--	--	--	--	--	--	--	--	--	--	--	40	80
12-2-63	0940	66	45,000	7.7	8.4	--	--	50	--	--	--	--	--	--	--	--	--	60	50	130
12-30-63	0915	61	40,000	8.0	6.9	--	--	--	--	--	--	--	--	--	--	--	--	--	0	130
1-27-64	1000	58	48,000	8.2	6.8	--	--	--	--	--	--	--	--	--	--	--	--	--	0	95
2-10-64	0845	59	50,000	8.0	6.5	--	--	--	--	--	--	--	--	--	--	--	--	--	0	40
3-2-64	0925	56	40,000	8.2	3.4	--	--	--	--	--	--	--	--	--	--	--	--	--	0	65
3-30-64	0955	61	30,000	8.1	1.7	--	--	--	--	--	--	--	--	--	--	--	--	100	50	175
5-4-64	1035	62	30,200	8.0	1.6	--	100	--	--	--	--	--	--	--	--	--	--	--	100	290
6-1-64	1025	65	39,000	7.90	1.9	--	--	--	20	--	--	--	--	--	--	--	--	--	20	60
6-22-64	1345	81	38,700	7.90	1.7	--	--	--	--	25	--	--	--	--	--	--	--	--	25	120
7-21-64	1530	75	38,000	7.95	3.0	--	--	--	--	45	--	--	--	--	--	--	--	--	45	50
7-27-64	1330	80	35,700	7.90	2.8	--	--	--	--	40	--	--	--	--	--	--	--	--	40	130
8-3-64	1305	80	30,900	7.90	6.0	--	--	--	--	55	--	--	--	--	--	--	--	250	15	305
8-10-64	1535	78	35,700	7.77	7.5	--	--	--	--	30	--	--	25	--	--	--	--	--	45	55
10-5-64	1355	76	32,800	7.8	8.4	--	40	--	--	85	--	--	--	--	--	--	--	100	40	225
10-19-64	1455	--	38,400	7.88	3.6	--	--	--	--	40	--	--	--	--	--	--	--	--	70	40
11-2-64	1145	--	39,200	7.88	2.5	--	--	--	--	30	--	--	--	5	--	--	--	--	20	35
11-16-64	1110	60	37,200	7.98	2.2	--	--	--	--	40	--	--	--	--	--	--	--	--	40	40
12-14-64	0850	55	28,800	8.02	--	--	--	--	--	20	--	--	10	10	--	--	--	--	270	40
6-7-65	1710	68	33,000	7.97	6.86	--	--	--	--	70	--	--	--	--	--	--	--	--	10	70
6-14-65	1125	67	34,200	7.88	5.02	--	--	--	--	130	--	--	--	--	--	--	--	--	10	130
6-21-65	1200	67	--	7.9	9.70	--	--	--	--	65	--	--	--	--	--	--	--	550	20	615
7-12-65	1125	69	--	7.9	10.28	--	--	--	--	55	--	--	10	--	--	--	--	--	--	65
7-26-65	1445	78	41,000	8.19	12.15	--	--	--	--	70	--	--	10	--	--	--	--	--	70	80
8-30-65	1300	77	39,600	7.88	7.56	--	--	--	--	65	--	--	10	20	--	--	--	--	70	95
9-13-65	1130	72	38,800	7.80	18.21	--	--	--	--	55	--	--	15	--	--	--	--	--	65	70
9-20-65	1445	80	36,400	7.88	18.01	--	20	--	T/	85	--	--	T	--	--	--	--	--	45	105
9-27-65	1455	70	40,000	7.95	9.21	--	--	--	--	90	--	--	10	T	--	--	--	--	30	100
10-4-65	1515	68	38,000	7.83	4.26	--	75	--	--	140	--	--	--	--	--	--	--	--	55	215
10-11-65	1200	74	38,400	7.88	2.91	--	30	--	--	90	--	--	35	--	--	--	--	--	55	155
10-18-65	1130	70	38,000	7.92	2.35	--	--	--	--	50	--	--	--	20	--	--	--	--	20	50
11-1-65	1210	70	39,600	7.98	1.66	--	--	--	T	25	--	--	15	--	--	--	--	--	--	60

TABLE 10

BASIC DATA-TAILWATER, BLOCK B

BENNETT PLOT, FRESNO COUNTY

Date	Time PST	Temp. °F	EC umho/cm	pH	Flow gpm	Concentrations in parts per trillion														
						Aldrin	BHC	Chlordane	DDE	DDD and/or DDT	Dieldrin	Heptachlor	Heptachlor Epoxide	Lindane	Kelthane	Simazine and/or Atrazine	Toxaphene	Unknown	Sum of Identified	Computed Maximum Total
11-4-63	0935	55	--	--	--	40	30	--	70	330	--	--	--	--	--	--	250	--	720	720
7-30-64	1530	93	3,450	8.65	5	--	--	--	320	1,000	--	--	60	--	--	--	--	30	1,380	1,360
8-3-64	1100	74	2,810	8.08	4.5	--	--	--	170	680	--	--	40	--	--	--	--	60	890	1,000
8-10-64	1145	80	2,280	7.73	25.0	--	--	--	290	470	--	--	25	--	--	--	--	30	785	800
8-17-64	1510	82	2,280	8.30	6	--	--	--	150	530	--	--	50	--	--	--	--	30	730	800
5-21-65	0915	56	1,000	7.15	--	--	--	--	--	200	--	--	--	37,400	--	--	--	--	37,600	42,000
5-25-65	1115	67	1,500	8.00	150	--	--	--	--	600	--	--	--	62,000	--	--	--	--	62,600	70,000
6-1-65	1405	73	1,800	8.50	150	--	--	--	--	220	--	--	--	9,600	--	--	--	--	9,820	9,800
6-7-65	1730	78	1,610	8.20	100	--	--	--	17	320	--	--	--	9,000	--	--	--	--	9,320	7,000
6-14-65	1250	77	1,540	7.47	25	--	--	--	12	160	--	--	--	8,200	--	--	--	--	8,360	8,900
6-21-65	1335	83	820	8.36	200	--	--	--	25	110	--	--	--	4,700	--	--	--	10	4,835	6,600
6-30-65	1400	83	620	8.40	300	--	--	--	--	100	--	--	--	2,700	--	--	--	--	2,800	2,800
7-12-65	1245	83	880	8.60	231	--	--	--	--	90	--	--	--	940	--	--	--	--	1,030	1,300
7-19-65	1430	91	700	8.68	125	--	--	--	--	60	--	--	--	1,200	--	--	--	--	1,260	1,800
7-26-65	1530	84	780	8.47	100	--	--	--	--	35	--	--	--	540	--	--	--	--	575	940
8-2-65	1250	84	690	7.96	600	--	--	--	--	90	--	--	--	630	--	--	--	10	720	1,700
8-9-65	1300	--	680	8.08	250	--	--	--	--	110	--	--	--	630	--	--	--	20	740	920
8-16-65	1515	--	670	8.08	200	--	--	--	--	90	--	--	--	490	--	--	--	--	580	760
8-30-65	1500	78	670	7.98	10	--	--	--	--	30	--	--	--	310	--	--	--	10	340	660
9-13-65	1325	73	720	7.98	10	--	--	--	--	45	--	--	T	160	--	--	--	--	205	410

1/ T = Trace

TABLE II

BASIC DATA-TILE DRAIN EFFLUENT, BLOCK B

BENNETT PLOT, FRESNO COUNTY

Date	Time PST	Temp. °F	EC umho/cm	pH	Flow gpm	Concentrations in parts per trillion														
						Aldrin	BHC	Chlordane	DDE	DDD and/or DDT	Dieldrin	Heptachlor	Heptachlor Epoxide	Lindane	Kelthane	Simazine and/or Atrazine	Toxaphene	Unknown	Sum of Identified	Computed Maximum Total
9-23-63	1240	73	--	--	5.3	--	--	--	100	300	--	--	--	--	--	--	500	--	900	900
10-18-63	1050	72	--	--	56.0	--	--	--	--	--	--	--	--	30	--	--	--	--	30	30
10-24-63	0945	71	--	--	67.3	--	150	--	50	200	--	--	--	--	--	--	--	--	400	400
10-28-63	1000	71	--	--	68.6	--	200	--	--	50	--	--	--	--	--	--	--	--	250	300
11-4-63	1015	68	--	--	69.3	--	--	--	--	--	--	--	--	--	--	--	--	--	0	20
11-25-63	1125	66	40,000	--	62.6	--	--	--	10	60	--	--	--	--	--	--	--	--	70	100
12-2-63	1110	63	30,000	7.8	61.6	--	--	50	--	--	--	--	--	--	--	--	--	--	50	120
12-30-63	1100	58	28,000	7.8	62.8	--	--	--	--	--	--	--	--	--	--	--	--	--	0	70
1-27-64	1045	60	40,000	8.0	60.9	--	--	--	--	--	--	--	--	--	--	--	--	--	0	65
2-10-64	1020	58	38,000	8.0	49.5	--	--	--	--	--	--	--	--	--	--	--	--	--	0	30
3-2-64	1155	59	40,000	7.9	18.0	--	--	--	--	--	--	--	--	--	--	--	--	--	0	75
3-30-64	1130	63	28,400	7.85	9.1	--	--	--	--	--	--	115	--	--	--	--	--	100	115	300
5-4-64	1125	60	25,600	7.90	6.6	--	150	--	10	--	--	--	--	--	--	--	--	200	160	400
6-1-64	1130	67	31,500	7.92	5.7	--	--	--	15	55	--	--	15	--	--	--	--	40	85	150
6-22-64	1455	69	27,600	7.90	4.2	--	--	--	--	40	--	--	--	--	--	--	--	150	40	250
7-13-64	1200	79	24,300	7.90	39.8	--	--	--	15	35	--	--	--	--	--	--	--	75	60	140
7-21-64	1640	74	28,400	8.00	58.6	--	--	--	--	125	--	--	--	--	--	--	40	50	165	220
7-27-64	1635	80	28,800	7.81	70.2	--	--	--	--	50	--	--	--	--	--	--	--	60	50	110
8-3-64	1430	78	29,400	7.80	83.7	--	--	--	--	35	--	--	--	--	--	--	60	40	95	140
8-10-64	1645	85	27,300	7.85	92.8	--	--	--	--	20	--	--	--	--	--	--	--	60	20	100
8-17-64	1510	78	24,900	7.82	100.7	--	--	--	--	15	--	--	--	--	--	--	--	50	15	70
8-24-64	1635	82	20,800	7.90	102.8	--	--	--	--	20	--	--	--	--	--	--	--	250	20	300
8-31-64	1455	68	25,200	7.68	84.1	--	--	--	15	110	--	--	--	--	--	--	--	--	125	140
10-5-64	1510	76	14,400	7.9	107.3	--	--	--	--	15	--	--	--	--	--	--	--	85	15	110
10-19-64	1345	--	30,400	7.90	22.1	--	--	--	--	15	--	--	--	--	--	--	--	40	15	60
11-2-64	1340		28,000	8.0	14.3	--	--	--	10	50	--	10	--	10	--	--	--	25	80	85
11-16-64	1400	64	24,800	7.90	13.0	--	--	--	10	65	--	15	--	--	--	--	--	15	90	125
12-14-64	0945	60	24,400	7.95	--	--	--	--	--	30	--	T 1/	--	10	--	--	--	--	40	110
5-16-65	1720	67	15,000	8.70	36.4	--	--	--	20	40	--	--	--	1,600	--	--	--	--	1,660	1,800
5-17-65	1530	68	15,000	7.98	74.7	--	--	--	10	50	--	--	--	1,200	--	--	--	--	1,260	1,700
5-18-65	1315	68	15,600	7.90	61.7	--	--	--	10	40	--	--	--	850	--	--	--	--	900	810
5-19-65	1145	72	16,400	7.98	--	--	--	--	10	30	--	--	--	1,000	--	--	--	--	1,040	600
5-20-65	1615	67	17,000	8.26	83.8	--	--	--	10	30	--	--	--	860	--	--	--	--	900	530
5-21-65	1050	62	19,600	7.80	--	--	--	--	--	50	--	--	--	390	--	--	--	--	440	650
5-25-65	1615	78	20,000	8.25	91.6	--	--	--	--	150	--	--	--	600	--	--	--	--	750	870
6-1-65	1505	68	27,300	8.02	105.2	--	--	--	10	280	--	--	--	1,600	--	--	--	--	1,890	2,800
6-7-65	1830	65	25,500	7.88	88.6	--	--	--	T	50	--	--	T	1,600	--	--	--	--	1,650	2,400
6-14-65	1405	71	26,100	7.92	95.6	--	--	--	--	40	--	--	T	1,800	--	--	--	--	1,840	1,600
6-21-65	1405	83	27,300	7.92	95.3	--	--	--	--	25	--	--	--	2,600	--	--	--	--	2,625	3,000
6-30-65	1515	71	28,000	7.92	99.2	--	--	--	--	65	--	--	--	1,600	--	--	--	--	1,665	2,000
7-12-65	1350	76	21,300	7.85	97.2	--	--	--	--	120	--	--	--	890	--	--	--	15	1,010	1,200
7-19-65	1530	74	22,400	8.01	--	--	--	--	--	80	--	--	--	750	--	--	--	--	830	1,300
7-26-65	1810	78	22,200	7.91	126.9	--	--	--	--	45	--	--	--	900	--	--	--	--	945	1,400
8-2-65	1345	82	28,500	7.90	--	--	--	--	--	85	--	--	--	370	--	--	--	10	455	1,000
8-9-65	1415	--	23,500	8.16	--	--	--	--	--	30	--	--	--	590	--	--	--	--	620	940

1/ T = Trace

TABLE II (Continued)

BASIC DATA-TILE DRAIN EFFLUENT, BLOCK B

BENNETT PLOT, FRESNO COUNTY

Date	Time PST	Temp. °F	EC umho/cm	pH	Flow gpm	Concentrations in parts per trillion														
						Aldrin	BHC	Chlordane	DDE	DDD and/or DDT	Dieldrin	Heptachlor	Heptachlor Epoxide	Lindane	Kelthane	Simazine and/or Atrazine	Toxaphene	Unknown	Sum of Identified	Computed Maximum Total
8-16-65	1615	--	21,600	7.72	--	--	--	--	--	30	--	--	--	550	--	--	--	60	580	1,200
8-30-65	1645	77	21,000	7.95	42.0	--	--	--	--	30	--	--	10	590	--	--	--	--	630	1,080
9-13-65	1430	74	--	7.92	146.3	--	--	--	--	65	--	--	15	230	--	--	--	--	310	760
9-20-65	1645	71	21,400	8.30	142.9	--	--	--	--	35	--	--	T	180	--	--	--	--	215	470
9-27-65	1620	68	25,000	7.90	38.8	--	--	--	T1/	120	--	--	10	280	--	--	--	--	410	565
10-4-65	1705	72	20,400	7.90	21.1	--	--	--	--	55	--	--	15	260	--	--	--	--	330	560
10-11-65	1515	79	21,000	7.90	16.2	--	--	--	30	110	35	--	25	155	--	--	--	--	355	860
10-18-65	1250	72	21,300	8.03	12.2	--	--	--	20	120	--	--	10	180	--	--	--	--	330	920
11-1-65	1455	67	25,300	8.00	9.3	--	--	--	10	75	--	--	20	70	--	--	--	15	175	440

1/ T = Trace

TABLE 12

BASIC DATA-TAILWATER, BLOCK C
BENNETT PLOT, FRESNO COUNTY

Date	Time PST	Temp. °F	EC umho/cm	pH	Flow gpm	Concentrations in parts per trillion													
						Aldrin	BHC	Chlordane	DDE	DDD and/or DDT	Dieldrin	Heptachlor	Heptachlor Epoxide	Lindane	Kelthane	Simazine and/or Atrazine	Toxaphene	Unknown	Sum of Identified	Computed Maximum Total
11-4-63	1125	58	--	--	--	--	30	--	20	90	--	--	--	--	--	--	--	--	140	140
5-20-65	1645	--	630	7.07	50	--	--	--	20	80	--	--	10	50	--	--	--	--	160	300
6-1-65	1525	78	1,000	7.92	150	--	--	--	T1/	140	--	--	T	60	--	--	--	--	200	280
6-14-65	1415	78	920	7.75	40	--	60	--	10	130	--	--	--	--	--	--	--	--	200	250
6-21-65	1515	89	570	7.99	165	--	45	--	T	85	--	--	--	--	--	--	--	--	130	230
7-12-65	1415	85	580	7.72	200	--	--	--	--	65	--	--	--	--	--	--	--	--	65	230
7-29-65	1230	77	500	7.55	200	--	--	--	--	30	--	--	T	--	--	--	--	10	30	330
8-30-65	1700	75	500	7.52	--	--	--	--	--	45	--	--	10	--	--	--	--	--	55	350
9-13-65	1445	68	700	7.80	57	--	30	--	T	70	--	--	15	--	--	--	--	T	115	240

1/ T = Trace

TABLE 13

BASIC DATA-TILE DRAIN EFFLUENT, BLOCK C

BENNETT PLOT, FRESNO COUNTY

Date	Time PST	Temp. °F	EC umho/cm	pH	Flow gpm	Concentrations in parts per trillion													
						Aldrin	BHC	Chlordane	DDE	DDD and/or DDT	Dieldrin	Heptachlor	Heptachlor Epoxide	Lindane	Kelthane	Simazine and/or Atrazine	Toxaphene	Unknown	Sum of Identified
9-23-63	0930	73	--	--	4.6	--	--	--	100	100	--	--	100	--	--	--	--	--	300
10-14-63	0855	72	--	--	73.9	--	40	100	--	--	--	--	--	--	--	--	100	--	240
10-24-63	0830	71	--	--	94.7	--	--	--	50	150	--	--	--	--	--	--	--	--	200
10-28-63	1120	70	--	--	68.7	--	--	--	--	--	--	--	--	--	--	--	--	--	0
11-11-63	1135	67	--	--	90.0	--	--	--	--	--	--	--	--	20	--	--	--	--	20
12-2-63	1145	65	7,500	7.8	90.6	--	--	--	--	--	--	--	--	--	--	--	--	--	0
12-30-63	1120	60	23,000	8.0	89.5	--	--	--	--	--	--	--	--	--	--	--	--	--	0
1-27-64	1150	60	8,500	8.0	74.7	--	--	--	--	--	--	--	--	--	--	--	--	--	0
2-10-64	1050	59	18,000	7.9	31.0	--	--	--	--	--	--	--	--	--	--	--	--	--	0
3-2-64	1345	58	16,000	8.1	7.6	--	--	--	--	--	--	--	--	--	--	--	--	--	0
3-30-64	1330	63	20,400	7.9	3.0	--	--	--	--	--	--	--	--	--	--	--	100	130	100
5-4-64	1330	61	10,300	8.02	5.2	--	--	--	--	--	--	40	--	--	--	--	--	240	40
6-1-64	1330	72	14,480	7.98	3.8	--	10	--	10	90	10	--	20	--	--	--	--	--	140
6-22-64	1140	72	13,500	7.97	1.9	--	--	--	--	25	15	--	--	--	--	--	--	75	40
7-30-64	1200	78	12,900	7.88	86.2	--	--	--	--	65	--	--	--	--	--	--	--	65	65
8-3-64	1530	75	12,000	7.88	114.6	--	--	--	--	30	--	--	--	--	--	--	--	20	30
8-10-64	1740	78	12,000	7.78	120.7	--	--	--	--	50	--	--	--	--	--	--	--	40	50
8-31-64	1355	69	11,280	7.55	149.3	--	--	--	10	95	--	--	10	--	--	--	--	15	115
10-5-64	1550	74	22,800	7.85	127.8	--	20	--	--	40	--	--	--	--	--	--	--	125	60
10-19-64	1155	69	10,400	7.98	11.6	--	--	--	--	35	--	--	--	--	--	--	--	100	35
11-2-64	1445	--	10,950	8.07	5.0	--	--	--	--	35	--	--	--	--	--	--	--	50	35
11-16-64	1505	63	10,650	7.09	2.9	--	--	--	--	25	--	--	--	--	--	--	--	95	25
12-14-64	1050	52	11,100	7.98	1	--	--	--	--	30	--	--	--	T	--	--	--	50	30
5-17-65	1410	68	9,100	8.02	112.9	--	--	--	--	90	--	--	20	10	--	--	--	--	120
5-18-65	1405	68	6,500	8.21	126.8	--	--	--	--	60	--	--	10	--	--	--	--	--	70
5-19-65	1330	68	7,500	8.01	--	--	--	--	T 1/	80	--	--	10	10	--	--	--	--	100
5-21-65	1130	61	7,200	8.25	142.4	--	--	--	--	75	--	--	T	T	--	--	--	10	75
5-25-65	1715	71	9,400	7.85	171.3	--	--	--	--	100	--	--	--	T	--	--	--	30	100
6-1-65	1615	66	9,100	8.02	183.5	--	--	--	--	380	--	--	T	T	--	--	--	--	380
6-7-65	1820	64	8,400	7.90	123.2	--	--	--	--	170	--	--	--	--	--	--	--	25	170
6-14-65	1510	68	9,600	7.90	165.8	--	--	--	--	60	--	--	--	--	--	--	--		60
6-21-65	1610	76	8,700	7.94	174.9	--	--	--	--	50	--	--	--	T	--	--	--		50
7-12-65	1505	75	8,200	7.88	136.6	--	--	--	--	75	--	--	--	--	--	--	--	55	75
7-29-65	1455	78	10,000	8.28	182.6	--	--	--	10	80	10	--	T	T	--	--	--	35	100
8-30-65	1810	74	9,000	7.78	35.6	--	--	--	--	15	--	--	--	--	--	--	--	15	15
9-13-65	1600	72	8,200	7.93	208.8	--	--	--	20	120	--	--	30	10	--	--	--	25	180
9-20-65	1800	69	8,000	7.90	176.5	--	--	--	--	35	--	--	T	T	--	--	--	T	35
9-27-65	1745	66	8,800	8.05	31.5	--	--	--	T	90	--	--	--	--	--	--	--	T	90
10-4-65	1825	67	8,200	7.91	15.1	--	--	--	10	60	--	--	20	20	--	--	--	20	110
10-11-65	1635	72	8,800	7.90	8.9	--	--	--	15	110	35	--	30	40	--	--	--	25	230
10-18-65	1355	72	8,300	7.92	7.3	--	--	--	--	85	--	--	--	10	--	--	--	35	95
11-1-65	0945	65	8,800	8.18	2.6	--	--	--	--	65	--	--	20	45	--	--	--	20	130

Date	Computed Maximum Total
9-23-63	300
10-14-63	240
10-24-63	200
10-28-63	200
11-11-63	20
12-2-63	40
12-30-63	75
1-27-64	75
2-10-64	50
3-2-64	45
3-30-64	270
5-4-64	320
6-1-64	150
6-22-64	120
7-30-64	110
8-3-64	65
8-10-64	100
8-31-64	130
10-5-64	180
10-19-64	150
11-2-64	85
11-16-64	125
12-14-64	85
5-17-65	270
5-18-65	100
5-19-65	160
5-21-65	190
5-25-65	180
6-1-65	360
6-7-65	180
6-14-65	90
6-21-65	85
7-12-65	420
7-29-65	540
8-30-65	230
9-13-65	460
9-20-65	200
9-27-65	250
10-4-65	480
10-11-65	1,200
10-18-65	520
11-1-65	560

1/ T = Trace

TABLE 14

BASIC DATA--CHLORINATED HYDROCARBON PESTICIDES IN BLOCK A SOIL

Bennett Plot, Fresno County

April 1963

	Depth							
	0-2"	2"-12"	1'-2'	2'-3½'	3½'-5'	5'-7'	7'-9½'	9½'-12'
DDE	44,600[1]	14,000	11,100	12,200	18,800	10,800	6,000	9,900
DDD and/or DDT	56,000	38,500	21,800	38,000	40,500	23,900	12,600	26,700
Heptachlor Epoxide	28,900	10,700	12,800	18,000	19,400	15,400	9,500	13,100
Lindane	31,000	23,000	19,000	22,900	21,700	17,100	13,900	16,900
Unknown	10,600	4,000	17,200	7,500	7,600	8,200	7,500	5,300
Sum of Identified	160,500	86,200	64,700	91,100	100,400	67,200	42,000	66,600

April 1964

	Depth							
	0-2"	2"-12"	1'-2'	2'-3½'	3½'-5'	5'-7'	7'-9½'	9½'-12'
DDE	20,600	21,200	10,600	9,400	7,600	11,100	10,200	13,000
DDD and/or DDT	38,400	38,600	23,000	22,500	20,800	20,300	27,000	44,000
Heptachlor Epoxide	23,600	20,400	7,700	8,400	9,100	6,100	8,500	10,500
Lindane	26,200	21,800	12,300	7,100	7,400	13,600	16,100	21,000
Unknown	5,400	4,800	4,000	5,400	3,300	3,100	5,600	15,100
Sum of Identified	108,800	102,000	53,600	47,400	44,900	51,100	61,800	88,500

February 1965

	Depth							
	0-2"	2"-12"	1'-2'	2'-3½'	3½'-5'	5'-7'	7'-9½'	9½'-12'
DDE	17,800[1]	16,500	8,200	6,900	7,800	5,400	4,200	3,100
DDD and/or DDT	31,500	32,700	10,900	18,500	11,000	14,600	10,800	7,200
Heptachlor Epoxide	15,100	16,700	9,500	14,000	8,800	8,500	6,800	6,000
Lindane	22,500	24,600	16,400	19,800	18,400	12,100	13,100	10,200
Unknown	7,300	6,500	3,000	6,000	6,900	4,000	2,900	3,300
Sum of Identified	86,900	90,500	45,000	59,200	46,000	40,600	34,900	26,500

February 1966

	Depth							
	0-2"	2"-12"	1'-2'	2'-3½'	3½'-5'	5'-7'	7'-9½'	9½'-12'
DDE	2,300	900	600	600	600	400	300	100
DDD and/or DDT	2,700	3,000	1,700	2,500	3,700	1,500	1,700	1,200
Heptachlor Epoxide	800	400	500	600	400	200	200	100
Lindane	400	1,600	400	100[3]	100[3]	700	300	800
Other Pesticides	8,000[2] 900[3]	—	—	700[3]	400[3]	—	—	—
Unknown	—	—	—	400	—	—	—	—
Sum of Identified	15,100	5,900	3,200	4,500	5,200	2,800	2,500	2,200

1/ Pesticide concentrations in parts per trillion
2/ Dieldrin
3/ Heptachlor

TABLE 15

BASIC DATA-CHLORINATED HYDROCARBON PESTICIDES
IN BLOCK B SOIL

Bennett Plot, Fresno County

April 1963

	Depth						
	0-1'	1'-2'	2'-3½'	3½'-5'	5'-7'	7'-9½'	9½'-12'
DDE	—	5,000[1]	18,000	10,000	12,000	11,000	—
DDD and/or DDT	—	46,000	19,000	12,000	15,000	12,000	—
Heptachlor Epoxide	—	52,000	15,000	30,000	13,000	15,000	—
Lindane	—	—	12,000	9,500	11,000	10,000	67,000
Unknown	230,000	300	16,000	5,000	12,900	10,000	27,000
Sum of Identified	0	103,000	64,000	61,500	51,000	48,000	67,000

April 1964

	Depth						
	0-1'	1'-2'	2'-3½'	3½'-5'	5'-7'	7'-9½'	9½'-12'
DDE	50,000	15,000	7,000	7,000	6,000	8,000	4,000
DDD and/or DDT	370,000	20,000	13,000	11,000	12,000	15,000	10,000
Heptachlor Epoxide	—	17,000	4,000	10,000	13,000	8,000	9,000
Lindane	—	22,000	6,000	8,000	13,000	8,000	—
Unknown	—	9,300	—	—	7,000	—	—
Sum of Identified	420,000	74,000	30,000	36,000	44,000	39,000	23,000

February 1965

	Depth						
	0-2"	2"-12"	1'-2'	2'-3½'	3½'-5'	5'-7'	7'-9½'	9½'-12'
DDE	180,000[1]	28,000	16,000	10,000	13,000	4,000	5,000	5,000
DDD and/or DDT	2,740,000	230,000	170,000	79,000	74,000	40,000	15,000	15,000
Unknown	—	—	—	—	—	—	5,000	—
Sum of Identified	2,920,000	258,000	186,000	89,000	87,000	44,000	20,000	20,000

February 1966

	Depth							
	0-2"	2"-12"	1'-2'	2'-3½'	3½'-5'	5'-7'	7'-9½'	9½'-12'
DDE	64,200	30,500	4,000	1,000	2,000	—	—	—
DDD and/or DDT	235,000	263,000	32,000	17,000	34,000	3,000	6,000	2,000
Heptachlor	—	—	—	—	—	—	—	1,000
Heptachlor Epoxide	13,300	14,000	1,000	800	1,600	—	300	100
Lindane	33,400	6,000	2,000	2,000	2,500	1,000	—	700
Sum of Identified	345,900	313,500	39,000	20,800	40,100	4,000	6,300	3,800

1/ Pesticide concentrations in parts per trillion

TABLE 16

BASIC DATA-CHLORINATED HYDROCARBON PESTICIDES
IN BLOCK C SOIL

Bennett Plot, Fresno County

April 1963

Depth

	0-2"	2"-12"	1'-2'	2'-3½'	3½'-5'	5'-7'	7'-9½'	9½'-12'
DDE	28,000[1/]	14,600	9,900	15,600	12,200	15,800	12,900	8,700
DDD and/or DDT	52,500	28,100	23,200	25,500	35,200	32,900	33,700	16,300
Heptachlor Epoxide	27,200	15,100	16,500	18,500	18,300	21,500	17,000	9,500
Lindane	39,500	21,500	25,500	36,400	29,300	36,400	24,400	14,600
Unknown	15,000	10,100	5,800	19,400	15,200	19,300	14,500	5,400
Sum of Identified	147,200	79,300	75,200	96,000	95,000	106,600	88,000	49,000

April 1964

Depth

	0-2"	2"-12"	1'-2'	2'-3½'	3½'-5'	5'-7'	7'-9½'	9½'-12'
DDE	21,200	6,400	11,600	14,000	6,500	7,400	4,000	5,200
DDD and/or DDT	33,000	17,100	24,800	18,700	21,600	25,700	17,600	23,000
Heptachlor Epoxide	14,100	9,200	18,400	17,500	11,300	11,600	12,800	7,900
Lindane	30,200	23,000	45,500	30,400	24,600	21,600	19,500	17,900
Unknown	5,900	14,800	—	7,000	4,100	4,100	4,600	5,200
Sum of Identified	98,500	55,700	100,300	80,600	64,000	66,300	53,900	33,300

February 1965

Depth

	0-2"	2"-12"	1'-2'	2'-3½'	3½'-5'	5'-7'	7'-9½'	9½'-12'
DDE	8,000[1/]	4,600	4,100	4,300	3,400	3,700	3,100	1,300
DDD and/or DDT	18,800	12,600	6,200	10,400	7,000	7,100	6,600	5,300
Heptachlor Epoxide	8,900	4,500	4,000	5,300	5,000	6,200	4,300	3,900
Lindane	20,600	16,100	12,800	10,300	12,900	20,000	8,600	8,800
Unknown	4,500	4,000	3,100	3,200	4,800	6,600	2,100	3,100
Sum of Identified	56,300	35,800	27,100	30,300	23,800	37,000	22,600	19,800

February 1966

Depth

	0-2"	2"-12"	1'-2'	2'-3½'	3½'-5'	5'-7'	7'-9½'	9½'-12'
DDE	4,000	1,000	3,000	—	4,600	1,000	—	—
DDD and/or DDT	8,000	4,000	4,000	4,000	3,000	3,000	4,000	3,000
Heptachlor	—	—	—	—	400	—	—	500
Heptachlor Epoxide	1,000	—	—	—	—	—	—	—
Lindane	4,000	12,000	1,000	500	300	500	300	400
Sum of Identified	17,000	18,000	8,000	4,000	8,300	4,500	4,300	3,900

1/ Pesticide concentrations in parts per trillion