SAMPLING FOR PESTICIDE RESIDUES IN CALIFORNIA WELL WATER

1993 Update
Well Inventory Data Base

Eighth Annual Report to the Legislature,
State Department of Health Services,
Office of Environmental Health Hazard Assessment,
and the State Water Resources Control Board

Pursuant to the
Pesticide Contamination Prevention Act

California Environmental Protection Agency
DEPARTMENT OF PESTICIDE REGULATION

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DEPARTMENT OF PESTICIDE REGULATION

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by

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EH93-06

EXECUTIVE SUMMARY

PURPOSE:

The Pesticide Contamination Prevention Act (PCPA, see Appendix A, p. 84), requires the Director of the Department of Pesticide Regulation (DPR) within the California Environmental Protection Agency to maintain a statewide data base of wells sampled for active ingredients of pesticide products, and all agencies to submit to the Director the results of any well sampling for the active ingredients of pesticides. The PCPA directs DPR, in consultation with the California Department of Health Services (CDHS) and the State Water Resources Control Board (SWRCB), to annually report: (1) specified information contained in the data base to the Legislature, the CDHS, the Office of Environmental Health Hazard Assessment, and the SWRCB; (2) actions taken by the Director and the SWRCB to prevent pesticides from leaching to ground water; and (3) factors contributing to the movement of pesticides to ground water.

BACKGROUND:

The well inventory data base was developed by DPR (then a division of the California Department of Food and Agriculture) in 1983, before the passage of the PCPA in 1985. The purposes of the data base were to centralize reliable information on the occurrence of non-point source contamination of ground water by the agricultural use of pesticides and to facilitate graphical, numerical, and spatial analyses of the data. The contents of the data base were described in the report, *Agricultural Pesticide Residues in California Well Water: Development and Summary of a Well Inventory Data Base for Non-Point Sources* (Cardozo *et al.*, 1985). To meet the requirements of the PCPA, both point source (where the contaminant flows in a fairly distinct plume from an identifiable source) and non-point source (contamination that cannot be traced to a single definable location) sampling results are now included in the data base.

This 1993 report is the eighth annual report. In 1992, a cumulative report on the entire contents of the data base was issued (Maes, *et al.*, 1992); this is the first update to the 1992 report. A numerical summary of the data contained in the data base by report year is given in Table 1. A glossary of terms used in this report is in Appendix B (p. 97).

Table 1. Numerical Summary of Well Sampling Results Included in the Well Inventory Database, By Report Year, For Data Reported Through June 30, 1993.

CATEGORY	REPORT YEAR 1986	1987	1988	1989	1990	1991	1992	1993	TOTAL
Total Wells Sampled	8,987	574	3,074	752	2,784	1,557	4,741	2,324	18,440
Wells with No Detections	6,583	317	2,791	543	2,550	1,351	3,985	1,945	14,587
Wells with Detections	2,404	257	283	209	234	206	756	379	3,853
Wells with Verified Detections	44	29	4	140	93	133	67	80	547
Total Counties Sampled	53	20	41	33	53	30	52	46	58
Counties with No Detections	30	6	24	11	27	11	24	25	14
Counties with Wells with Detections	23	14	17	22	26	19	28	21	44
Counties with Wells Having Verified Detections	5	3	3	16	8	14	9	17	29
Total Pesticides and Related Compounds Analyzed	160	79	167	96	191	186	125	112	286
Pesticides and Related Compounds with No Detections	144	64	142	81	164	166	85	83	211
Pesticides and Related Compounds with Detections	16	15	25	15	27	20	40	29	75
Pesticides and Related Compounds with Verified Detections	8	6	5	9	6	9	5	10	20
Pesticides and Related Compounds Detected in Ground Water as the Result of Legal, Agricultural Use	9	8	1	7	6	7	5	11	14

(a) Verified, and unverified detections are included in the total.

(b) Detections are designated as verified if residues of a compound are detected in one sample as a result of an analytical method approved by the Department and verified, within 30 days in a second discrete sample taken from the well, by a second analytical method or a second analytical laboratory approved by the Department.

(c) The total is not additive. It is a total of the unique items existing in a category (e.g., a single well that had sampling data reported in the 1986, 1988, and 1990 reports is counted one time only).

(d) Legal, agricultural use is the application of a pesticide, according to its labelled directions and in accordance with federal and state laws and regulations. Agricultural use is defined in Food and Agricultural Code Section 11408.

Interpretation of sampling results in the well inventory data base is subject to the following limitations:

1. *Only data submitted to DPR between July 1, 1992 and June 30, 1993 are included and discussed in this report;*

2. *Data included in this report are not the results of a single study. Rather, they are the result of 46 studies, designed and conducted by eight agencies for varying purposes using different sampling and analytical methods;*

3. *Pesticide residue detections in the well inventory do not represent a complete survey of ground water contamination in the state. The detected compounds are limited to only those for which the sample was specifically analyzed. Therefore, the data indicate which pesticides are present in California well water among those pesticides for which analyses were carried out, but not among all pesticides used statewide;*

4. *Sampling by agencies other than DPR is not necessarily related to suspected agricultural non-point sources of contamination. Consequently, it should not be assumed that the reported results are an indication of which pesticides are more or less likely to leach to ground water as a result of non point-source agricultural use.*

Despite these limitations, the well inventory is a unique archive of ground water sampling data for a single state. Although data bases have been compiled in at least nine other states with the results of ground water monitoring for pesticides, only California centralizes monitoring results on an ongoing basis from all sampling agencies into a single repository.

The information on pesticide residues contained in the well inventory data base can be used in all of the following applications:

1. *Displaying the geographic distribution of well sampling;*

2. *Displaying the known geographic distribution of pesticide residues in wells among those wells sampled;*

3. *Identifying areas potentially sensitive to pesticide leaching;*

4. *Designing studies for future sampling.*

METHODS:

The PCPA requires the Director to maintain a statewide data base of wells sampled for pesticide active ingredients. All sampling results reported to DPR were reviewed to determine if they met the following criteria for inclusion in the data base:

1. *Sampling results were for the analyses of agricultural-use pesticides (see Glossary) or their breakdown products;*

2. *Samples were taken from a well, i.e., from ground water, not surface water or soil;*

3. *Samples were obtained from an untreated and unfiltered system;*

4. *Location of each sampled well was identified by at least township/range/section according to the U.S. Geological Survey Public Lands Survey Coordinate system;*

5. *Data had not been entered into the data base previously.*

The data were entered into a computer and checked with computer verification programs for accuracy.

MAJOR FINDINGS, July 1, 1992 through June 30, 1993:

A total of 30,453 records were added to the well inventory data base for the 1993 update report. Each chemical analysis of a well water sample for a pesticide or related chemical constitutes one record in the data base.

Altogether, samples were taken from 2,324 wells in 46 of California's 58 counties and analyzed for an overall total of 112 pesticide active ingredients and breakdown products. The data represent 46 well sampling surveys conducted by eight agencies from 1985 through 1993 that were reported to DPR during the period July 1, 1992 through June 30, 1993.

Of the 112 compounds analyzed for, Verified detections were made of ten compounds: atrazine, bentazon, bromacil, deethyl-atrazine, deisopropyl-atrazine, diuron, prometon, simazine, TPA, and xylene. Detections are designated as verified if residues of a compound are detected using an analytical method approved by the Department, and

verified within 30 days in a second discrete sample taken from the well, by a second analytical method or a second analytical laboratory approved by the Department.

Verified detections of atrazine, bentazon, bromacil, diuron, prometon, simazine, TPA, and xylene have been reported previously. These were the first detections of deethyl-atrazine and deisopropyl-atrazine in California. Verified detections of pesticides previously found in other areas of the state were made in the following counties for the first time: atrazine in Merced and Ventura counties; bromacil in Orange, Riverside, San Joaquin, and Ventura counties; diuron in Los Angeles and San Bernardino counties; prometon in Merced County; and simazine in Merced, San Bernardino, Ventura, and Yolo counties.

Altogether, pesticide residues were detected and verified in 80 wells in 17 counties. Of the 80 wells with verified detections, 50 were public drinking water wells, 19 were private drinking water wells, and 11 were agricultural or industrial (non-drinking water) wells.

Agricultural applications were determined by DPR to be the source of residues of seven compounds detected in ground water: atrazine, bentazon, bromacil, deethyl-atrazine, deisopropyl-atrazine, diuron, and simazine. DPR also considers agricultural applications to be the source of residues of TPA in ground water. Altogether, 62 wells in 11 counties were determined by DPR to contain pesticide residues as a result of non-point source, legal agricultural use. Simazine (33 wells) was detected most frequently due to such use, followed by atrazine (29 wells), deethyl-atrazine (15), diuron (10), bromacil (7), deisopropyl-atrazine (6), and bentazon (6). (Two or more compounds were detected in 31 of the 62 wells.) Counties with detections due to such use were Fresno, Glenn, Kern, Los Angeles, Orange, Riverside, San Bernardino, Tehama, Tulare, Ventura, and Yuba.

These were the first detections of pesticide residues in ground water in San Bernardino and Ventura counties that were determined by DPR to result from non-point source, legal agricultural use. Previously, detections of atrazine, bentazon, bromacil, diuron, and simazine (singly or in combination) resulting from agricultural use were reported in Butte, Colusa, Contra Costa, Fresno, Glenn, Kern, Los Angeles, Merced, Orange, Placer, Riverside, Sacramento, Stanislaus, Sutter, Tehama, Tulare, Yolo, and Yuba counties.

Use of atrazine, bromacil, diuron, and simazine is controlled in pesticide management zones (PMZs), where the pesticides were detected and determined to be present in ground water as a result of agricultural use. (A PMZ is a geographic surveying unit of approximately one square mile [a section] that is designated in regulation as sensitive to ground water pollution.) During the period July 1, 1992 through June 30, 1993, a total of 33 new PMZs were recommended (singly or in combination) for atrazine, bromacil, diuron, and simazine in Los Angeles, Orange, Riverside, San Bernardino, Tulare, and Ventura counties. These are the first PMZs for San Bernardino and Ventura counties.

No further action will be taken on the verified bentazon detections reported for 1993 because DPR determined that the source of those residues was due to agricultural use of bentazon in rice-growing areas, before DPR prohibited such use in California.

Investigations by DPR show that residues of the pesticide breakdown product TPA reached ground water as the result of normal, agricultural use. However, TPA will not be reviewed under the provisions of the Pesticide Contamination Prevention Act, because the Act specifies that only pesticide degradation products which pose a threat to public health shall be reviewed. The Medical Toxicology Branch of DPR has determined that, at the levels found, TPA does not pose a threat to public health (Oshima, 1992).

Agricultural applications are also considered by DPR to be the source of residues of three other compounds detected in ground water: 1,2-dibromo-3-chloropropane (DBCP); 1,2-dichloropropane (1,2-D); and ethylene dibromide (EDB). Unverified detections of DBCP were reported in 241 wells; 1,2-D in eight wells; and EDB in eight wells. Because those compounds are no longer registered for use in California, the detections were referred to the SWRCB.

Verified detections of xylene in two wells were referred to the SWRCB as possible point-source contamination, because samples taken from the wells during DPR's investigation were found also to contain gasoline components. Xylene, used as a solvent in agricultural pesticides, is also a component of gasoline.

Factors that contribute to ground water contamination by pesticides used in agriculture include amounts used and method of application, irrigation practices, the physicochemical characteristics of the pesticide, soil type, and climate. Regulation of pesticides to prevent residues from entering ground water as a result of non-point source agricultural use depends on scientific knowledge of how pesticides move to ground water. The role each factor plays in the contamination process is not fully understood. DPR environmental scientists are continuing their work to understand these factors by conducting field studies on pesticide movement; investigating contaminated wells; compiling extensive data bases; and reviewing the work of other scientists. The knowledge gained from these activities is being used to develop pesticide use practices that will prevent ground water contamination by the agricultural use of pesticides.

Actions taken by the SWRCB and the California Regional Water Quality Control Boards (RWQCBs) in 1993 to prevent pesticides from migrating to ground water follows:

A. SWRCB staff participated in the following activities:

1. Regularly attended meetings sponsored by DPR, including the interagency Pesticide Advisory Committee, Pesticide Registration and Evaluation Committee, State Environmental Hazards Assessment Committee, and the Interagency Coordinating Committee for Agricultural Regulatory Programs (ICCARP). The ICCARP, formed in 1993, will initially focus on identifying all regulatory programs for state and federal lands that impact the rice industry.

2. Conferred with U.S. Geological Survey scientists to discuss studies dealing with pesticides and water quality.

3. Initiated the development, in cooperation with DPR staff, of a schedule for establishing the Management Agency Agreement that will further coordinate pesticide and water quality management activities and uphold the provisions of the Memorandum of Understanding (MOU) between the two agencies.

4. Reviewed and commented on DPR's proposed amendments to regulations placing pesticides on the Ground Water Protection List and describing PMZs.

5. Prepared text summarizing the State and Regional Water Boards' responsibilities for two drafts of the State Ground Water Protection Plan for Pesticides being developed by DPR.

6. Submitted a workplan to U.S. Environmental Protection Agency pursuant to Section 106 of the Clean Water Act for Federal Fiscal Year 1994 funding for pesticides and ground water-related work.

7. Reviewed on an ongoing basis, DPR Notices of "Materials Entering Evaluation" and will advise DPR on potential water quality impacts of pesticide registration and use decisions.

8. Worked on adapting the Pesticide Use Retrieval System database queries of 1990 and 1991 pesticide usage in select watersheds within the State.

B. RWQCBs:

Actions taken by the nine RWQCBs to prevent and/or mitigate the impact of pesticides on ground water include site contamination assessment investigations, development and implementation of remediation plans (including site and ground water clean-up), and monitoring. In addition, some situations involving pesticide detections in soil and water were referred to appropriate agencies for follow-up action.

PREFACE

This report fulfills the requirements contained in section 13152, subdivision (e) of the Food and Agricultural Code, directing the Department of Pesticide Regulation (DPR) to report specified information on sampling for pesticide residues in California ground water to the Legislature, the California Department of Health Services, the Office of Environmental Health Hazard Assessment, and the State Water Resources Control Board (SWRCB) annually by December 1.

This is the eighth annual report and the first update of the 1992 cumulative report (Maes *et al.*, 1992) which summarized ground water sampling results for agricultural-use pesticides that were reported to DPR between November 1, 1983 and July 1, 1992. This report presents data reported to DPR during the period July 1, 1992 through June 30, 1993.

The Pesticide Contamination Prevention Act (PCPA) requires that the annual report give the location of wells for which sampling results were reported. Although well locations are specified by state well number or township/range/section in the data base, listing individual results by township, range, and section in this report is not possible due to the large number of wells sampled. Instead, sampling locations are summarized by county.

The information in this report is presented in four parts: Sections I, II, and III were written by staff of DPR. Section IV was written by staff of the SWRCB.

ACKNOWLEDGMENTS

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DISCLAIMER

The mention of commercial products, their source or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such product.

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AB 1803	Assembly Bill No. 1803 (Connelly, 1983), Health and Safety Code, sections 4026.2 and 4026.3
AB 2021	Assembly Bill No. 2021 (Connelly, 1985), Food and Agricultural Code, sections 13141 through 13152
AL	action level
AR	active registration
BDPA	The Birth Defect Prevention Act of 1984 (SB 950)
CAL	California Action Level
Cal/EPA	California Environmental Protection Agency
Caltrans	California Department of Transportation
3CCR	Title 3, California Code of Regulations
CDHS	California Department of Health Services
CIMIS	California Irrigation Management Information Systems
CISWP	California Inland Surface Waters Plan
CUI	currently under investigation
CVRWQCB	Central Valley Region, Regional Water Quality Control Board
1,2-D	propylene dichloride; 1,2-dichloropropane
1,3-D	1,3-dichloropropene
2,4-D	2,4-dichlorophenoxyactic acid
DBCP	1,2-dibromo-3-chloropropane
DCPA	chlorthal-dimethyl
DDD	1,1-dichloro-2,2-bis(p-chlorophenyl) ethane
DDT	dichloro diphenyl trichloroethane
DPR	Department of Pesticide Regulation
DRASTIC	a model used for predicting areas vulnerable to ground water contamination
DWR	California Department of Water Resources

EDB	ethylene dibromide
EHAP	Environmental Hazards Assessment Program
ELISA	enzyme-linked immunosorbent assay
EMPM	Environmental Monitoring and Pest Management Branch (DPR)
EPTC	s-ethyl dipropylthiocarbamate (eptam)
ETo	reference evapotranspiration
ETU	ethylene thiourea
FAC	Food and Agricultural Code
GC	gas chromatography
GWPA	ground water protection advisory
GWPL	Ground Water Protection List
HAL	health advisory level
HPLC	high performance liquid chromatography
Koc	soil adsorption coefficient
MCL	maximum contaminant level
MDL	minimum detection limit
MRR	minimum reporting requirement
MS	mass spectroscopy
MTP	monomethyl 2,3,5,6-tetrachloroterephthalate acid
NAS	National Academy of Science
NCRWQCB	North Coast Region, Regional Water Quality Control Board
ND	not detected
NR	not registered
NWQO	numerical water quality objectives
PAC	Pesticide Advisory Committee
PCA	pest control advisor

PCPA	The Pesticide Contamination Prevention Act of 1985 (AB 2021)
PDRP	The Pesticide Detection Response Process
PMZ	pesticide management zone
ppb	parts per billion
ppm	parts per million
PREC	Pesticide Registration Evaluation Committee
RWQCB	Regional Water Quality Control Board
SB 950	The Birth Defect Prevention Act
SCS	Soil Conservation Service
SEHAC	State Environmental Hazards Assessment Committee
SMP	State Management Plan
SNARL	suggested no-adverse-response-level
SNV	specific numerical value
SWRCB	State Water Resources Control Board
TPA	2,3,5,6-tetrachloroterephthalic acid
TRS	township/range/section
USDA	United States Department of Agriculture
USFS	United States Forest Service
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
YCEHS	Yolo County Environmental Health Services

I. WELL INVENTORY DATA BASE

I. WELL INVENTORY DATA BASE

INTRODUCTION:

This report presents information about California water wells that were sampled for the presence of pesticide residues. The sampling results were compiled during the period July 1, 1992 through June 30, 1993 by the Department of Pesticide Regulation (DPR, a department within the California Environmental Protection Agency [Cal/EPA]). The results are an update to the report *Sampling for Pesticide Residues in California Well Water: 1992 Well Inventory Data Base, Cumulative Report 1986-1992* (Maes *et al.*, 1992). The report includes a discussion of actions taken by DPR and the State Water Resources Control Board ([SWRCB] also part of Cal/EPA), including the nine Regional Water Quality Control Boards, to prevent pesticides from entering ground water (Section II, page 21 and Section IV, page 59). Also included in this report is a discussion of factors contributing to the movement of pesticides to ground water as a result of agricultural use (Section III, page 41).

BACKGROUND:

Until 1979, very little well water sampling was conducted in California to determine if pesticide residues had reached ground water, because it was believed that pesticides did not have sufficient mobility or longevity in soil to migrate to ground water. In 1979, however, the soil fumigant 1,2-dibromo-3-chloropropane (DBCP) was detected in ground water in Lathrop, California. That discovery prompted widespread testing, and many areas of DBCP contamination were found. Testing for other pesticides followed and since then, studies have been conducted throughout California by various agencies to determine whether pesticide residues have migrated to ground water.

In 1983, the Environmental Hazards Assessment Program (EHAP) of DPR developed the well inventory data base in order to identify reliable information on the occurrence of non-point source (not traceable to a single definable location) contamination of ground water due to the agricultural use of pesticides, and to facilitate graphical, numerical, and spatial analyses of the data. The contents of the data base were described in the report *Agricultural Pesticide Residues in California Well Water: Development and Summary of a Well Inventory Data Base for Non-Point Sources* (Cardozo *et al.*, 1985).

On January 1, 1986, the Pesticide Contamination Prevention Act (PCPA, see Appendix A, p. 84) added sections 13141 through 13152 to Division 7 of the Food and Agricultural Code (FAC). The PCPA requires DPR to maintain a statewide data base of wells sampled for the active ingredients of pesticides (FAC section 13152[c]) and to report annually to the Legislature, the SWRCB, the California Department of Health Services (CDHS) and the Office of Environmental Health Hazard Assessment specific information from the data base, as well as actions taken by the Director of DPR and the SWRCB to prevent pesticides from migrating to ground water (FAC section 13152[e]). The first annual report pursuant to the PCPA, *Sampling for Pesticide Residues in California Well Water: 1986 Well Inventory Data Base* (Brown, *et al.*, 1986), presented data from the original data base, plus additional data received by DPR from early 1984 through August 31, 1986. Since the passage of the PCPA, both point source (where the contaminant flows in a fairly distinct plume from an identifiable source) and non-point source data are included in the well inventory. The majority of sampling results are from non-point sources.

This report is the eighth annual report and the first update of the 1992 cumulative report. Each report has presented a discussion of well sampling data submitted to the well inventory data base for the report year, as well as the results of investigations conducted by DPR of detections of pesticides currently registered for agricultural use.

It should be noted that data included in the well inventory for the 1993 report are not the results of a single study. Rather, they are the result of 46 separate monitoring surveys, designed and conducted by eight agencies for various purposes, and do not represent a comprehensive study of ground water contamination in the state by agricultural-use pesticides. The data only indicate which pesticides are present in California well water among the pesticides analyzed for in areas where samples were taken, but not among all pesticides used statewide.

Despite these limitations, the well inventory is a unique archive of ground water sampling data for a single state. Although data bases have been compiled in at least nine other states for the results of ground water monitoring for pesticides, only California centralizes monitoring results from all sampling agencies into a single collection point on an ongoing basis.

Sections I, II, and III of this report contain the following information:

Number of wells sampled;
Number of wells, by county, that had detections of pesticide residues;
Status of detected pesticides;
Factors contributing to pesticide movement to ground water as a result of agricultural use;
Actions taken to prevent pesticides from entering ground water.

Section IV of the report contains a summary of actions taken by the SWRCB and the Regional Water Quality Control Boards to prevent pesticides from migrating to ground water.

A glossary of terms used in the 1993 report is provided in Appendix B, page 97.

MATERIALS AND METHODS:

Data Collection

Section 13152, subdivision (c) of the PCPA requires all government agencies that sample wells for pesticides to submit their sampling data and analytical results to DPR for inclusion in the well inventory data base. DPR has notified appropriate agencies of this law and requested them to submit required information on a DPR reporting form, on a form of their own, or on magnetic tape. DPR has also contacted private companies that conduct well sampling for pesticides to request those sampling results for the well inventory.

All sampling results reported to DPR were reviewed to determine if they met the following criteria for inclusion in the data base:

1. *Sampling results were for the analyses of pesticides or pesticide breakdown products;*
2. *Samples were taken from a well;*
3. *Samples were obtained from an untreated and unfiltered system;*
4. *Location of each sampled well were identified by at least township/range/section according to the U.S. Geological Survey's Public Lands Survey Coordinate system;*
5. *Data had not been entered into the data base previously.*

Agencies supplied well sampling data as published reports, raw laboratory results, or retrievals of information on floppy disks or magnetic tape from their data bases.

Published reports were examined to determine if the data met the above criteria. In the case of unpublished laboratory results, verbal confirmation was requested from the appropriate agency staff and noted in file records. For evaluation purposes, print-outs were made of data received on floppy disks or magnetic tape.

The PCPA also requires DPR, the SWRCB, and CDHS to jointly agree on minimum well sampling requirements for all results submitted to DPR. The agencies agreed upon the following minimum reporting requirements, effective December 1, 1986, which are applicable only to well samples taken after that date:

1. *State well number (township/range/section/tract/sequence number/ base and meridian);*
2. *County;*
3. *Date of sample (month, day, and year);*
4. *Chemical analyzed for;*
5. *Individual sample concentration, in parts per billion;*
6. *Minimum detectable limit, in parts per billion;*
7. *Sampling agency;*
8. *Analyzing laboratory;*
9. *Street address of well location*
10. *Well type;*
11. *Sample type (e.g., initial or confirmation).*

Optional information to be included when available:

1. *Method of analysis;*
2. *Well depth (in feet);*
3. *Depths of top and bottom perforations of the well casing (in feet);*
4. *Depth of standing water in the well at time of sampling (in feet);*
5. *Year the well was drilled;*
6. *Whether a driller's log was located;*
7. *Known or suspected source of contamination.*

Data collection required a significant amount of interagency cooperation to ensure that submitted sampling data contained the required information.

Data Preparation

The analytical results for each pesticide residue or related chemical in a well water sample constitute one record in the well inventory data base. The format used for records in the data base is explained in Appendix C, page 108.

Unless they were received on computer tape, data that met the prescribed criteria were transcribed onto forms for data entry. A number was assigned to each sampling survey under which all pertinent records and notes were filed. When possible, state well numbers were obtained from the Department of Water Resources (DWR) and noted on the original data sheets for DPR surveys.

Data Entry into the Permanent Data Base

The completed coding forms were sent to the Franchise Tax Board for data entry. The data were returned to DPR on magnetic tape and loaded onto a computer. Print-outs of the data were generated, proofread against the original data, and edited as necessary. Data received on computer tape were converted to the well inventory data base format by computer program. An additional program was then run on the transformed data to assign to each record a code (called the sample-type) which designated whether the analysis was negative, confirmed positive, or unconfirmed positive (see page 8).

Before being added to the permanent well inventory data base, each record was run through verification programs developed by DPR staff. An explanation of each program follows.

1. ***Column verification:***
   Certain values are allowed for each column in a data base record. The column verification program tests data validity by comparing the values entered in a column to its allowable values. For instance, the third column of the township field may contain either "N" or "S"; any other value will be rejected as an error.

2. ***Field verification** includes the following programs:*

   a. ***Township/range/section (T/R/S) verification:***
      The townships, ranges, and sections assigned to each county by the U.S. Geological Survey's Public Lands Survey Coordinate System were coded and entered into a computer file. A program was written to compare that file with the values entered for the township, range, and section in each record.

b. ***Base Meridian verification:***

Six counties in California (Kern, San Luis Obispo, Trinity, Inyo, Siskiyou, and San Bernardino) are intersected by the Public Lands Survey baseline/meridian boundaries. Data for a single well reported with different base meridians but under the same well number would exist as two unique wells in the data base. This program examines the township and range for each well number in the affected counties to verify that the assigned base meridian is accurate.

3. ***Unique Address verification:***

The well location address for each new record is checked against existing well location information for that well number in the data base. When a discrepancy is found, the new record is flagged as an error.

Data identified by the computer verification programs as requiring further investigation were examined and edited as necessary. The data were then entered into the permanent well inventory data base and summary tables were produced for the annual report.

CONTENTS OF THE WELL INVENTORY DATA BASE:

Format for Reporting Results:

The 1992 cumulative report was a comprehensive summary of all sampling results added to the data base since its inception in November 1983, and the first report to discuss number of wells with detections resulting from the legal, agricultural use of pesticides. Prior to 1992, well inventory reports emphasized the number of wells with confirmed, positive samples. In 1989, however, precise and comprehensive criteria (Biermann, 1989) were established for verifying detections of pesticide residues in ground water as specified by the PCPA (FAC section 13149(3)(d)). Since then, positive samples, whether confirmed or unconfirmed (see below), have not been regulated; only wells with verified detections of pesticide residues (see below) are subject to DPR regulatory action. Therefore, detections are summarized separately in this part of the report as follows: (1) by total number of wells sampled and total number of wells with verified detections and (2) positive, unverified samples. A numerical summary of all well sampling results included in the well inventory, by report year, is given in Table 1, page 155.

Criteria for Classifying Records Added to the Well Inventory Data Base:
Each record in the well inventory data base represents a well water sample that was analyzed for a pesticide residue. Each record was classified according to those analytical results as follows.

Well water samples in which pesticide residues were not detected at or above the minimum detection limit (MDL) of the instruments used for analysis were designated as *negative*.

Positive samples were designated as *unconfirmed* when pesticide residues were detected in only a single sample during the time period of a single monitoring survey. Confirmation of the initial detection by a second positive sample was not possible because either (1) only a single sample was taken from the well or (2) analyses of all other samples taken from the well during the survey were negative for the compound under investigation.

Positive samples were designated as *confirmed* if a specific compound was detected in two discrete samples taken from a single well during the time period of a single monitoring survey. Confirmed detections may be either verified or unverified.

Confirmed detections are *verified* if they meet the criteria specified in FAC section 13149(d) of the PCPA. Section 13149(d) requires that the detection of a pesticide in ground water result from an analytical method approved by DPR and that the initial detection be verified within 30 days after the initial detection by a second analytical method or a second analytical laboratory approved by DPR. Criteria have been set by DPR (Biermann, 1989; see Appendix D, page 113) for determining whether the detection of a pesticide or its breakdown product(s) in ground water meet the standards of section 13149(d). Wells with verified detections of pesticide residues are subject to regulatory action by the Department as outlined in Section II, page 23.

SUMMARY OF DATA BASE CONTENTS BY TOTAL WELLS SAMPLED AND WELLS WITH VERIFIED DETECTIONS

RESULTS BY REPORTING AGENCY

Sampling Distribution

The results from 46 well sampling surveys were reported to DPR for inclusion in the well inventory during the period July 1, 1992 through June 30, 1993. The data represent a total of 2,324 wells in 46 counties that were sampled for an overall total of 112 pesticide active ingredients and breakdown products. The eight agencies (including number of wells sampled by each) submitting data for the 1993 Update Report were:

Federal: *U.S. Department of Agriculture (9 wells);*
State: *DPR (428 wells), CDHS (1,851 wells), DWR (2 wells), Central Valley Regional Water Quality Control Board ([CVRWQCB], 6 wells);*
County: *Glenn (1 well), Yolo (31 wells), and Yuba (47 wells).*

The surveys were conducted from 1985 through 1993. (Some wells were sampled by more than one agency.) A summary of each survey is presented in Appendix E (page 118).

Of the 2,324 wells sampled, 2,066 (89%) were public drinking water wells; 206 (8.9%) were private drinking water wells; 17 (0.7%) were monitoring (non-drinking water) wells; and 35 (1.5%) were agricultural or industrial (non-drinking water) wells.

Type of Wells with Verified Detections

Verified detections were made in a total of 80 wells. Of those, 50 (62.5%) were public drinking water wells, 19 (23.8%) were private drinking water wells, and 11 (13.8%) were agricultural or industrial wells.

RESULTS BY PESTICIDE

Sampling Distribution

Sampling results for 112 pesticide active ingredients and breakdown products were reported. A list of the compounds by total number of counties and wells sampled, number of wells with unverified detections, and number of wells with verified detections, is given in Table 2, page 156.

Sampling frequency varied among the pesticides. For example, 19 of the compounds were each analyzed for in at least 500 wells per compound; 66 other pesticides were analyzed for in less than 50 wells per compound. A comparison of the pesticides most frequently analyzed for, by number of wells and number of counties sampled, illustrates this variation. The six pesticides most frequently analyzed for, by number of wells sampled, were atrazine (1,284 wells), simazine (1,281), 1,2-dichloropropane [1,2-D] (1,094), methyl bromide (1,084), naphthalene and ortho-dichlorobenzene (1,047 each). By number of counties sampled, the six compounds most frequently analyzed for were xylene (41 counties), 1,2-D (40), and 1,3-dichloropropene [1,3-D], methyl bromide, naphthalene, and ortho-dichlorobenzene (39 each).

Wells with Verified Detections

Overall, a total of ten compounds were found in the 80 wells with verified detections. Simazine (verified in 45 wells) was found most frequently, followed by atrazine (32 wells), deethyl-atrazine (15 wells), diuron (13 wells), bromacil (12 wells), bentazon (6 wells), deisopropyl-atrazine (6 wells), xylene (2 wells), prometon (2 wells), and 2,3,5,6-tetrachloroterephthalic acid (TPA , a breakdown product of the active ingredient chlorthal-dimethyl, 1 well). Two or more of these compounds were found in 39 (49%) of the 80 wells with verified detections. A summary of wells with verified detections, by county and pesticide, is given in Table 3, page 159. California counties with verified detections of pesticides in ground water are shown in Figure 1, page 11.

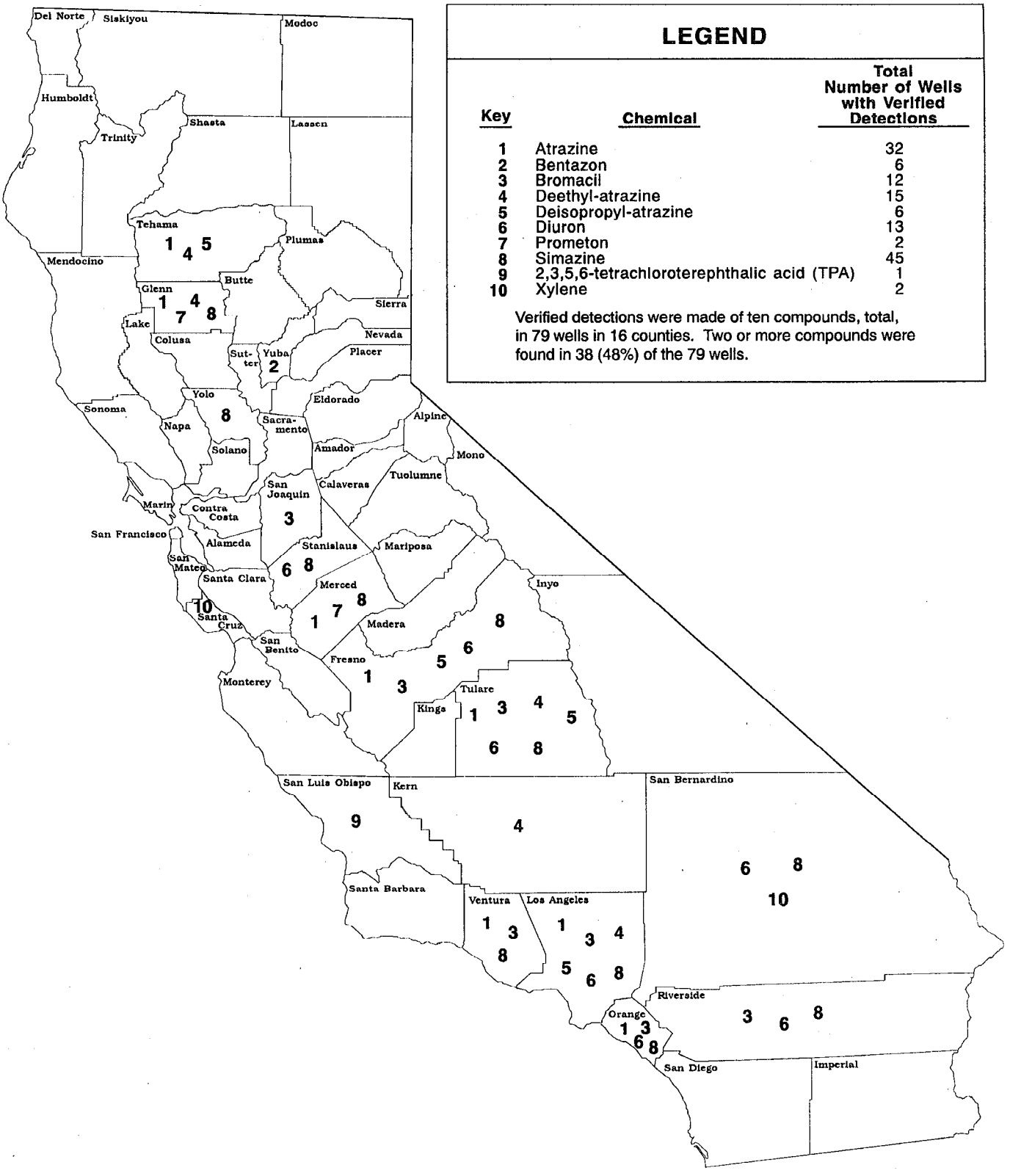
First-time, Verified Detections of Pesticide Metabolites

For the first time in California, sampling was conducted for deethyl-atrazine (a metabolite of the active ingredient atrazine) and deisopropyl-atrazine (a metabolite of the active ingredients atrazine and simazine, see also Section II, p. 30). The monitoring, conducted by DPR during February and March 1993, resulted in verified detections of deethyl-atrazine in 15 wells and deisopropyl-atrazine in six wells. Altogether, the metabolites were detected and verified in 17 wells in six counties. (Both metabolites were detected in four wells.)

Possible Point-source Detections

Verified detections of xylene in two wells were referred to the SWRCB as possible point-source contamination, because samples taken from the wells during DPR's

Figure 1. California counties with confirmed detections of pesticide residues in ground water that were verified pursuant to Food and Agricultural Code Section 13149(d). Results are for data reported to the Department of Pesticide Regulation during the period July 1, 1992 through June 30, 1993.



LEGEND

Key	Chemical	Total Number of Wells with Verified Detections
1	Atrazine	32
2	Bentazon	6
3	Bromacil	12
4	Deethyl-atrazine	15
5	Deisopropyl-atrazine	6
6	Diuron	13
7	Prometon	2
8	Simazine	45
9	2,3,5,6-tetrachloroterephthalic acid (TPA)	1
10	Xylene	2

Verified detections were made of ten compounds, total, in 79 wells in 16 counties. Two or more compounds were found in 38 (48%) of the 79 wells.

investigation were found to contain gasoline components. (Xylene, used as a solvent in agricultural pesticides, is also a component of gasoline.) The SWRCB and nine Regional Water Quality Control Boards (RWQCBs) implement California's system of water quality control. Overseeing mitigation measures and monitoring ground water at point-source sites are under the jurisdiction of the SWRCB and the RWQCBs.

Status of Pesticides and Pesticide Breakdown Products with Verified Detections Included in the 1993 Update to the Database:

Atrazine (Key 1, Figure 1, p. 11)

Atrazine is a selective herbicide used in California primarily for weed control in corn, sorghum, and other crops (Cal/EPA, 1991). It is also used for non selective weed control on rights-of-way and in non cropped areas. Atrazine has been reviewed through the Pesticide Detection Response Process (PDRP) pursuant to sections 13149 through 13151 (FAC). (See also Section II, page 23.) As a result, DPR adopted regulations which prohibit the agricultural, outdoor institutional, and outdoor industrial use of pesticides containing atrazine within atrazine pesticide management zones (PMZs). A PMZ is a geographic surveying unit of approximately one square mile (a section) that is designated in regulation as sensitive to ground water pollution.

Atrazine residues were verified in 32 wells in eight counties out of 1,271 wells sampled in 36 counties. Concentrations of detected residues ranged from 0.1 to 1.0 parts per billion (ppb). CDHS has set a maximum contaminant level (MCL) of 3.0 ppb for atrazine. The counties with verified detections were Fresno (1 well), Glenn (1 well), Los Angeles (19 wells), Merced (1 well), Orange (2 wells), Tehama (2 wells), Tulare (2 wells), and Ventura (4 wells). These were the first verified detections of atrazine in Merced and Ventura counties.

Bentazon (Key 2, Figure 1, p. 11)

Bentazon is an herbicide that was used primarily in California for weed control in rice paddies prior to March 1989 (Cal/EPA, 1991). DPR suspended bentazon use in California after it was detected in ground water in ten counties where rice is a major crop until regulations were adopted in January 1992 that prohibit the use of bentazon on rice, limit bentazon use to non-irrigated or sprinkler-irrigated sites during April through July, and prohibit the use of bentazon in Del Norte and Humboldt counties.

Bentazon residues were verified in six wells in Yuba County out of 393 wells sampled in 21 counties. Concentrations of detections ranged from 0.12 to 3.0 ppb. CDHS has set an MCL of 18.0 ppb for bentazon.

Bromacil (Key 3, Figure 1, p. 11)
Bromacil is an herbicide used primarily in California for weed control in citrus orchards (Cal/EPA, 1991). Bromacil has been reviewed through the PDRP. As a result, DPR adopted regulations which prohibit the agricultural, outdoor institutional, or outdoor industrial uses of bromacil in non-crop areas and on rights-of-way within bromacil PMZs.

Bromacil residues were verified in 12 wells in seven counties out of 943 wells sampled in 34 counties. The detections had concentrations ranging from 0.1 to 1.5 ppb. The U.S. Environmental Protection Agency (USEPA) has established a lifetime health advisory level (HAL) of 90.0 ppb for bromacil. Counties with verified detections were Fresno (1 well), Los Angeles (1 well), Orange (1 well), Riverside (4 wells), San Joaquin (1 well), Tulare (3 wells), and Ventura (1 well). These were the first verified detections of bromacil in Orange, Riverside, San Joaquin, and Ventura counties.

Deethyl-atrazine and ***Deisopropyl-atrazine***
(Key 4 and Key 5, Figure 1, p. 11)
In February and March 1993, DPR conducted the first sampling survey in California for the degradation products deethyl-atrazine and deisopropyl-atrazine (see also Section II, page 30). Deethyl-atrazine is a metabolite of the pesticide active ingredient atrazine; deisopropyl-atrazine, also known as deisopropyl-simazine, is a metabolite of atrazine and the pesticide active ingredient simazine.

Samples were taken from 30 wells located in PMZs in eight counties that were previously found by DPR to contain atrazine residues. Deethyl-atrazine was verified in 15 wells in five counties. Deisopropyl-atrazine was verified in six wells in four counties. Concentrations of detections of deethyl-atrazine ranged from 0.1 to 0.52 ppb. Concentrations of detections of deisopropyl-atrazine ranged from 0.1 to 1.8 ppb. MCLs or HALs have not been set for deethyl-atrazine and deisopropyl-atrazine.

However, the maximum level of combined residues of atrazine plus degradates did not exceed the MCL of 3.0 ppb for atrazine set by CDHS.

Counties with verified detections of deethyl-atrazine were Glenn (1 well), Kern (1 well), Los Angeles (9 wells), Tehama (2 wells), and Tulare (2 wells). Counties with verified detections of deisopropyl-atrazine were Fresno (1 well), Los Angeles (1 well), Tehama (1 well), and Tulare (3 wells).

Diuron (Key 6, Figure 1, p. 11)
In California, the herbicide diuron is used chiefly for weed control on rights-of-way (Cal/EPA, 1991). Diuron has been reviewed through the PDRP. As a result, DPR adopted regulations that prohibit the agricultural, outdoor institutional, or outdoor industrial uses of diuron in non-crop areas or on rights-of-way within diuron PMZs.

Diuron residues were verified in 13 wells in seven counties out of 478 wells sampled in 32 counties. Concentrations of the residues ranged from 0.1 to 0.96 ppb. The USEPA has set a lifetime HAL of 10.0 ppb for diuron. Counties with verified detections were Fresno (1 well), Los Angeles (2 wells), Orange (3 wells), Riverside (3 wells), San Bernardino (2 wells), Stanislaus (1 well), and Tulare (1 well). These were the first detections of diuron in Los Angeles and San Bernardino counties.

Prometon (Key 7, Figure 1, p. 11)
Prometon is an herbicide primarily used in California for landscape maintenance (Cal/EPA, 1991). Prometon has been reviewed through the PDRP. As a result, DPR adopted regulations which prohibit the agricultural, outdoor institutional, and outdoor industrial use of pesticides containing prometon within prometon PMZs.

Prometon residues were verified in one well in Glenn County and one well in Merced County out of 426 wells sampled in 31 counties. Concentrations ranged from 0.16 to 0.67 ppb. The USEPA has set an HAL of 100.0 ppb for prometon. This was the first verified detection of prometon in Merced County.

Simazine (Key 8, Figure 1, p. 11)
Simazine is an herbicide used in California primarily to control weeds in vineyards, citrus orchards, and on rights-of-way (Cal/EPA, 1991). Simazine has been reviewed through the PDRP. As a result, DPR adopted regulations that prohibit the agricultural,

outdoor industrial, or outdoor institutional use of pesticides containing simazine in non-crop areas or on rights-of-way within simazine PMZs.

Simazine residues were verified in 45 wells in 11 counties out of 1,264 wells sampled in 36 counties. Concentrations of the detections ranged from 0.1 to 1.14 ppb. CDHS has set an MCL of 10.0 ppb for simazine. Counties with verified detections were Fresno (2 wells), Glenn (1 well), Los Angeles (9 wells), Merced (1 well), Orange (10 wells), Riverside (7 wells), San Bernardino (4 wells), Stanislaus (1 well), Tulare (7 wells), Ventura (1 well), and Yolo (2 wells). These were the first verified detections of simazine in Merced, San Bernardino, Ventura, and Yolo counties.

TPA (2,3,5,6-tetrachloroterephthalic acid) (Key 9, Figure 1, p. 11)
TPA is a metabolite of the pesticide active ingredient chlorthal-dimethyl. Chlorthal-dimethyl is an herbicide used in California primarily for weed control on broccoli and onion crops (Cal/EPA, 1991). TPA was detected and verified in one well out of six wells sampled in San Luis Obispo County by DPR. The concentrations detected were 1.28 and 4.0 ppb. USEPA has set a lifetime HAL of 4,000.0 ppb for the combined total of chlorthal-dimethyl and its metabolites.

Although DPR's investigation suggests that TPA reached ground water as a result of agricultural use, TPA was not reviewed under the provisions of the PCPA. Pesticide degradation products that are detected in ground water are reviewed through the PDRP, pursuant to FAC section 13149, when they pose a threat to public health and have migrated to ground water as a result of legal, agricultural use. At the request of the Department, the registrant submitted all available toxicology studies on TPA. After a review of the toxicological data, the Medical Toxicology Branch of DPR concluded that, at the levels detected in ground water, TPA does not pose a threat to public health (Oshima, 1992). Therefore, TPA was not submitted into the PDRP.

Xylene (Key 10, Figure 1, p. 11)
Xylene is registered for use as an active ingredient in agricultural pesticides. Xylene is also used as a solvent in the formulation of certain pesticides and is a manufacturing intermediate for various organic products, including gasoline. Residues of xylene were verified in one well in San Bernardino County and one well in Santa Cruz County out of 992 wells sampled in 41 counties. Concentrations of detections ranged from 1.2 to 140.0 ppb. CDHS has set an MCL of 1,750.0 ppb for xylene. Xylene has not been

reviewed through the PDRP because it has not been detected in ground water as a result of legal, agricultural use.

RESULTS BY COUNTY

Sampling Distribution

Sampling results were reported for 46 of California's 58 counties for the 1993 report. A tabular summary, by county, of the pesticides for which analyses were run (providing number of wells with negative, positive, and verified detections, and total number of wells sampled for each compound) appears in Appendix F (p. 124). A comparison, by county, of total wells sampled versus number of wells with verified, negative, and unverified detections is given in Table 4, page 160.

The total number of pesticides sampled per county ranged from two (Lake County) to 66 (Kern County). More than 25 compounds, total, were sampled for in half of the counties reporting results.

The number of wells sampled per county ranged from one (Del Norte, Nevada, and Shasta counties) to 426 (Los Angeles County). Of total wells sampled, over half (1,238) were located in five counties: Los Angeles (426 wells), San Bernardino (224), Sacramento (212), Orange (194), and Fresno (182). This variation is attributable not only to differences in pesticide use among counties, but also to differences in design of well sampling studies among various agencies.

Counties with Wells with Verified Detections

Verified detections were made in a total of 17 counties. Los Angeles County had 22 wells with verified detections; Orange County, ten wells; Tulare County, nine wells; Riverside, seven wells; Yuba County, six wells; and San Bernardino County, five wells. The remaining 11 counties had fewer than five wells each with verified detections: Fresno, Glenn, Kern, Merced, San Joaquin, San Luis Obispo, Santa Cruz, Stanislaus, Tehama, Ventura, and Yolo.

The most pesticides detected and verified in a single county was six. Verified detections of six compounds were made in both Los Angeles and Tulare counties. Verified detections were made of five compounds in Fresno County, four compounds in both Glenn and Orange counties, and one to three compounds in each of the remaining 12 counties.

Counties with First-time, Verified Detections

For the first time, verified detections of pesticides previously found in other areas of California were made in the following counties: atrazine in Merced and Ventura counties; bromacil in Orange, Riverside, San Joaquin, and Ventura counties; diuron in Los Angeles and San Bernardino counties; prometon in Merced County; and simazine in San Bernardino, Ventura, and Yolo counties.

Possible Point-source Detections

Detections of xylene in one well in San Bernardino County and another well in Santa Cruz County were determined not to be the result of agricultural use, since other components of gasoline were present in samples taken from the wells. Those detections have been referred to the SWRCB.

SUMMARY OF DATA BASE CONTENTS BY POSITIVE, UNVERIFIED SAMPLES

Of the 30,417 records (samples) added to the well inventory for the 1993 update report, 697 were unverified, positive samples. These samples did not result in verified detections because either (1) follow-up sampling was not conducted by DPR because the compound reported detected was not registered for agricultural use; or (2) analyses of all other samples taken by DPR in response to the positive sample were negative for the compound under investigation. Negative follow-up samples may result from different analytical methods or MDLs used, or from delays (sometimes years) in reporting the initial detection to DPR. A summary of all positive samples (verified and unverified) added to the data base for the 1993 update report is given in Table 5, page 162.

Overall, positive, unverified samples were taken from 299 wells in 18 counties for a total of 25 pesticide active ingredients and three breakdown products. Nine of the compounds with unverified samples also had verified detections: atrazine, bentazon, bromacil, deethyl-atrazine, deisopropyl-atrazine, diuron, prometon, simazine, and xylene. Six of the compounds with unverified, positive samples were not registered for use in California: 1,2-D; DBCP; EDB; ortho-dichlorobenzene; tetrachloroethylene; and toxaphene. Another compound, naphthalene, was not registered for agricultural use.

Information on those samples was reported to the SWRCB. Of the remaining compounds, 11 were pesticide active ingredients currently registered for agricultural use: alachlor, aldicarb, benomyl, dimethoate, endosulfan, EPTC (eptam), methomyl, methyl bromide, molinate, prometryn, and thiram; and one, endosulfan sulfate, was a breakdown product of the active ingredient endosulfan.

LIMITATIONS ON INTERPRETING THE DATA

Interpretation of sampling results in the well inventory data base are subject to the following limitations:

1. *Only data submitted to DPR between July 1, 1992 and June 30, 1993 are included and discussed in this report.*

2. *The data included in this report are not the results of a single study. Rather, they are the results of 46 studies, designed and conducted by eight agencies for varying purposes.*

3. *Pesticide residue detections in the well inventory do not represent a complete survey of ground water contamination in the state. The pesticides detected are limited to those for which the sample was specifically analyzed. Therefore, the data indicate which pesticides are present in California well water among those pesticides for which analyses were carried out, but not among all pesticides used statewide.*

4. *Sampling by agencies other than DPR is not necessarily related to suspected agricultural non-point sources of contamination. Consequently, it should not be assumed that the submitted results, by those agencies, are an indication of which pesticides are more or less likely to leach to ground water as a result of non-point source agricultural use.*

Despite these limitations, the information on pesticide residues contained in the well inventory data base can be used in all of the following applications:

- *Displaying the geographic distribution of well sampling;*
- *Displaying the known geographic distribution of pesticide residues in wells among those sampled;*
- *Identifying areas potentially sensitive to pesticide leaching;*
- *Designing studies for future sampling.*

SUMMARY

During the period July 1, 1992 through June 30, 1993, results were reported for 2,324 wells, located in 46 counties, that were sampled for an overall total of 112 pesticide active ingredients and breakdown products. The data represent 46 well sampling surveys conducted by eight agencies from 1985 through 1993.

Of the 112 compounds for which analyses were reported, 29 pesticide active ingredients and breakdown products were reported detected in 379 wells in 21 counties. Verified detections were made of ten compounds, total, in 80 wells in 17 counties. Two or more compounds were found in 39 (49%) of the 80 wells. Of those, 50 were public drinking water wells, 19 were private drinking water wells, and 11 were agricultural or industrial (non-drinking water) wells.

For the first time, deethyl-atrazine (a metabolite of the active ingredient atrazine) and deisopropyl-atrazine (a metabolite of the active ingredients atrazine and simazine) were sampled for and detected in California. Of the ten compounds with verified detections, simazine (detected in 45 wells) was found most frequently, followed by atrazine (32 wells), deethyl-atrazine (15 wells), diuron (13 wells), bromacil (12 wells), bentazon (6 wells), deisopropyl-atrazine (6 wells), xylene (2 wells), prometon (2 wells), and TPA (1 well). The detections of xylene were referred to the SWRCB as possible point-source detections.

Verified detections of pesticides previously found in other areas of California were made in the following counties for the first time: atrazine in Merced and Ventura counties; bromacil in Orange, Riverside, San Joaquin, and Ventura counties; diuron in Los Angeles and San Bernardino counties; prometon in Merced County; and simazine in San Bernardino, Ventura, and Yolo counties.

II. ACTIONS TAKEN BY THE DEPARTMENT OF PESTICIDE REGULATION TO PREVENT PESTICIDES FROM ENTERING GROUND WATER AS A RESULT OF AGRICULTURAL USE

II. ACTIONS TAKEN BY THE DEPARTMENT OF PESTICIDE REGULATION TO PREVENT PESTICIDES FROM ENTERING GROUND WATER AS A RESULT OF AGRICULTURAL USE

ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM:

The Environmental Hazards Assessment Program (EHAP) of the Environmental Monitoring and Pest Management Branch provides the lead role in implementing DPR's environmental protection programs. EHAP designs and conducts field studies on the environmental fate of pesticides; conducts monitoring for pesticides in air, soil, surface, and ground water; investigates wells with reported detections of pesticides; compiles extensive data bases; reviews scientific literature; and writes regulations to prevent pesticide contamination of ground water. A summary of some of those actions, taken during the period July 1, 1992 through June 30, 1993, follows.

REGULATIONS PROPOSED, July 1, 1992 through June 30, 1993:

Regulations were proposed by the Department in September 1992 that would: (1) add pesticides to both subsections (a) and (b) of the Groundwater Protection List (GWPL); (2) identify new pesticide management zones (PMZs) which are geographic areas determined to be sensitive to ground water pollution; and (3) modify the way that pesticides containing aldicarb, atrazine, bentazon, bromacil, diuron, prometon, or simazine are regulated in those sensitive areas by removing the chemical specific designation of all current or proposed PMZs.

A public hearing was held and written comments were received regarding the proposed regulations. To fully address those comments, the Department has withdrawn the proposed regulations and is reviewing options for modifying the ground water protection program.

STATE MANAGEMENT PLAN FOR PESTICIDES:

In October of 1991, the U.S. Environmental Protection Agency (USEPA) issued its *Pesticides and Ground Water Strategy* (USEPA, 1991). In that Strategy, USEPA outlined their plans for requiring states to prepare State Management Plans (SMP):

"In the event the EPA determined that the SMP requirement is necessary for a chemical, its legal sale and use would be confined to states with an acceptable SMP approved by EPA. EPA will be applying SMPs as label requirements, so that the product can be legally used only in states with an approved SMP." (p. ES-10)

DPR, with funding from the USEPA, has put together a preliminary draft of a generic SMP titled *State of California Management Plan for Pesticides and Ground Water Protection (Generic)* (Stoddard, 1993). Because Federal requirements and guidance for State Management Plans have not been established, the California Plan was not submitted to the USEPA for concurrence as a SMP, but rather to fulfill obligations of a USEPA grant.

GROUND WATER PROTECTION TRAINING:

The Department has conducted ground water protection training for licensed pest control advisors (PCAs) since 1990. In February 1993, ground water protection training was conducted in order to enable PCAs to write site-specific ground water protection advisories (GWPAs). The GWPA contains specific information for applying the regulated pesticide for crop production in a PMZ in order to prevent the movement of pesticide residues to ground water. They are written by PCAs who have successfully completed the training program and must be submitted by permit applicants before a county agricultural commissioner can issue a permit for allowed uses of a regulated pesticide in a PMZ. Three-hour training sessions were held at Visalia, Fresno, Sacramento, and San Bernardino. The training provided up-to-date information on the extent of pesticide residues in ground water, the sources of pesticide residues, pathways by which contamination can occur, factors which influence migration of pesticides to ground water, and measures which can be taken to decrease such movement. The training placed special emphasis on water management, which is fundamental for developing site-specific ground water protection strategies.

THE PESTICIDE DETECTION RESPONSE PROCESS (PDRP, conducted pursuant to sections 13149 through 13151 [FAC] of the PCPA):

Detections of pesticide residues in ground water may be the result of monitoring surveys conducted by DPR or may be reported to DPR by local, state, federal, or non-governmental agencies that conduct monitoring. When detections of pesticides in

ground water are reported to DPR, they are reviewed for appropriate follow-up action under the provisions of the PCPA.

All detections of pesticide active ingredients currently registered for agricultural use or their breakdown products are investigated by DPR to determine if their presence in ground water is the result of legal agricultural use; i.e., the pesticide was properly applied according to its labeled directions and in accordance with federal and state laws and regulations. Detections of pesticides in the following categories are referred to the SWRCB: detections of pesticides not currently registered for use (e.g., DBCP); detections of pesticides registered for other than agricultural or outdoor uses; and detections of pesticides determined *not* to be present in ground water as a result of legal agricultural, outdoor institutional, or outdoor industrial use. The SWRCB and nine Regional Water Quality Control Boards protect the quality of all waters of the state and regulate factors which may affect the quality of waters of the state in order to attain the highest water quality which is reasonable.

During the Pesticide Detection Response Process, the detection of a pesticide residue in soil or ground water is investigated, evaluated, and when necessary, mitigated. Mitigation measures range from the adoption of regulations which modify the agricultural use of a pesticide to reduce its likelihood of reaching ground water, to the suspension or cancellation of a pesticide registration. The investigative phase includes verification of the reported detection and an agricultural use determination. These investigative activities include a determination of whether:

- *the residue detected (active ingredient, breakdown product, or any other specified ingredient) is from a pesticide that is registered for agricultural use in California;*
- *the application of such a pesticide in the vicinity of the detection was reasonably likely;*
- *a point source was not a likely cause;*
- *a non-agricultural use of the pesticide was not a likely source; or*
- *a non-pesticide source was not a likely cause.*

DPR conducts two types of surveys during an investigation of pesticide residues in ground water. First, a well monitoring survey is conducted to determine if there is a second well in the same area as the reported positive well that contains verified

detections of the pesticide under investigation. This helps in determining that the residue did not result from a point source. The well survey consists of collecting water samples from other wells in the same section as the reported positive well and/or in one or more of the three sections located closest to the positive well. Second, a land use survey is conducted to identify potential sources of the contamination and to gather information on the physical features of the area surrounding the positive well. Geographical features (such as natural vegetation, residences or industry) are identified on a map, and the area immediately surrounding the well is investigated.

Samples taken from the selected wells are analyzed to confirm the initial detection. Section 13149(d) (FAC) of the PCPA requires that the detection of a pesticide or its breakdown product in ground water must be by an analytical method approved by the Department and must be verified, within 30 days, by a second analytical method or a second analytical laboratory approved by the Department. Criteria have been set (Biermann, 1989; see Appendix D, p. 113) for meeting these requirements. Detections meeting the criteria are designated as verified. Pesticide active ingredients with verified detections of residues in ground water, and which are determined to be present as the result of legal agricultural use, are subject to regulatory action by the Director. Reported detections that are not verified are removed from the PDRP.

Actions Taken by DPR on Reported Detections

A total of 29 pesticide active ingredients and breakdown products were reported with detections during the period July 1, 1992 through June 30, 1993. Monitoring surveys were conducted by EHAP according to the PDRP for 11 of those compounds: alachlor, benomyl, dimethoate, endosulfan and its breakdown product endosulfan sulfate, EPTC, methomyl, methyl bromide, prometryn, thiram, and xylene. In addition, surveys were completed during that period for eight compounds still under investigation at the time the 1992 well inventory report was released: carbon disulfide, chlorthal-dimethyl, 1,3-D, 2,4-D, lindane, methoxychlor, methyl bromide, and thiobencarb. Monitoring surveys were also conducted for seven pesticide active ingredients that were previously reviewed: aldicarb, atrazine, bentazon, bromacil, diuron, prometon, and simazine.

Investigations were not conducted by DPR for ten of the 29 detected compounds because they were either no longer registered for use in California (DBCP, 1,2-D, EDB, ortho-dichlorobenzene, tetrachloroethylene, and toxaphene); not currently

registered for agricultural use in California (naphthalene); were breakdown products of active ingredients that have already been reviewed through the PDRP (deethyl-atrazine and deisopropyl-atrazine); or, in the case of TPA, will not be regulated under the provisions of the PCPA (see also page 23). Detections of compounds that were no longer registered for use or were not registered for agricultural use were referred to the SWRCB.

Monitoring Surveys for Pesticides Previously Reviewed through the PDRP

Monitoring surveys were conducted by DPR in 11 counties for new detections of the seven compounds previously reviewed through the PDRP. As a result, verified detections of atrazine, bentazon, bromacil, diuron, prometon, and simazine were made in 14 wells in five counties: atrazine and bromacil in one well in Los Angeles County; atrazine, prometon, and simazine in one well in Merced County; simazine and diuron in one well in Stanislaus County; bentazon in six Yuba County wells; and, in Tulare County, bromacil, diuron, and simazine in one well, bromacil in another well, and simazine in three other wells. A reported detection of aldicarb in a small water system in Yolo County, made in 1987, was not verified because no residues of the parent compound or its breakdown products, aldicarb sulfone and aldicarb sulfoxide, were detected in follow-up samples. A reported detection of prometon in Kern County, made in 1986, was also not verified because no residues of that compound were detected in follow-up samples.

Use of atrazine, bromacil, diuron, prometon, or simazine is regulated in Pesticide Management Zones (PMZs), where the pesticides were detected and determined to be present in ground water as a result of agricultural use. (A PMZ is a geographic surveying unit of approximately one square mile [a section] that is sensitive to ground water pollution.) The bromacil detections in Tulare County were determined to be due to non-point source, legal agricultural use; consequently, two sections in Tulare County were recommended as PMZs for bromacil. Monitoring surveys are currently in progress in Los Angeles, Merced, Stanislaus, and Tulare counties to determine the source of residues of other detections of atrazine, bromacil, diuron, prometon, and simazine that were made during the 21 initial surveys.

Verified detections of bentazon in six Yuba County wells were determined to be the result of agricultural use of bentazon in rice-growing areas before the adoption of regulations in January 1992 that prohibited such use.

Monitoring Surveys for Pesticides not Previously Reviewed through the PDRP

Monitoring surveys were conducted by DPR in 19 counties for compounds not previously reviewed through the PDRP. Results of those surveys are listed by county in Table 1, pages 28 and 29.

Of the 17 active ingredients and one breakdown product under investigation, only detections of xylene were verified in follow-up monitoring. Those residues were determined to be likely point-source contaminants as other components of gasoline were found in the positive wells. Initial detections of the remaining compounds were not verified because either no pesticide residues were detected in follow-up samples, or pesticide residues were detected in only one of the follow-up samples and could not be verified by a second positive sample.

TPA, a metabolite previously found in California ground water, was also detected during follow-up sampling conducted for the active ingredient chlorthal-dimethyl. Although DPR's investigation suggests that TPA can occur in ground water as a result of non-point source, legal agricultural use, TPA will not be regulated under the provisions of the PCPA. Degradation products of pesticides detected in ground water are reviewed through the PDRP only when they pose a threat to public health and have migrated to ground water as a result of legal, agricultural use (FAC section 13149[a][3]). At the request of DPR, the registrant of chlorthal-dimethyl submitted all available toxicology studies on TPA. After a review of the data, the Medical Toxicology Branch of DPR concluded that, at the levels detected in ground water, TPA does not pose a threat to public health (Oshima, 1992).

In addition to the 18 compounds, samples taken during the monitoring surveys were also analyzed for five herbicides previously found in California ground water: atrazine, bromacil, diuron, prometon, and simazine. Overall, verified detections of atrazine, bromacil, diuron, and simazine were made in a total of 11 wells in five counties during the PDRP surveys.

Of the detections made during the PDRP surveys, the following were determined to be the result of non-point source, legal agricultural use: simazine in two wells in Riverside County and two wells in San Bernardino County, simazine and diuron in another well in San Bernardino County, and atrazine in four wells in Ventura County.

Table 1. Detections of pesticide active ingredients, or their metabolites, investigated by the Department of Pesticide Regulation between July 1, 1992 through June 30, 1993, which were reviewed through the Pesticide Detection Response Process (PDRP).

County	Active Ingredient or Metabolite	Result of Investigation
Fresno	1,3-D, xylene	Not detected in follow-up sampling (ND); removed from the PDRP.
Glenn	endosulfan, endosulfan sulfate	ND, removed from PDRP.
Humboldt	benomyl, thiram	ND, removed from PDRP.
Kern	EPTC, xylene	ND, removed from PDRP.
Los Angeles	chlorthal-dimethyl, 2,4-D, lindane (2 surveys), xylene thiobencarb, methoxychlor	ND, removed from PDRP.
Madera	methyl bromide	ND, removed from PDRP.
Monterey	xylene	ND, removed from PDRP.
Orange	dimethoate, prometryn	ND, removed from PDRP.
Riverside	thiobencarb (2 surveys)	ND, removed from PDRP.
San Bernardino	alachlor, thiobencarb, xylene (2 surveys)	Detection of xylene in one well was possible point-source, non-pesticide use; others ND; all removed from PDRP.
San Francisco	methomyl	ND, removed from PDRP.
San Joaquin	2,4-D	ND, removed from PDRP.
San Luis Obispo	chlorthal-dimethyl, carbon disulfide (2)	ND, removed from PDRP.
San Mateo	2,4-D, xylene	ND, removed from PDRP.
Santa Cruz	xylene	Possible point-source, non-pesticide use; removed from PDRP.
Sonoma	carbon disulfide (2), xylene	ND, removed from PDRP.
Tulare	xylene, methyl bromide	ND, removed from PDRP.

Table 1. (continued)

County	Active Ingredient metabolite	Result of Investigation
Ventura	methyl bromide	ND, removed from PDRP.
Yuba	2,4-D (2)	ND, removed from PDRP.

As a result, five PMZs were recommended: two atrazine PMZs in Ventura County; one simazine PMZ in Riverside County; one simazine PMZ in San Bernardino County; and a PMZ for diuron and simazine in San Bernardino County. The remaining detections of atrazine and bromacil in one well in Fresno County; bromacil and simazine in one well in Tulare County; bromacil in one well in San Joaquin County; bromacil in one well and simazine in another well in Ventura County are currently under investigation by DPR.

ADJACENT SECTION MONITORING:

The Department samples wells located in sections adjacent to PMZs to determine if the adjacent sections are also sensitive to ground water pollution. A land use survey is conducted concurrently to determine if pesticides regulated in PMZs may have been used in the area under investigation. Those results, together with analyses of the well samples and any other available evidence, are used to determine whether an adjacent section should also be declared a PMZ.

During the period July 1, 1992 through June 30, 1993, well sampling was conducted in 23 previously unmonitored sections adjacent to PMZs in Los Angeles County. Fourteen additional sections were examined but not monitored because no wells could be located, existing wells were not operating, or permission to sample could not be obtained from well owners. In Orange County, sampling was conducted in nine of the 17 sections that were examined. In Riverside County, wells were sampled in three of the nine sections that were examined.

Out of a total of 57 wells sampled, verified detections were made in 28 wells (49.1%). Two or more compounds were found in half of the 28 wells with verified detections. Overall, simazine was detected most frequently (19 wells), followed by atrazine (14), diuron (8), and bromacil (5).

Verified detections were made in all three sections sampled in Riverside County. Six of the nine sections sampled in Orange County had verified detections, as did ten of 23 sections in Los Angeles County. Altogether, verified detections were made in 19 of the 35 sections sampled (54.3%) in the three counties. Simazine and atrazine, the two most frequently detected pesticides, were found in 37.1% and 31.4%, respectively, of the sections sampled.

As a result of adjacent section monitoring conducted during July 1, 1992 through June 30, 1993, 26 new sections were recommended as PMZs. Results of adjacent section monitoring for the three counties are presented in Table 2, page 31.

BENTAZON MONITORING:

About 98 percent of the herbicide bentazon was used on rice paddies in California before its detection in 1989 in wells in ten counties where rice is a major crop. As a result of those detections, bentazon use was banned until it was reviewed through the PDRP. The Department adopted regulations in January 1992 that added bentazon to the Ground Water Protection List (section 6800(a) (3CCR)), prohibited the use of bentazon on rice, limited bentazon use to non-irrigated or sprinkler-irrigated sites during April through July, and prohibited the use of bentazon in Del Norte and Humboldt counties. The Director of DPR also required staff continue to monitor for the presence of bentazon in ground water in areas of bentazon use after the establishment of the use modifications.

A survey of nine wells was conducted in May 1993 in San Mateo and Santa Barbara counties where two-thirds of all bentazon reported used in 1991 had been applied. The areas were also selected for sampling because they were far removed from rice-growing areas with historical uses of bentazon. Wells located in sections with documented use of bentazon were chosen for sampling. In addition to bentazon, samples taken from the wells were analyzed for atrazine, bromacil, diuron, prometon and simazine. No pesticide residues were detected in any of the monitored wells.

WELL SURVEY FOR TWO ATRAZINE DEGRADATION PRODUCTS:

Atrazine has been detected in more than 100 wells in California. Atrazine is a selective herbicide used in California primarily for weed control in corn, sorghum, and other crops (Cal/EPA, 1991). Deethyl-atrazine and deiospropyl-atrazine, degradation

Table 2. Number of wells and sections and number of wells with detections verified pursuant to Food and Agricultural Code section 13149 (d), by county, during a well survey conducted by the Department of Pesticide Regulation in sections adjacent to Pesticide Management Zones (PMZs). Results are for sampling conducted during February and March 1993.

	Number of wells containing:					Total number of wells:		Number of sections containing:				Total number of sections:		
County	Atrazine	Simazine	Bromacil	Diuron	Two or More compounds	With Verified detections	Sampled	Atrazine	Simazine	Bromacil	Diuron	With Verified detections	Recommended as PMZs *	Sampled
Los Angeles	12	5	0	2	5	14	35	9	4	0	1	10	14	23
Orange	2	9	1	3	5	9	16	2	6	1	2	6	9	9
Riverside	0	5	4	3	4	5	6	0	3	3	2	3	3	3
Totals	14	19	5	8	14	28	57	11	13	4	5	19	26	35

* Although not sampled, four sections in Los Angeles County and three sections in Orange County were recommended as PMZs based on a preponderance of evidence.

products associated with atrazine, have been found in ground water in Wisconsin and Canada. Deethyl-atrazine is a metabolite of the active ingredient atrazine. Deisopropyl-atrazine, also known as deisopropyl-simazine, is a metabolite of atrazine and the active ingredient simazine. In February and March 1993, DPR conducted the first sampling survey for the degradation products in California (Kim, 1993).

Samples, analyzed for atrazine, simazine, deethyl-atrazine, and deisopropyl-atrazine, were taken from 30 wells located in PMZs that were previously found to contain atrazine residues. Results of the monitoring are presented in Table 3, page 33. Detections of atrazine were verified in 16 wells, simazine in 10 wells, deisopropyl-atrazine in 6 wells, and deethyl-atrazine in 15 wells. Residues of at least one compound were found in 21 (70%) of the 30 wells sampled. The maximum level of combined residues of atrazine plus degradates did not exceed the CDHS maximum contaminant level (MCL) of 3.0 parts per billion (ppb) for atrazine. The maximum level of combined residues of simazine plus degradates did not exceed the CDHS MCL of 10 ppb for simazine.

GROUND WATER PROTECTION LIST MONITORING:

The Ground Water Protection List (GWPL) is a list of pesticides having the potential to pollute ground water. It is established by FAC section 13145(d) and placed in section 6800 (3CCR). The GWPL is divided into sublists (a) and (b). Sublist (a) is comprised of chemicals detected in soil or ground water as a result of legal, agricultural use. Sublist (b) includes chemicals that meet the conditions specified in FAC section 13145(d). These are pesticide active ingredients whose physicochemical properties exceed certain values (called specific numerical values or SNVs, [Johnson, 1991]) and that are labeled for use under any of the following conditions: (1) application to or injection into the soil; or (2) for application to or injection into soil by chemigation; or (3) application to be followed, within 72 hours, by flood or furrow irrigation. In order to determine whether these economic poisons have migrated to ground water, DPR is required to conduct monitoring for materials on the GWPL.

Before monitoring begins, chemicals on the GWPL are ranked for various factors used to determine in which order and to what extent the compounds should be monitored in California. First priority for monitoring is given to pesticide active ingredients that have been detected in ground water due to non-point sources in other states or which

Table 3. Number of wells[1], by county, with detections verified pursuant to Food and Agriculture Code section 13149 (d) during a well survey conducted by the Department of Pesticide Regulation for two atrazine degradation products, deethyl atrazine and deisopropyl atrazine. Results are for sampling conducted during February and March 1993.

County	atrazine	deethyl-atrazine	deisopropyl-atrazine	simazine	Totals
Fresno			1	1	1
Glenn	1	1			1
Kern		1			1
Los Angeles	11	9	1	6	12
Orange				1	1
Tehama	2	2	1		2
Tulare	2	2	3	2	3
Totals	**16**	**15**	**6**	**10**	

[1] Detections are designated as verified if residues of a compound are detected in one sample as a result of an analytical method approved by the Department and verified, within 30 days in a second discrete sample taken from the well, by a second analytical method or a second analytical laboratory approved by the Department.

are given a high priority for risk assessment on the list of pesticide active ingredients created for implementing the Birth Defect Prevention Act (SB950). For chemicals given first priority, between 25 and 40 wells are sampled. Second priority pesticides are selected based on pounds of active ingredient sold per year and on a combination of physicochemical factors; 15 to 25 wells are sampled for this group. Remaining compounds on the list are given third priority for monitoring, and 10 to 15 wells are sampled.

In 1992, 48 pesticide active ingredients were placed on the GWPL and prioritized. As a result, 24 pesticides were placed in the first priority group. A total of 97 wells in 16 counties were sampled for six compounds from the first priority group during February, March, and April 1993. Seven to 23 wells were sampled for each compound. Sampling results, by county and pesticide, are presented in Table 4, page 35. None of the compounds from sublist (b) of the GWPL were detected in any of the wells. However, verified detections were made of pesticides on sublist (a): simazine in one well in Fresno County, one well in Glenn County, and two wells in Yolo County; prometon in one well in Glenn County; and diuron in one well in Fresno County. These detections triggered follow-up investigations that are still under way.

Additional wells will be sampled between July 1, 1993 and June 30, 1994 to complete the sampling requirements for 2,4-D, cyanazine, diazinon, hexazinone, and metribuzin. Between 25 and 40 wells will also be sampled for two or more additional compounds from the first priority group.

MONITORING FOR THE PRESENCE OF SOIL-APPLIED HERBICIDES IN RIGHTS-OF-WAY INFILTRATION DRAINAGE BASINS IN SAN JOAQUIN COUNTY:

The Department conducted a study (Simmons, 1993) in cooperation with the California Department of Transportation (CalTrans) to investigate the presence of herbicide residues in rights-of-way infiltration drainage basins. The objective was to determine the presence of soil-applied herbicide residues in storm runoff water flowing into the basins and in basin soil. In addition, ground water samples were collected from three domestic water wells located on properties immediately adjacent to two of the infiltration basin study sites.

Table 4. Number of wells sampled, by county, for pesticide active ingredients placed on the Ground Water Protection List (Title 3, California Code of Regulations, section 6800 (b)). Results are for sampling conducted by the Department of Pesticide Regulation during the period February 1993 through June 1993.

County	2,4-D	Cyanazine	Diazinon	Hexazinone	Metribuzin	Molinate
Butte						6
Colusa	5					4
Fresno		3	4	6		
Glenn	1					6
Kern		4				
Kings	1					
Madera			4			
Merced			4	5		
Placer						1
Sacramento	5					
San Joaquin				4	4	
Solano	2					
Stanislaus			4			
Sutter					1	5
Yolo	5				10	
Yuba						1
Totals	**19**	**7**	**16**	**15**	**15**	**23**

Based on pesticide residues detected in surface water in the nearby basins, samples from two of the wells were analyzed for atrazine, bromacil, diuron, oryzalin, oxyfluorfen, prometon, and simazine. Samples from the third well were analyzed for atrazine, bromacil, diuron, prometon, and simazine. No pesticide residues were detected in any of the well water samples.

COMPLIANCE MONITORING:

Regulations to prevent further ground water contamination in PMZs include prohibiting certain uses of chemicals listed in sublist (a) of the GWPL within their PMZs. Agricultural, outdoor industrial, and outdoor institutional use of atrazine within atrazine PMZs or prometon within prometon PMZs is prohibited. Non-crop and rights-of-way use of bromacil, diuron, or simazine is prohibited within their respective PMZs. To ensure compliance with those prohibitions, the Department conducts yearly soil monitoring in approximately 10% of the PMZs for each regulated pesticide. Monitoring is carried out according to the "Protocol for monitoring pesticides for which some or all uses are prohibited in Pesticide Management Zones".

During the period July 1, 1992 through June 30, 1993, compliance monitoring was conducted for atrazine, bromacil, diuron, and simazine. The number of PMZs selected for monitoring each herbicide is listed by county in Table 5, page 37. A total of 19 PMZs were monitored, including six that were monitored for two herbicides and one that was monitored for three herbicides. Sixteen PMZs were sampled for simazine, two for atrazine, five for diuron, and three for bromacil. Monitoring sites were selected in each PMZ at locations where the regulated chemical(s) might have been used based on historical use patterns. Replicate, shallow soil samples were collected at each site and analyzed for the herbicide under investigation.

Soil samples collected from atrazine and simazine PMZs were analyzed using an enzyme linked immunosorbent assay (ELISA). This method provides a measure of total triazine residues but does not distinguish between atrazine, simazine, and other triazine herbicide residues. Results are reported as simazine equivalents because a measure of individual triazine herbicide concentrations cannot be obtained by this method. As a standard practice, compliance soil samples that contain more than 1,000 ppb (1 part per million [ppm]) of triazine herbicide as measured by ELISA, were routinely analyzed by a gas chromatographic (GC) method to determine the actual

Table 5. Locations of Pesticide Management Zones (PMZs) selected by the Department of Pesticide Regulation for compliance monitoring during fiscal year 1992-1993.

	Number of PMZs monitored for:[a]			
County	**Atrazine**	**Simazine**	**Bromacil**	**Diuron**
Fresno	0	5	1	1
Orange	0	2	0	0
Riverside	0	4	0	1
Stanislaus	1	2	0	0
Tehama	1	0	1	0
Tulare	0	3	1	3
Totals	2	16	3	5

(a) A total of 19 PMZs were monitored; 12 were sampled for one herbicide, 6 for two herbicides and 1 for three herbicides.

Table 6. Occurrence of herbicide residues in Pesticide Management Zones (PMZs) selected by the Department of Pesticide Regulation for compliance monitoring during fiscal year 1992-1993.

		Number of PMZs that:		
Herbicide	**# of PMZs monitored**	**Contained no residues**	**Contained residues**	**Conc. range in ppb (a)**
Atrazine	2	2	0	none detected
Simazine	16	4	12	17-5450 (b)
Bromacil	3	1	2	48-7553
Diuron	5	1	4	51-893

(a) ppb = parts per billion on a dry soil weight basis.

(b) Soil sampled for simazine was analyzed using enzyme linked immunosorbent assay (ELISA) which does not differentiate between various triazine herbicides. Analytical results were reported as simazine equivalents which may include simazine and/or other triazine residues.

concentration of the regulated triazine(s). Analyses of samples collected from bromacil or diuron PMZs were performed using standard GC methods. For any soil sample containing a minimum of 2 ppm of bromacil or 3 ppm of atrazine, diuron, prometon, or simazine, a calculation is performed. The concentration of herbicide and total weight of soil in the collected sample are used to estimate the total quantity of the active ingredient in the sample. A back calculation is then performed to determine the rate of active ingredient that would need to be applied to the same soil surface area to reach that concentration. That rate is compared to the lowest rate for non-crop use indicated on the pesticide label. If the mean of the calculated rates for the five soil samples taken from a monitoring location equals or exceeds that minimum label rate, the residue is considered to have potentially resulted from a recent application. An investigation is then conducted to determine whether and by whom a recent application was made.

No triazine (simazine equivalent) residues were detected in either of the two atrazine PMZs that were monitored (Table 6, page 37). However, 12 of the 16 simazine PMZs did contain triazine residues that ranged in concentration from 17 to 5,450 parts per billion (ppb) of simazine equivalent. One soil sample collected from a PMZ in Fresno County contained 1,940 ppb of simazine equivalent and 1,132 ppb of actual simazine residue. Three samples from a site in Tulare County also contained concentrations greater than 1,000 ppb: 5,450 ppb simazine equivalent (1,650 ppb simazine), 2,750 ppb simazine equivalent (1,880 ppb simazine), and 1,240 ppb simazine equivalent (1,090 ppb simazine). Follow-up analysis by GC and back calculations indicated that the residues were not from recent applications.

Diuron residues were detected in four out of five diuron PMZs at concentrations ranging from 51 to 893 ppb. The results did not indicate that a recent application had been made. For bromacil PMZs, residues of bromacil were found in two of three PMZs that were monitored. Bromacil concentrations ranged from 48 to 7,553 ppb. Soil samples from one site in Tulare County contained the highest concentrations at 3,128 ppb and 7,553 ppb. The mean concentration for the five samples collected at that monitoring site indicated that the residues of bromacil could have resulted from a recent application. That finding has been reported to DPR's Pesticide Use Enforcement Branch and the Tulare County Agricultural Commissioner for further investigation.

SUMMARY

During the period July 1, 1992 through June 30, 1993, EHAP sampled 424 wells in 32 counties. The samples were analyzed for a total of 41 pesticide active ingredients and breakdown products.

Overall, verified detections of nine compounds were made in 80 wells throughout 17 counties: atrazine, bentazon, bromacil, deethyl-atrazine, deisopropyl-atrazine, diuron, prometon, simazine, and xylene. Residues of xylene in two wells were possible point-source contaminants and have been referred to the SWRCB.

DPR determined that residues of atrazine, bentazon, bromacil, deethyl-atrazine, deisopropyl-atrazine, diuron, and simazine had reached ground water as a result of non-point source, legal agricultural use. Altogether, a total of 62 wells in 11 counties were determined to contain pesticide residues as a result of legal, agricultural use: Fresno, Glenn, Kern, Los Angeles, Orange, Riverside, San Bernardino, Tehama, Tulare, Ventura, and Yuba. Simazine (33 wells) was detected most frequently, followed by atrazine (29 wells), deethyl-atrazine (15), diuron (10), bromacil (7), deisopropyl-atrazine (6), and bentazon (6). (Two or more compounds were detected in 31 of the 62 wells.) Wells with detections made pursuant to FAC section 13149 are shown, by county, in Table 7, p. 40.

Agricultural applications are also considered by DPR to be the source of residues of three other compounds reported with detections in ground water: DBCP, 1,2-D, and EDB. Because those compounds are no longer registered for use in California, the detections were reported to the SWRCB.

During the period July 1, 1992 through June 30, 1992, a total of 33 PMZs were recommended: fourteen in Los Angeles County, nine in Orange County, four in Riverside County, and two each for San Bernardino, Tulare, and Ventura counties. These were the first PMZs recommended for San Bernardino and Ventura counties. Use of atrazine, bromacil, diuron, and simazine is controlled in PMZs where the pesticides were detected and determined to be present in ground water as a result of agricultural use.

Table 7. Number of wells with detections of active ingredients of pesticides registered for use as of June 30, 1993 that were determined to be present in ground water as the result of legal, agricultural use, pursuant to Food and Agricultural Code section 13149, by county. Results are for data reported during the period July 1, 1992 through June 30, 1993.

County	atrazine	bentazon	bromacil	deethyl-atrazine	deisopropyl-atrazine	diuron	simazine	Total wells, by county
Fresno					1		1	1
Glenn	1			1				1
Kern				1				1
Los Angeles	18			9	1	2	9	21
Orange	2		1			3	10	10
Riverside			4			3	7	7
San Bernardino						2	4	4
Tehama	2			2	1			2
Tulare	2		2	2	3		2	5
Ventura	4							4
Yuba		6						6
Total wells, by chemical	**29**	**6**	**7**	**15**	**6**	**10**	**33**	

III. FACTORS CONTRIBUTING TO PESTICIDE MOVEMENT TO GROUND WATER AS A RESULT OF AGRICULTURAL USE

III. FACTORS CONTRIBUTING TO THE MOVEMENT OF PESTICIDES TO GROUND WATER AS A RESULT OF AGRICULTURAL USE

INTRODUCTION:

The PCPA requires the Department to include in the annual report a discussion of the factors that contribute to the movement of pesticides to ground water. These factors include volume of use, method of application, irrigation practices, physicochemical characteristics of pesticides, soil type, and climate. These factors are discussed separately, beginning on page 46. For the past three years, however, EHAP scientists have been developing an approach that integrates several of these factors for the purpose of identifying California areas vulnerable to non-point source ground water contamination by pesticides.

The project, funded in part by USEPA, provides a way to integrate a number of the contributing factors into one analysis. Climatic, soil, and geographic factors have been combined to provide unique spatial descriptions for the occurrence of pesticide residues in ground water. Other factors such as cropping patterns and specific agricultural practices will be added to provide further interpretation and meaning to the results. A discussion of the project follows.

USING MULTIPLE FACTORS TO IDENTIFY AREAS VULNERABLE TO GROUND WATER CONTAMINATION BY PESTICIDES IN CALIFORNIA:

In last year's report (Maes, *et al.*, 1992), progress was reported on a new approach EHAP scientists have been developing to identify California areas vulnerable to ground water contamination by pesticides. The study integrated data from climatic, soil, and geographic factors and analyzed their combined influence on the movement of pesticides to ground water. A discussion of 1993 investigations into this integrated approach follows.

Background

Multiple factors have been used by other geographic modeling systems in order to ascribe vulnerability ratings to sensitive areas. DRASTIC, an example of this type of approach, is a model used for predicting areas vulnerable to ground water contamination (Aller *et al.*, 1985). Results of recent well monitoring studies,

however, have not shown a good correlation between DRASTIC indices and the detection of pesticide residues in well water (USEPA, 1992; Balu and Paulsen, 1991; Holden *et al.*, 1992). One of the problems with this approach is that it assumes that ground water contamination occurred solely by pesticides leaching through soil.

In the EHAP multiple factor study, no single pathway for contamination was assumed (Troiano *et al.*, 1992). Clustering techniques were used to determine if vulnerable sections, defined as sections where pesticide residues have been detected in ground water due to agricultural use, form unique clusters based on climatic, soil and geographic data. The goal of the 1992 investigations were to provide a description of vulnerable areas based on available climatic, soil and geographic data. Further investigations would then be formulated to provide relationships between pathways of contamination and identified clusters. Best management practices could then be formulated to match the predominant factors identified for each cluster.

The preliminary results from 1992 indicated that the approach was successful: vulnerable sections could be clustered first by climatic and then by soil data. A profiling procedure was developed to test the classification of sections with unknown vulnerability against profiles for vulnerable clusters. If a section passed the test it would be determined to be a member of one of the vulnerable clusters. If the section was not determined to be a member of a vulnerable cluster, then it was classified as unknown.

Study Approach

The goals of the 1993 investigations were the following:

1 . To rerun the clustering procedure with a greater number of vulnerable sections and confirm the results of the preliminary clustering procedures.

2. To apply the profiling procedure to candidate sections in order to determine geographical patterns in the clustering results.

As reported last year, multivariate clustering techniques were used to determine the level of similarity/dissimilarity between sections. A vulnerable section was defined as a section of land where pesticide residues had been detected in ground water due to agricultural use. Vulnerable sections included all sections identified as PMZs as of June 30, 1993 and other sections containing wells with detections of pesticides that are

not regulated in PMZs such as bentazon and aldicarb. Except for DBCP, sections with detections of pesticides no longer registered for use were also included. DBCP was omitted from the study because its large number of detections could indicate a broad movement of residues between sections. Although this problem could exist with other pesticides, the widespread, high rates of DBCP application and its extraordinarily long half-life could produce an extreme result in terms of ground water aquifer movement. Less extensive, lower rates of application of other pesticides provide some assurance that their detections are more reflective of local use.

In 1992, 171 sections were used in the clustering analysis. In 1993, that number rose to 259, a substantial increase on which to base a cluster analysis. Although the potential number of vulnerable sections was greater then 261, not all could be used because of lack of soil data. For example, reliable soil survey data was not available for vulnerable sections in Los Angeles County.

Soils data were obtained from two sources. One data set identified the occurrence of each mapping unit in vulnerable sections. The other data set, obtained from the Soil Conservation Service (SCS), contained soil information for soil mapping units surveyed in California. Data for occurrence of soil mapping units within each section was used to extract soil information contained in the SCS data set. Data were derived for each variable on a section basis by averaging across all soil mapping units in a section. Climatic variables were obtained from 130 weather station data available from DWR.

The classification procedure was developed using Principal Components Analysis (PCA). Twelve soil variables were used in the PCA analysis to provide a profile consisting of 12 Principal Components (PCs) for each cluster. An algorithm was derived that tested the 12 PC scores from each candidate section against corresponding PC scores for each vulnerable soil cluster. In order to be declared a member of a cluster, all PC scores must have been within 3.5 standard deviations of each corresponding cluster PC score.

Summary of work completed

Identification of unique clusters occurred in two phases. In the first phase, climatic data were used to identify unique clusters based on weather variables. Two clusters were identified using only mean July precipitation. Five sections in Del Norte and

Humboldt counties were shown to differ from remaining sections due to higher summer rainfall (Table 1).

Table 1. Description and average values for July precipitation in each of two weather station clusters.

Cluster Description	# of Vulnerable Sections	Average July Precipitation
		----------Inches----------
Dry Coastal, Valley, Foothill Locations	254	0.13
Wet Coastal and Mountainous Locations	5	0.80

All other vulnerable sections fell into a low rainfall cluster. Sections in this cluster were tested as a group to determine if clusters could be identified based on soil and geographic data. As reported last year, clustering was strongly indicated in the analysis. Five clusters were identified using two variables, namely the number of soil particles that pass through a No. 200 sieve (a variable that quantifies the texture of soils) and the indication of a hardpan layer. The predominant features of each cluster are indicated in Table 2.

Table 2. Description and average sectional values in each of 5 clusters for the presence of hardpan and % soil particles passing a No 200 soil sieve.

Cluster Description	# of Vulnerable Sections	Hardpan[a]	Soil Texture[b]
			--------%------
No Hardpan and Coarse Textured	72	0.08	36
Hardpan and Coarse-Medium Textured	82	0.50	49
No Hardpan and Medium Textured	26	0.01	60
Hardpan and Medium Textured	26	0.94	62
No Hardpan and Fine Textured	48	0.03	82

a. Scale from 0-1 with a 0 value representing no soils in section with hardpan and a 1 indicating all soils in that section with hardpan.

b. Measured by the percentage by weight of soil particles that pass a No. 200 soil sieve. The smaller the percentage, the sandier the soil.

Next, sections in Fresno and Glenn counties were subjected to the classification algorithm that was derived based on the soil clustering results. Soil data, where

available, were derived for all sections in Fresno and Glenn counties, resulting in 1,752 candidate sections in Fresno county and 880 candidate sections tested in Glenn County. A geographical representation of the classification of the candidate sections for Fresno County is given in Figure 1; Figure 2 shows results for Glenn County. Some important feature of these graphics are:

1. The clusters formed discrete geographical areas in each county. In Fresno County, an area of coarse, sandy soil was surrounded to the north and east by an area containing relatively coarse textured soils that were underlain by a hardpan. In Glenn County, an area of fine clay soil was surrounded by an area containing loamy soils.

2. Not all sections were members of one of the vulnerable clusters. This indicated that the algorithm had discriminatory power and could identify section profiles unique to the sections used to produce the profile algorithm.

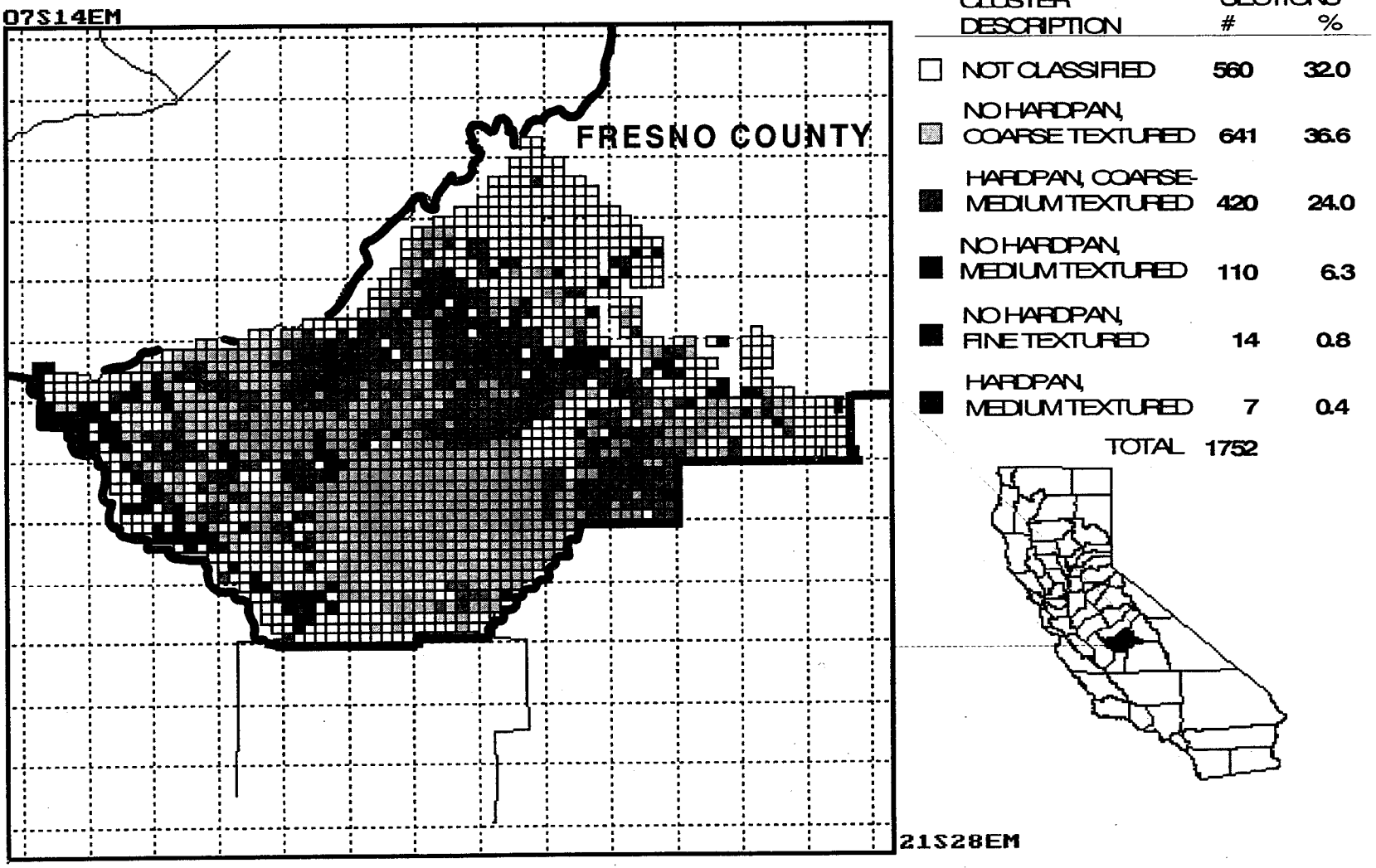
3. "Not-Classified" sections were located near the fringes of the clusters indicating a geographic gradient in soil properties that was related to spatial distance between sections.

Based on these encouraging results, investigations will continue on this method of identifying vulnerable areas in California. Objectives for 1994 include confirming the geographic boundaries of the clusters by conducting well monitoring studies and providing descriptions of the potential pathways for ground water contamination in each cluster.

FACTORS CONTRIBUTING TO THE MOVEMENT OF PESTICIDES TO GROUND WATER

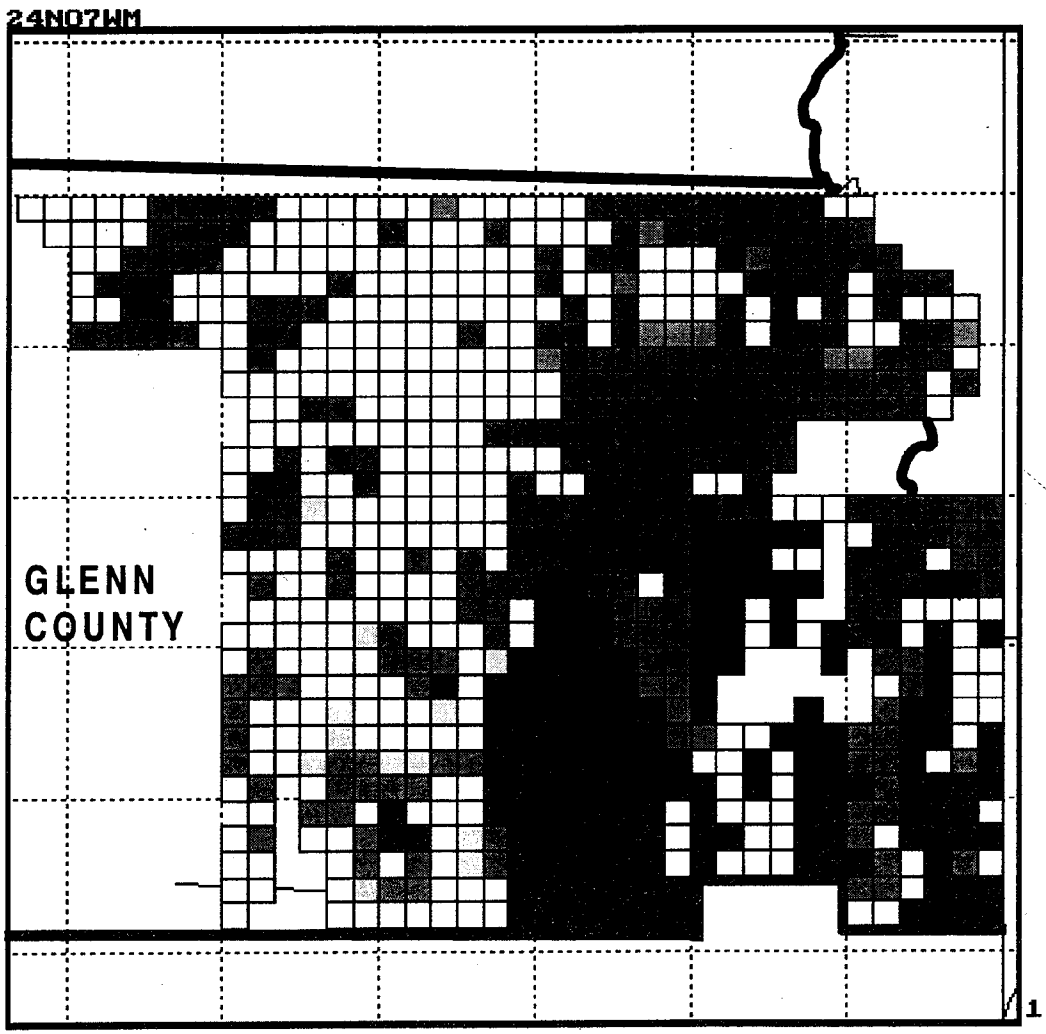
Factors contributing to the movement of pesticides to ground water include method of application (pesticide use practices), irrigation practices, physicochemical characteristics of pesticides, soil type, and climate. Two routes by which pesticide residues can move to ground water are leaching and direct streaming. *Leaching* is the process by which pesticide residues are dissolved in soil water and follow the movement of water through the soil matrix as it recharges a ground water aquifer. *Direct streaming* is the movement of pesticide residues to ground water through direct routes such as dry wells or macropores. A summary of information from recent studies conducted by EHAP on the effect of these factors, including the leaching and direct streaming processes, follows.

Figure 1. Classification of sections in Fresno County into soil vulnerability clusters for ground water contamination by pesticides.



CLUSTER DESCRIPTION	SECTIONS #	%
NOT CLASSIFIED	560	32.0
NO HARDPAN, COARSE TEXTURED	641	36.6
HARDPAN, COARSE-MEDIUM TEXTURED	420	24.0
NO HARDPAN, MEDIUM TEXTURED	110	6.3
NO HARDPAN, FINE TEXTURED	14	0.8
HARDPAN, MEDIUM TEXTURED	7	0.4
TOTAL	1752	

Figure 2. Classification of sections in Glenn County into soil vulnerability clusters for ground water contamination by pesticides.



CLUSTER DESCRIPTION	SECTIONS #	%
NOT CLASSIFIED	331	41.0
NO PAN, COARSE TEXTURED	11	1.4
HARDPAN, COARSE-MEDIUM TEXTURED	12	1.5
NO HARDPAN MEDIUM TEXTURED	286	35.4
NO HARDPAN FINE TEXTURED	147	18.2
HARDPAN, MEDIUM TEXTURED	21	2.6
TOTAL	880	

Pesticide Use Practices

Leaching

Pesticides found in ground water that originate from non-point sources are almost exclusively active ingredients that are applied to the soil. Pesticides that are applied to foliage, such as protective foliar fungicides and many insecticides, may not be important leachers for two reasons: (1) exposure to sun enhances the rate of degradation and (2) concentrations that eventually reach the soil are low enough to allow for rapid degradation before leaching.

Also, there are no known differences in the leaching potential of different pesticide formulations, such as wettable powders, granulars, or emulsifiable concentrates. There has been some research on the use of slow-release formulations as a method to prevent pesticide movement through the soil. However, the results to date are still preliminary.

Direct Streaming

A recent DPR study was conducted to measure the concentrations of herbicides in water sampled near dry well drainage structures (Braun and Hawkins, 1991). Excess water at the edge of fields occurred as a result of either winter rainfall or runoff from irrigation. Concentrations of herbicides in rain runoff ranged from 2.4 to 1,130 ppb for simazine, 3.1 to 890.5 ppb for diuron, and from non-detectable to 47.2 ppb for bromacil. Concentrations in water collected after irrigation events ranged from non-detectable to 25.2 ppb for simazine, non-detectable to 19.1 ppb for diuron, and from non-detectable to 4.7 ppb for bromacil. The presence of herbicide residue in these samples indicates that further study is needed to determine the effect of application and soil incorporation on mitigating the presence of residues found in water sampled near dry wells.

Although many pre-plant herbicides are applied to the soil surface, their actual site of action is the first few inches of soil where weed seeds germinate. To complete the application, most of these types of herbicides contain label statements recommending shallow incorporation or irrigation sufficient to wet the soil to the depth of several inches to the treated area in order to move the pesticide from the surface into the soil matrix. If heavy rainfall or heavy irrigation follows application, there is a greater risk that residues could be physically moved offsite (downward in soil or into surface water) with runoff water.

Irrigation Practices

Leaching

An irrigation study (Troiano, *et al.*, 1990) was conducted by the EHAP in 1987 and 1988 to compare the effect of three amounts of deep percolating water (denoted by low, medium, and high) applied by four methods (drip, sprinkler, floor, and furrow) of irrigation on leaching of atrazine, an herbicide that has been found in ground water. The amount of water added was based on a water budgeting method that used measures of evapotranspiration (ETo), which is an estimate of the amount of water required to replenish that lost from soil evaporation and plant transpiration. The irrigation study indicated that use of available measures of ETo in conjunction with water budgeting methods could be an effective technique for controlling water and, subsequently, pesticide movement in soil. However, the use of ETo values in limiting pesticide movement will require further refinement when applied to different methods of irrigation. Models could aid in defining the requirement specific to each irrigation method to prevent leaching.

One aspect of pesticide use that may be critical to leaching may be the timing of pesticide application in relation to irrigation applications. A theory of soil adsorption (Di Toro, 1985) proposes that the longer a pesticide remains in contact with the soil, the more resistant it becomes to leaching because the pesticide becomes more tightly bound to soil over time. Current labels for several of the herbicides detected in California ground water recommend that the compound should be moved into soil with a small amount of water (e.g., 0.25 to 0.50 inches) if sufficient rainfall does not fall within a specified period after application. Additions of greater than 0.50 inches of water could leach residue past the weed root zone, away from the intended zone of pesticidal activity. This same result could occur from many small applications of water timed too closely in succession. Therefore, once the pesticide is watered into the zone of activity, the timing of the next irrigation may determine whether or not the pesticide leaches downward in soil.

A study was conducted in 1990 (Troiano and Garretson, 1993) to determine if leaching of herbicides was reduced by lengthening the time between application of a pesticide and initiation of irrigation treatments. Bromacil and simazine were broadcast onto soil and immediately incorporated into soil with a 0.5-inch sprinkler application. Irrigation treatments commenced at 1, 7 or 14 days after the application and incorporation of the pesticide. Lengthening the time between pesticide application and initiation of

irrigation did not affect depth of leaching. However, results differed between herbicides. Bromacil was moved deeper than simazine which can be explained by their dissimilar physicochemical properties. Estimates of soil half-life and water solubility are greater for bromacil than for simazine, and soil adsorption is less for bromacil than for simazine (Johnson, 1991). The practical interpretation of these data is that, under the conditions of this study, delaying irrigations following application of simazine and bromacil had no impact on pesticide leaching.

Direct Streaming

Irrigation management may also be important in controlling off-site movement of pesticides to ground water by direct streaming. As indicated in the study by Braun and Hawkins (1991), a potential exists for herbicide residue to move off-site with runoff water. Runoff water is commonly produced in surface irrigation systems such as furrow, basin-flooding and border types of irrigation which can be very inefficient. One goal of research conducted by irrigation scientists is to increase the efficiency of applying irrigation water which can reduce the runoff and the potential of pesticides to contaminate ground water.

Physicochemical Characteristics of Pesticides

Leaching

The physicochemical properties which the PCPA associates with the potential of a pesticide to leach through soil are water solubility, soil adsorption (usually denoted by the coefficient of soil versus water partitioning), hydrolysis half-life due to microbial or chemical activity, field dissipation, and vapor pressure. These characteristics are used in models of pesticide transport through soils (Rao, 1985). Cohen *et al.* (1984) estimated values of the characteristics to act as indicators of leaching potential. In addition, section 13144(a) (FAC) requires DPR to set Specific Numerical Values (SNVs) for some of these characteristics that are used to identify pesticides with the potential to leach to ground water. The Department has updated the established SNV's described by Wilkerson and Kim (1986) in three reports entitled: *Setting Revised Specific Numerical Values* (Johnson, 1988, 1989 and 1991).

As indicated in the Irrigation Practices section, greater leaching of bromacil than simazine was measured in the delayed irrigation study. This result was explained by differences in their physicochemical properties. Although bromacil has a greater water

solubility and is less reactive with soil than simazine, both pesticides have been detected in ground water as a result of non-point source agricultural applications.

Soil Type and Properties

Leaching

Soil type could be an important factor in determining the likelihood of a pesticide to leach to ground water in a given area. Teso *et al.* (1988) have described the occurrence of DBCP residues in ground water in eastern Fresno County in relation to soil type as a means of predicting the sensitivity of soils in Merced County to pesticide contamination of ground water. DPR has been developing a data base of soil types in mapped portions of California on a section basis; currently, soil types that are present in PMZs can be identified in a computer file. Evaluation of these data for regulatory use is ongoing.

Direct Streaming

Under dry conditions, certain clay soils, know as vertisols, develop large, deep cracks that may reach from 1 to 2.2 meters (3.3 to 7.2 feet) in depth. Such soils are known to exist in the Sacramento Valley in areas where pesticides have been detected in ground water. A study, funded by DPR, was conducted to measure the location of pesticide residues with respect to cracks in these soils (Graham and Ulery, 1990). Though the study was limited in scope, the authors concluded that detection of residues below the surface layer was apparently related to the presence of cracks in the soil. Movement of residues through soil features such as cracks presents a unique circumstance with respect to mitigating contamination of ground water because in the presence of such cracks, any pesticide active ingredient, regardless of physicochemical characteristics could move downward in soil towards ground water. Controlling pesticide movement could be attained only by management of the soil environment, if possible. This is an example where considerations of pesticide use must include geographical setting in order to derive effective mitigation decisions.

Climate

Leaching

Climatic factors, such as precipitation, may override all of the previously mentioned factors in causing ground water contamination. An example of the influence of climate is the aldicarb residues detected in well water in Del Norte County (Lee, 1983).

Because soils in that area are high in organic matter, they may be expected to retard pesticide movement. However, annual rainfall may be over 2 meters (6.67 feet), with as much as 1.3 meters (4.2 feet) occurring during the winter months from November to March. Aldicarb used to be applied in the fall to lily bulb fields to control nematode problems in the soil. The amount of winter rainfall was apparently sufficient to drive aldicarb residues to the shallow ground water located at about 3 meters (10 feet), in spite of the high soil organic matter.

A different result was observed in another DPR study (Troiano and Garretson, 1988). The effect of winter rain on movement of pesticides in the central San Joaquin Valley was investigated in the Fresno area. Because soils there are sandy, the area might be expected to be vulnerable to pesticide leaching from winter rainfall. However, winter rainfall is usually much less there than in the Northern Coastal areas (e.g., 0.25 meters [10 inches] in the San Joaquin Valley compared to 1.3 meters [4.2 feet] on the North Coast). For the study, an inorganic ion tracer was detected at about the 1.7 meter (5.5 feet) depth in the soil, with some detected down to 3 meters (10 feet), the lowest depth sampled. In contrast, most of the pesticide simazine, which is known to leach through soils, was recovered in the first 0.15 meters (0.5 feet) of soil, with some residues detected down to 1.9 meters (6 feet). At this site, the amount of winter rainfall was insufficient to move the major portion of simazine beyond the first six inches of soil. Thus, climatic conditions, such as heavy rainfall, must not be overlooked as important factors in the leaching of pesticides through soils, and they may be important considerations in timing applications of pesticides.

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IV. ACTIONS TAKEN BY THE STATE WATER RESOURCES CONTROL BOARD TO PREVENT PESTICIDES FROM ENTERING GROUND WATER

Memorandum

To : James W. Wells, Director
Department of Pesticide Regulation
1220 N Street, Room A-414
Sacramento, CA 95814

Date : NOV 03

Dale Claypoole
for Walt Pettit
Executive Director

From : **STATE WATER RESOURCES CONTROL BOARD**

Subject: PESTICIDE CONTAMINATION PREVENTION ACT (AB 2021) EIGHTH ANNUAL REPORT (1993) TO THE LEGISLATURE

The attached report is a summary of actions taken during the past year by the State Water Board and the California Regional Water Quality Control Boards for inclusion in your report to the Legislature as required under the Pesticide Contamination Prevention Act.

If we can be of further assistance, please feel free to telephone Jesse M. Diaz, Chief of the Division of Water Quality, at 657-0756. The staff person currently working on this issue is Valerie Van Way, and she can be reached at 657-0583.

Attachment

cc: James M. Strock (with attachment)
Secretary for Environmental Protection
California Environmental Protection Agency
555 Capitol Mall, Suite 235
Sacramento, CA 95814

PESTICIDE CONTAMINATION PREVENTION ACT
ANNUAL REPORT TO THE LEGISLATURE
STATE WATER RESOURCES CONTROL BOARD
DECEMBER 1993

Actions taken by the State Water Resources Control Board (State Water Board) and the California Regional Water Quality Control Boards (Regional Water Boards) to prevent economic poisons from migrating to ground waters of the State are as follows:

A. State Water Board

State Water Board staff participated in the following activities:

- Regularly attended meetings sponsored by the Department of Pesticide Regulation (DPR), including the interagency Pesticide Advisory Committee (PAC), Pesticide Registration and Evaluation Committee (PREC), State Environmental Hazard Assessment Committee (SEHAC), and the Interagency Coordinating Committee for Agricultural Regulatory Programs. This committee, formed in 1993, will initially focus on identifying all regulatory programs for State and federal lands that impact the rice industry. If the Committee is successful, its scope may be expanded later to include other sectors of the agricultural industry.

- Conferred with U.S. Geological Survey scientists to discuss studies dealing with pesticides and water quality.

- Initiated the development, in cooperation with DPR staff, of a schedule for establishing the Management Agency Agreement that will further coordinate pesticide and water quality management activities and uphold the provisions of the Memorandum of Understanding (MOU) between the two agencies.

- Reviewed and commented on DPR's proposed amendments to regulations placing pesticides on the Ground Water Protection List and describing Pesticide Management Zones.

- Prepared text summarizing the State and Regional Water Boards' responsibilities for two drafts of the State Ground Water Protection Plan for Pesticides being developed by DPR.

- Submitted a workplan to U.S. Environmental Protection Agency pursuant to Section 106 of the Clean Water Act for Federal Fiscal Year 1994 funding for pesticides and ground water-related work.

- o Reviewed on an ongoing basis, DPR Notices of "Materials Entering Evaluation" and will advise DPR on potential water quality impacts of pesticide registration and use decisions.

- o Worked on adapting the Pesticide Use Retrieval System database queries of 1990 and 1991 pesticide usage in select watersheds within the State.

B. REGIONAL WATER BOARD

Information on actions to prevent economic poisons from migrating to the ground waters of the State by each of the nine Regional Water Boards are listed in Tables 1 through 9.

Figure 1. State Water Resources Control Board and California Regional Water Quality Control Boards.

STATE WATER RESOURCES CONTROL BOARD

P.O. BOX 100, Sacramento, CA 95812-0100

Legislative and Public Affairs: (916) 657-2390
Water Quality Information: (916) 657-0687

Clean Water Programs Information: (916) 227-4400
Water Rights Information: (916) 657-2170

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARDS

NORTH COAST REGION (1)
5550 Skylane Blvd., Ste. A
Santa Rosa, CA 95403
(707) 576-2220

SAN FRANCISCO BAY REGION (2)
2101Webster Street, Ste. 500
Oakland, CA 94612
(510) 286-1255

CENTRAL COAST REGION (3)
81 Higuera Street, Ste. 200
San Luis Obispo, CA 93401-5427
(805) 549-3147

LOS ANGELES REGION (4)
101 Centre Plaza Drive
Monterey Park, CA 91754-2156
(213) 266-7500

CENTRAL VALLEY REGION (5)
3443 Routier Road
Sacramento, CA 95827-3098
(916) 255-3000

FRESNO BRANCH OFFICE
3614 East Ashlan Avenue
Fresno, CA 93726
(209) 445-5116

REDDING BRANCH OFFICE
415 Knollcrest Drive
Redding, CA 96002
(916) 224-4845

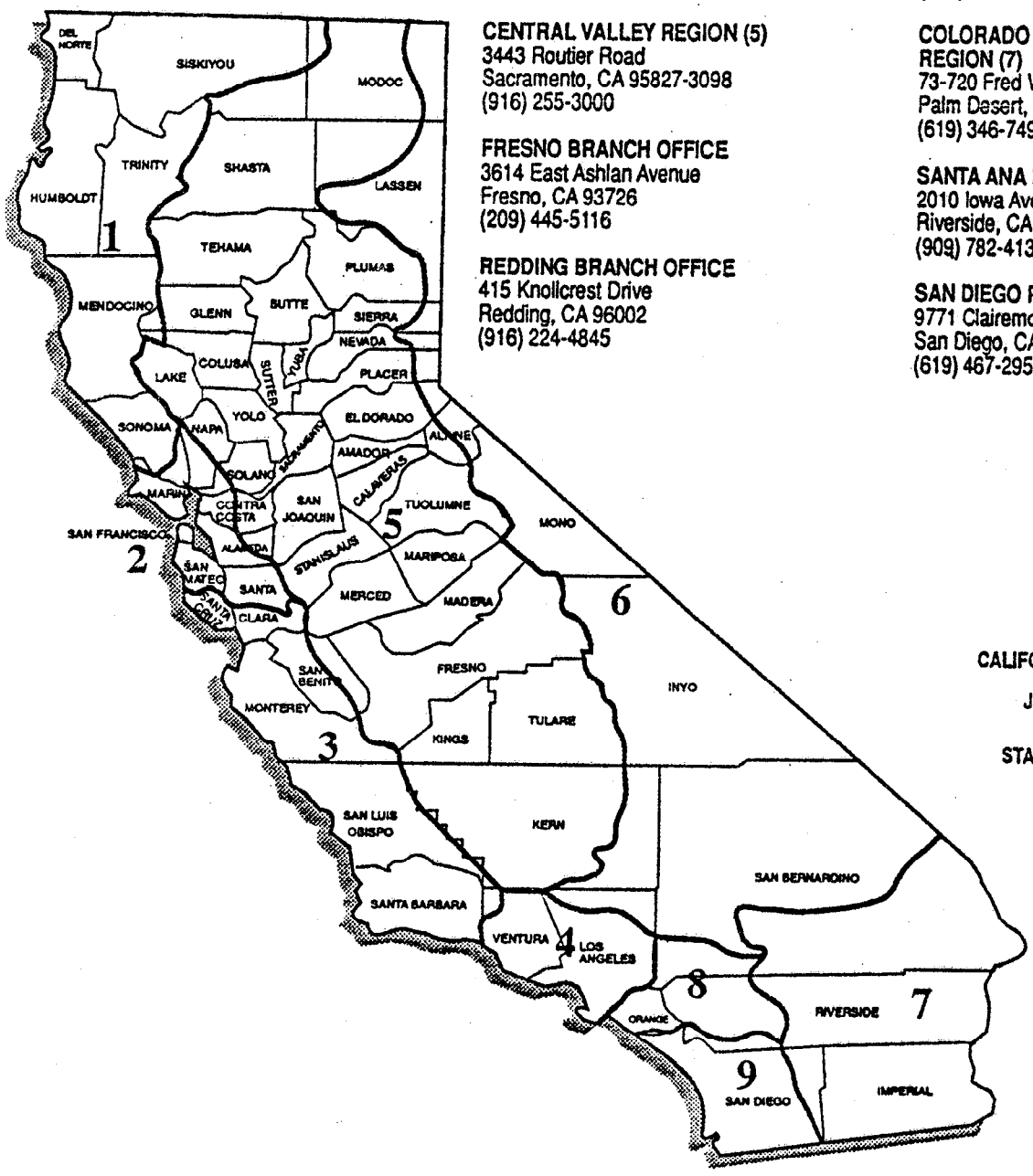
LAHONTAN REGION (6)
2092 Lake Tahoe Blvd., Ste. 2
South Lake Tahoe, CA 96150
(916) 544-5400

VICTORVILLE BRANCH OFFICE
15428 Civic Drive, Ste. 100
Victorville, CA 92392-2383
(619) 241-6583

COLORADO RIVER BASIN REGION (7)
73-720 Fred Waring Dr. Ste. 100
Palm Desert, CA 92260
(619) 346-7491

SANTA ANA REGION (8)
2010 Iowa Avenue, Ste. 100
Riverside, CA 92507-2409
(909) 782-4130

SAN DIEGO REGION (9)
9771 Clairemont Mesa Blvd., Ste. B
San Diego, CA 92124
(619) 467-2952



STATE OF CALIFORNIA
Pete Wilson, Governor

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
James M. Strock, Secretary

STATE WATER RESOURCES CONTROL BOARD
John P. Caffrey, Chair

9/14/93

Table 1

ACTIONS TAKEN BY THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, NORTH COAST REGION, IN 1993

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Del Norte	Smith River Plains	Aldicarb, 1,2-D	Ongoing monitoring program.
Humboldt	USFS Nursery McKinleyville	Dithiocarbamate	USFS monitoring with Regional Water Board support.
Humboldt	Blue Lake Forest Products	Pentachlorophenol, Tetrachlorophenol, Copper 8-Quinolinolate	State Superfund site with ongoing assessment.
Humboldt	Carlotta Lumber Company	Pentachlorophenol, Tetrachlorophenol	Ongoing contamination assessment and cleanup.
Humboldt	Beaver Lumber Company, Arcata	Pentachlorophenol, Tetrachlorophenol	Contamination cleanup.
Humboldt	Sun Valley Bulb Farms	Chlorothalonil, Dithiocarbamate	Ongoing monitoring and assessment to prevent discharges to surface water and ground water is under Regional Water Board direction.
Mendocino	L-P Corporation Covelo	Pentachlorophenol	Contamination assessment.
Mendocino	Marcel Peterson	Chlordane	Remediation underway.
Siskiyou	Stone Forest Industries, Happy Camp	Pentachlorophenol, Tetrachorophenol	Ongoing contamination assessment and cleanup.
Siskiyou	Hi-Ridge Lumber Company	Pentachlorophenol, Tetrachlorophenol	Ongoing contamination assessment and cleanup.
Trinity	Pine Mountain Lumber Company	Pentachlorophenol, Tetrachlorophenol	Ongoing contamination assessment and cleanup.
Trinity	Stone Forest Industries, Burnt Ranch	Pentachlorophenol, Tetrachlorophenol	Ongoing contamination assessment.

Table 2

ACTIONS TAKEN BY THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SAN FRANCISCO BAY REGION, IN 1993

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Alameda	Parker & Amchem	2,4-D	Soil removal in September 1988 (work completed). Ground water assessment ongoing. Regional Water Board Order No. 91-079 specifies schedules for investigations and cleanup.
	Jones-Hamilton	Pentachlorophenol	Regional Water Board Order No. 89-110 specified time schedule for investigation/cleanup. Ground water cleanup underway.
	Port of Oakland (Embarcadero Cove)	Chlordane, Penta-chlorophenol, DDT, Endosulfan, Chlordane, 2,3,7,8-TCDD, DDD	Department of Health Services has lead. Additional investigation/cleanup requested.
	Lincoln Properties (Orsetti Site)	DDE, 2,4-D	Alameda County Water District has lead.
	FMC, Newark	EDB	Regional Water Board Order No. 89-055 specified time schedule for investigation and cleanup. Ground water cleanup underway.
	Old Santa Rita Road, Pleasanton	Dicamba, Dichlorprop 2,4-D, 2,4,5-T	Pesticide found in grab water samples. Three monitoring wells may be installed on-site. ACDEH lead site.
Contra Costa	Chevron	Endrin, Lindane, Dieldrin, DDT	Submitted closure plan for Class I impoundment. A cut-off wall with a ground water extraction trench around the impoundment has been constructed.
	Levin Metals	Aldrin, 4,4'-DDD, 4,4'-DDE o,p,-DDT, Dieldrin & BHC	USEPA lead on-site cleanup.
	FMC, Richmond	DDT, DDD, DDE, Dieldrin Chlordane, Tedion, Endosulfan, Ethion, Carbophenothion, & Heptachlor	DHS lead on-site cleanup.
	ICI Americas	Vapam, Devrinol, Ordram	Site Cleanup Order No. 92-055 was rescinded in May 1992 following closure of the agricultural yard pond.
	Peerless Lighting Corporation, Berkeley	Aldrin, Heptachlor, Chlordane, Pentachlorophenol	Two of six monitoring wells most downgradient show detections. Additional investigational cleanup has been requested by the City of Berkeley Toxics Program.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Marin	Former Sonoma Mosquito Abatement District, San Rafael	DDD, DDE, DDT, Dieldrin	DTSC lead site. Some soil removal has taken place. DTSC is asking for installation of a permanent multilayer clay cap, remediation or encapsulation of the remaining contaminated soil, and a deed restriction on the property.

Table 3 **ACTIONS TAKEN BY THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, CENTRAL COAST REGION, IN 1993**

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Santa Cruz	WFS-Greengro, Watsonville	1,2-D, Endosulfan	Remedial design
	WFS, Watsonville	DDT, DDD, Toxaphene	Remedial design
Santa Clara	Castle Veg Tech, Morgan Hill	Toxaphene, Endrin, Lindane, Endosulfan	Remedial design
Monterey	WFS, Salinas	Dinoseb	Interim remediation
Monterey	Soilservice, King City	EDB, 1,2-D, DDT, DBCP, Toxaphene	Remediation
Santa Barbara	J.R. Simplot Inc. Guadalupe	Benzene, Toluene, Xylenes	Closed
Monterey	NH_3 Service Company Salinas	1,2-D	Remediation underway
Monterey	John Pryor, Soledad	1,2-D, Toluene, p-Bromofluorobenzene	Closed
Santa Barbara	Olocco Ag Services Santa Barbara	Endosulfan, 1,2-D	Site assessment ongoing.
Monterey	Castlerock Estates	Toxaphene	Delineation underway

Table 4 **ACTIONS TAKEN BY THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, LOS ANGELES REGION, IN 1993**

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Los Angeles	U.S. Post Office (formerly Challange Cook Brothers, Inc.), City of Industry	Lindane (gamma-BHC)	Additional soil and soil vapor assessment work ongoing. To date, a relationship between site soils and pesticides has not been confirmed.
	Montrose Chemical Company, Torrance	DDT	Cleanup and Abatement Order issued for site assessment and remediation. The site is on federal NPD (Superfund) list. USEPA is the lead agency on this case.
	Rhone-Poulenc (formerly Stauffer Chemical Company), Carson	4,4'-DDE, 4,4'-DDD, 4,4'-DDT, Alpha BHC, Beta BHC, Dieldrin, Arsenic	Under investigation.

Table 5 ACTIONS TAKEN BY THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, CENTRAL VALLEY REGION, IN 1993

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Fresno	Thompson Hayward Agriculture & Nutrition	Alpha-BHC, Beta-BHC, Gamma-BHC, Dieldrin, DBCP, Diphenamid, Heptachlor, Heptachlor Epoxide	State Superfund site. Contamination assessment ongoing.
	FMC Corporation	Aldrin, Dieldrin, DDT, DDD, DDE, Heptachlor, Lindane, Toxaphene, Ethyl Parathion, Malathion, Ethion, Endosulfan, Dimethoate, Furadan, DNOC, DNBP	State Superfund site. Remedial investigation/feasibility study in progress. ROD signed.
	Britz, Inc., Five Points	Toxaphene, DDT, Dinoseb	State Superfund site. Partial contamination assessment submitted. Additional contamination assessment ongoing.
	Chevron Chemical Company	Toxaphene, Arsenic	Pesticide contaminated soils have been removed. Site clean and has been closed.
	Fresno County Wells	DBCP, EDB, 1,2-D	Pesticides detected in 146 wells (AB 1803 sampling). San Joaquin Valley DBCP Advisory Committee is overseeing studies on remedial alternatives for DBCP problems.
	Union Carbide Test Plot	Aldicarb	Additional contamination assessment needed.
	Coalinga Airport	DDT, Chlorpyrifos, DEF, Ethion, Disyston	Contamination assessment needed.
	Spain Air	Ethion, DEF, Parathion, Trithion, Dinoseb, Paraquat, DDE, DDT, Endosulfan II	Assessment needed.
	UC Agricultural Field Station, Westside AFS (Five Points)	Simazine, Diuron, Prometon, MCPA	Pesticide contamination soils excavated. Site clean and has been closed.
	UC Agricultural Field Station, Kearney Agricultural Center, Parlier	DDD, DDE, Simazine Chlorpropham	See above.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Fresno	Occidental Chemical/J.R. Simplot	Dieldrin	Surface impoundment excavated and closed. Monitoring of ground water continues.
Kern	Brown & Bryant, Inc., Arvin	1,2-D, 1,3-D, DBCP, EDB, Dinoseb	Federal Superfund site. USEPA has prepared RIFS Report.
	Puregro Company, Bakersfield	DBCP	State Superfund site. Further assessment conducted. The waste discharge requirements for closure of a former dry well are dissued.
	Guimarra Vineyard	DBCP	Contamination assessment and pond closure plan requested. (J.R. Simplot-Edison).
	Dick Garriott Crop Dusting, Bakersfield	Chlordane, DDE, DDT, PCNB, Endosulfan I & II, Methoxychlor, Carbofuran, Carbaryl, Bufencarb, DEF, Tedion, Diazinon, Chlorpyrifos, Ethyl Parathion, Diuron, Dinoseb, Dicamba	Cleanup and Abatement Order issued. TPCA site. HAR completed. Work in progress to determine extent of ground water degradation. Impoundment is covered.
	Wasco Airport	Aldrin, Lindane, Endrin, Chlordane, Methoxychlor, DDT, DDD, DDE, Thimet, Malathion, Methyl Parathion, Paraoxon, Disyston, Omite, Paraquat	Site closed. Chapter 15 cap constructed above former toxic pit. WDRs adopted.
	USDA, Shafter	Dichlobenil, EPTC, Prometryne, DDT, DDE, DDD, Dieldrin, Toxaphene, Silvex, PCP, Chlorpropham, Ametryn, Atrazine	Developing a closure plan.
	Brown and Bryant, Inc., Shafter	Chlordane, DDD, DDE, DDT, Dieldrin, Endrin, Heptachlor, Toxaphene	State Superfund site. Contamination assessment ongoing.
Kern	Kern County Wells	DBCP, 1,2-D, EDB	Pesticides detected in 57 wells (AB 1803 sampling). No assessment underway.
Madera	Western Farm Service, Inc.	Dinoseb, DBCP, Dieldrin	Assessment ongoing. Impoundment closed.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Madera	Chowchilla Municipal Airport	Dieldrin, Alpha-BHC, Endosulfan, PCNB, DDT, DDE, Lindane	Contamination assessment needed.
	Madera County Wells	DBCP, 1,2-D, EDB	DBCP detected in 2 wells (AB 1803 sampling). No assessment underway.
Tulare	Mefford Field, City of Tulare	p,p'-DDT, p,p'-DDE, 2,4,5-TP, Dicamba, DNBP, Diuron	Contamination assessment and mitigation reports needed.
	Tulare Airport	2,4-D, DNBP	Assessment needed.
	Kaweah Crop Dusters	DDT, 2,4-D, 2,4,5-T, Methoxychlor	Department of Health Services Remedial Action Order issued January 1984. Cleanup of surface impoundment in progress.
	Harmon Field (County of Tulare)	DDT, DDE, TDE, Toxaphene, Methoxychlor, Endosulfan, Dieldrin	Department of Health Services Action Order issued March 1989. HAR complete. Remedial investigation/feasibility study nearly completed.
	Western Air	Aldrin, DDE, Heptachlor, Gamma-BHC, Demeton, Malathion, Phorate, Brodan, Diuron, Propachlor, Siduron, Chlorpyrifos, DEF	Hydrogeologic assessment (HA) and closure plan underway pursuant to Toxic Pits Cleanup Act. The HA indicates ground water has not been affected. The project is nearing completion.
	Tulare County Wells	1,2-D	1,2-D detected in wells (AB 1803 sampling). No assessment underway.
Sacramento	Sacramento Army Depot	Diazinon, Dursban	Assessment report requested. Federal Superfund work in progress.
Sacramento	McClellan Air Force Base	Aldrin, Alpha-BHC, Beta-BHC, Delta-BHC, Gamma-BHC, (Lindane), 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Dieldrin, Alpha Endosulfan, Endosulfan Sulfate, Heptachlor, Heptachlor Epoxide, 2,4-D, 2,4,5-T, 2,4,5-TP	Ground water cleanup underway.
San Joaquin	Occidental Chemical	2,4-D, 2,4,5-T, DEF, Toxaphene, Lindane, EDB, DBCP, Dieldrin, Delnav, Dimethoate, Disulfoton, Sevin, Heptachlor, DDT, DDE, DDD, Aldrin, Methyl Parathion, Ethyl Parathion	Site remediation occurring pursuant to stipulation and judgement approving settlement (1981).

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
San Joaquin	Defense Depot, Tracy	Dieldrin, Simazine	Assessment ongoing as part of the site-wide remedial investigations.
	Sharpe Army Depot, Stockton	Bromacil	Assessment ongoing. Contamination may be associated with dry wells.
	Marley Cooling	Arsenic, Copper, Chromium	Ground water cleanup underway.
	U.S. Navy Communication Station	DDD	Assessment ongoing.
	Triple "E" Produce	Chloroform	Bioremediation began 9/93.
	Pure Gro/Brea Agricultural Service, Stockton	1,2-DCP	Soil and ground water investigation ongoing. Four monitoring wells installed.
Stanislaus	Chemurgic	BHC, DDT	Ongoing monitoring. Revised C & A to be issued. Soil cleanup to start summer 1994, ground water source control in 1995.
	Geer Road Landfill	1,1-DCA, 1,1,1-TCA, TCE, PCA, Freons	Ground water cleanup underway.
	Rhone-Poulenc (formerly Union Carbide) Test Plots	Aldicarb	Additional assessment work ongoing.
	Shell Agricultural (Research facility; pesticides in ground water probably the result of use on test plots)	Bladex, Atrazine Chloroform, Planavin, 1,1-DCE, DBCP, Nitrate	Additional plume definition requested May 1991; not done.
	Thunderbolt Riverbank (wood treatment facility)	Chromium	Ground water extraction appears successful. Monitoring continues.
	Hawke Dusters (pesticides and possible breakdown products in ground water under rinse water storage pond)	Dicofol, Methomyl, PCNB, Copper	Enforcement action against site owners in order to obtain site assessment and cleanup.
		1,2-DCE, Chloroform, 1,2-DCA, 1,1,1-TCA, Carbon Tetrachloride, Bromodichloromethane	Cleanup and Abatement Order issued. Toxic Pits Cleanup Act site.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Stanislaus	Valley Wood	Copper, Chromium, Arsenic	Out-of-court settlement. Federal Superfund site. Interim cleanup in progress.
	City of Turlock Airport	Dieldrin, Propham, Neburon	Contaminated soil removed. Ground water being monitored. Site closed. Ground water monitoring discontinued with our June 24, 1991 approval.
Merced	Merced Municipal Airport	DDT, DDD, DDE, Endosulfan, Toxaphene, Alachlor, Endrin, Captan, Dicofol, Methoxychlor	Phase II investigation to determine extent of contamination.
	Hamburg Ranch	DDT and Derivatives, Endosulfan, Toxaphene, Nemacur, Ethyl Parathion	Extent of soil contamination has been determined. Excavation is underway. Extent of ground water contamination must still be determined and soil bioremediation done. Excavation and backfill with clean soil completed. Now ground water contamination has been detected. Soil remediation still remains to be done.
	J.R. Simplot, Winton	1,2-DCP, Dieldrin	Final investigation workplan submitted.
	BAC Pritchard	Chromium	Soil Closure Plan being drafted. Ground water extraction and treatment system being built. Ground water plume defined.
Sutter	Bowles Flying Service	2,4-D, Bolero, Diuron, Metalaxyl, Ordram, Simazine	Assessment ongoing. Toxic Pits Cleanup Act site. Cease and Desist Order issued. USEPA looking at this site.
Yolo	Frontier Fertilizer Company, Davis	EDB	State Superfund initiated. DTSC installing interim ground water treatment system. USEPA conducting investigation to determine extent.
	DOW Elanco, Davis Agricultural Research	Picloram, Dinoseb, 1,2-D 1,2-Dichloroethane	Soil cleanup completed, ground water monitoring for pesticides completed. Remediation of gasoline constituents in soil and ground water in progress.
	J.R. Simplot, Courtland	EDB	Final investigation workplan submnitted.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Yolo	U.C. Davis	Chlorpyrifos, Dicamba, Atrazine, Aldrin	Cleanup and Abatement Order issued.
Butte	Avag, Inc. (Aerial Applicater)	Toxaphene	Detected in monitoring well. Additional wells to be installed to confirm presence and extent of contamination.
Shasta	Calaran Lumber Company, Redding	Pentachlorophenol	Contaminated soil removed, monitoring shows minor contamination in ground water. Wells left intact. Cleanup and Abatement Order rescinded. No further action at this time.
	Fibreboard Corporation, Burney	Pentachlorophenol	Site cleanup completed and area paved. Monitoring wells closed. Waste Discharge Requirements rescinded. No further action required.
	Roseburg Forest Products, Paul Bunyan Facility	Pentachlorophenol	Facility has ceased operation. Discharger paved over contaminated soil and installed lysimeters. Discharger may consider soil removal.
	Sierra Pacific Industries, Central Valley	Pentachlorophenol	Soil contamination still present. Monitoring of runoff during storm periods indicates PCP still discharging to surface waters.
Tehama	Crane Mills, Paskenta	Pentachlorophenol	Contaminated soil removed and ground water monitoring in progress.
	Louisiana-Pacific, Red Bluff	Pentachlorophenol	Facility has ceased operation. Ground water monitoring in progress. Further cleanup required.
Plumas	Siskiyou-Plumas Lumber Company, Quincy	Pentachlorophenol	Contaminated soil removed. Ground water monitoring in progress.
Solano	Wickes Forest Industries	Chrome	Ground water cleanup underway.
Colusa	Moore Aviation (pesticides in ground water under rinse water disposal site)	2,4-D, MCPA	Site cleanup and ground water remediation. Soils bioremediation appears to be nearing completion. Ground water remediation program continuing.
Kings	Lemoore N.A.S.	Unspecified	Investigation ongoing.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Kings	Blair Field	2,4-D, Dicofol, Diazinon, Propargite	Assessment needed.
	Blair Aviation	Trifluralin, Mevinphos, Phorate	Contamination assessment needed.
	Lakeland	DDT, Toxaphene	Contaminated soils excavated and stockpiled on-site. Remediation underway.
Tuolumne	Tuolumne County Wells	Methylene Chloride	Methylene chloride detected in one well (AB 1803 sampling).
Yuba	Beale Air Force Base	Lindane	Ground water investigation underway.

Table 6 **ACTIONS TAKEN BY THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, LAHONTAN REGION, IN 1993**

In September 1993, the Regional Water Board adopted Resolution 6-93-89 "Approving a Revised Water Quality Control Plan for the Lahontan Region ...". The revised plan included an updated definition for pesticides. It also included updated problem descriptions of potential types of water quality problems related to pesticide use. The revised plan also included pesticide use control actions, as well as control actions for weed and vector control. The revised plan will soon be considered for approval by both the State Water Board and U.S. Environmental Protection Agency.

Table 7

ACTIONS TAKEN BY THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, COLORADO RIVER BASIN REGION, IN 1993

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Imperial	Central Brave Agricultural Service	4,4'-DDE, Endosulfan	Recalcitrant Discharger. Referred to Attorney General for nonpayment of fees.
	City of Brawley	4,4'-DDE, Dieldrin	Contaminated soil excavated and transported to Class I facility. Site closed.
	Visco Flying Service	4,4'-DDE, 4,4'-DDD, 4,4'-DDT, Endosulfan I & II	Impoundment remediated, capped, and closed in place.
	U.C. Davis Agricultural Field Station	Dacthal, Diuron	Completed remedial work, site closed in place.
	J.R. Simplot Company, Sandin Siding Facility	Dieldrin, 4,4'-DDT, Endrin	Cleanup and Abatement Order issued. Site in remediation process.
	Stoker Company	Endosulfan I & II, Dinoseb, 2,4-DB	Closure of land treatment facility.
	Ross Flying Service	4,4'-DDD, 4,4'-DDE 4,4'-DDT, Dieldrin	Closure of surface impoundment. Quarterly monitoring of ground water.
Riverside	West Coast Flying	Endosulfan I & II, Disulfoton,	Recalcitrant Discharger. Referred to Attorney General for nonpayment of fees.
	Woten Aviation Services	Disyston, DEF, Ethyl Parathion, Methyl Parathion	Cleanup and Abatement Order issued. USEPA has lead in cleanup.
	Foster Gardner, Inc., Coachella Facility	1,2-Dichloroethane, 1,2-D, Ethylene Dibromide	Cleanup and Abatement Order issued October 1991.
	Farmers Aerial Service, Inc.	4,4'-DDE, Endosulfan I	Closure of disposal area.
	Coachella Valley Mosquito Abatement District	DDT	Under investigation.
	Crop Production Services, Blythe (Formerly Pure Gro MW-24)	1,2 Dichloropropane	Under investigation.

Table 8

ACTIONS TAKEN BY THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SANTA ANA REGION, IN 1993

There are currently 99 confirmed detections of pesticides in the Santa Ana Region. Only one of these has been attributed to a point source discharge. Ground water extraction and treatment at this site is being performed under an order issued by the Regional Water Board. With the exception of this, all detections on this list are from domestic and agricultural production wells. Ninety six of these wells contain dibromochloropropane (DBCP), four contain simazine, and one contains 1,2-dichloropropane (two wells contain both DBCP and simazine).

The presence of DBCP in the Region's ground water has resulted in both an actual and threatened impact on the beneficial use of water as a drinking water supply, since 77 of the 94 wells containing DBCP are drinking water wells.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Orange	Great Western Savings, Irvine	1,2-D, EDB, 1,2-DCA	NDPES permit issued November 1986. Ground water extraction and treatment continuing. Permit was extended for another five years.
Riverside	Sunnymead MWC (North and South well)	DBCP	Both wells were sold to Eastern Municipal Water District in February 1991. Customers are being served by the new District from other supply sources. North well has been completely rehabilitated. The South well will be used for emergency purposes only.
	Arlington Basin	DBCP	Construction of a 7 MGD reverse osmosis plant with partial flow through a GAC unit for treatment of TDS, NO^3 and DBCP was completed in September 1990. About 4 MGD of ground water is treated and 2 MGD is bypassed. Treated water is mixed with the bypassed water and discharged to a local channel for ground water recharge purposes. Salt brine (0.8 MGD) is discharged to the Santa Ana Regional Interceptor which discharges to the ocean via the Orange County sewage treatment plant.
	City of Corona (Well 8, mun.)	Simazine	Well has been completely rehabilitated. Simazine was not detected in the sampling after rehabilitation work. No further action being taken.
	Home Gardens CWD (Wells 2 & 3, mun.)	DBCP, Simazine	Water purveyor has closed these wells and is now purchasing water from City of Riverside.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Riverside	City of Riverside, Twin Spring, mun.	DBCP	Well is out of service. No mitigation measures in effect.
	Victoria Farm MWC (Well 01, mun.)	DBCP	Well is being used; DBCP concentration is below Maximum Contaminant Level after water is blended with water purchased from the City of San Bernardino.
	City of Corona (Well 17, mun.)	Simazine	Well is being used. Trace of DBCP was detected in March 1991 sampling.
	City of Riverside (Russell "B")	Simazine	Water is being blended with other supply wells in the area.
	City of Riverside (1st Street)	DBCP	Well is not being used due to high concentrations of DBCP. No mitigation measures in effect.
	City of Riverside (Electric Street, mun.)	DBCP	Well is being blended with other supply wells; blended water is sampled on a weekly basis.
	City of Riverside (Palmyrita, mun.)	DBCP	Well is not being used due to high concentrations of DBCP. No mitigation measures in effect.
	City of Riverside (3 wells, mun.)	DBCP	Water from Hunt Wells No. 6, 10, and 11 is being blended with other wells in the area.
	City of Riverside (4 wells, emergency, Downtown Riverside)	DBCP	No mitigation measures in effect. These four wells are also contaminated with industrial organic solvents. Investigation is underway to determine the source of the solvents.
	Riverside County Hall Record, (pr)	DBCP	No mitigation measures in effect. VOCs such as TCE and PCE have also been found. Well is used for emergency purposes only.
	Loma Linda University, Arlington, (Wells 1 & 2, mun.)	DBCP	The University water supply system is tied into the City of Riverside domestic water supply distribution system. These two wells are used for irrigation purposes at the school.
	City of Riverside (Moor-Griffith, mun.)	DBCP	Water is blended with other supply wells in the area.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Riverside	Home Gardens School (mun.)	DBCP	Well was abandoned about three years ago. The school is now using water from Home Gardens Water District.
	Lake Hemet MWD (Wells A and B, mun.)	DBCP	Well A is being used for domestic purposes. No trace of DBCP has been found during the past two rounds of sampling. Well B is being used by a local farmer for irrigation purposes.
	Buschlen, Dwight (mun.)	DBCP	Well was abandoned about five years ago. A second well on the property with traces of DBCP is being used for irrigation only.
San Bernardino	Gage System Wells (11 wells, mun.)	DBCP	The City of Riverside operates the Gage System which consists of 13 wells located along the Santa Ana River. These wells are being blended for domestic use. Trace amounts of radon have been detected in some of these wells. The City has installed three deep wells in the area to increase blending capacity. New well will be in operation soon.
	Bunker Hill Basin: Crafton/Redlands area (32 wells)	DBCP	The City of Redlands started construction of a 6,000 gpm GAC treatment system in September 1991. This GAC system treats ground water from two wells. Treated water is being put into the local water supply distribution system. Funding for this system is from the State Water Board ($2.8 million) and Bond money through the State Expenditure Plan ($1.9 million) which is managed by Department of Toxic Substance Control. The system has been on line since May 1993.
	South San Bernardino Company Water District (4 wells, mun.)	DBCP	All four wells are out of service. The City of San Bernardino Water Department purchased the water district in July 1991. The City now supplies all the customers in the area.
San Bernardino	Cucamonga CWD (4 wells, mun.)	DBCP	Well No. 13 has not been used since 1991. The other three wells are standby wells and are used on a limited basis. Water is being purchased from MWD.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
San Bernardino	Monte Vista CWD (3 wells, mun.)	DBCP	All three wells are on stand-by status. Water is being purchased from MWD.
	City of Upland (15 wells)	DBCP	Eleven wells are out of operation. Four wells are currently being used and are being blended with other supply wells.
	City of Loma Linda (6 wells, mun.)	DBCP	Two wells have been abandoned. One well is out of operation due to high nitrates. DBCP concentration in all the wells is the MCL. The City also purchases treated water from the City of San Bernardino.

Table 9

ACTIONS TAKEN BY THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SAN DIEGO REGION, IN 1993

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
San Diego	City of Oceanside Water Utility District (Well No. 12-11S/4W-18L1 S)	1,2-DCP	This backup drinking water well is located in the San Luis Rey River Valley. Up to 2.3 ppm has been detected in this well. The City of Oceanside is continuing monitoring of this well and reports to the County.
	Truly Nolen Exterminating, Inc.	Aldrin, Dieldrin, Chlordane	This is an on-site abandoned well which allegedly received pesticide wastes several years ago. The pesticide constituents in the soil and ground water include Aldrin, Dieldrin, and Chlordane. Contaminated soil has been removed. Ground water is being monitored. Five year post remedial monitoring extended one year.
	San Pasqual Valley (three wells)	Ethylene Dibromide	Ground water monitoring ongoing.

APPENDICES

A. THE PESTICIDE CONTAMINATION PREVENTION ACT

Assembly Bill No. 2021

CHAPTER 1298

An act to add Article 15 (commencing with Section 13141) to Chapter 2 of Division 7 of the Food and Agricultural Code, relating to water contamination.

[Approved by Governor September 30, 1985. Filed with Secretary of State September 30, 1985.]

LEGISLATIVE COUNSEL'S DIGEST

AB 2021, Connelly. Economic poisons: groundwaters.

(1) Existing law does not require registrants of economic poisons to submit specified information relating to contamination of groundwaters as part of the initial registration or renewal of registration process.

This bill would enact the Pesticide Contamination Prevention Act. The bill would require each registrant of an economic poison registered for agricultural use to submit specified information to the Director of Food and Agriculture, not later than December 1, 1986, relating generally to the impact of the economic poison on water sources. The bill would provide for an extension for submission of some of this information for up to 2 years, as specified, but in no event later than December 1, 1989. Since violation of these provisions would be a misdemeanor, the bill would impose a state-mandated local program. Inadequate information on a particular economic poison would be defined to be a groundwater protection data gap after a specified determination by the director. The director would be prohibited from registering or renewing the registration of an economic poison with a groundwater protection data gap after December 1, 1988, for economic poisons applied with ground-based application equipment or by chemigation and after December 1, 1989, for economic poisons intended for use with other than ground-based application equipment, unless the registrant has been granted a current extension under the bill.

The director would be required to establish the Groundwater Protection List of specified economic poisons and to report specified information to the Legislature, the State Department of Health Services, and the State Water Resources Control Board not later than December 1, 1987, regarding economic poisons, as specified.

The director would be required to perform a soil and water monitoring program pursuant to a specified schedule and would be required to report all monitoring results to the State Department of Health Services and the board.

The bill would require the director, on or before December 1, 1987, and annually thereafter, to request a budget appropriation in order to fund specified activities under the bill.

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The bill would also require the director to cancel the registration of economic poisons with specified criteria relating to groundwater findings unless the registrant is granted an extension or the director makes specified findings.

The bill would also require the director to maintain a specified well sampling data base and, not later than June 30, 1986, the director, the State Department of Health Services, and the board, jointly, would be required to establish minimum requirements for well sampling that would apply to all agencies conducting the sampling after December 1, 1986. This requirement would impose a state-mandated local program on local agencies so affected. The director would be required to report annually, commencing on December 1, 1986, to the State Department of Health Services and the board on well sampling, as specified.

(2) The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement, including the creation of a State Mandates Claims Fund to pay the costs of mandates which do not exceed $500,000 statewide and other procedures for claims whose statewide costs exceed $500,000.

This bill would provide that reimbursement shall be made pursuant to those statutory procedures and, if the statewide cost does not exceed $500,000, shall be payable from the State Mandates Claims Fund, except that, for certain costs, the bill would provide that no reimbursement is required for a specified reason.

(3) The bill would provide that, notwithstanding Section 2231.5 of the Revenue and Taxation Code, this bill does not contain a repealer, as required by that section; therefore, the provisions of the bill would remain in effect unless and until they are amended or repealed by a later enacted bill.

The people of the State of California do enact as follows:

SECTION 1. Article 15 (commencing with Section 13141) is added to Chapter 2 of Division 7 of the Food and Agricultural Code, to read:

Article 15. The Pesticide Contamination Prevention Act

13141. The Legislature finds and declares all of the following:

(a) It is the right of every citizen in this state to drink safe, potable, wholesome, and pure drinking water.

(b) The health and economic prosperity of rural communities and individual farm families in the state are threatened by contaminated drinking water supplies because of their proximity to the use of pesticides.

(c) Pesticide contaminants and other organic chemicals are being

found at an ever increasing rate in underground drinking water supplies.

(d) The United States Environmental Protection Agency has concluded that evidence of relatively localized levels of pesticide pollution should be treated as a warning of more widespread, future contamination.

(e) Groundwater once polluted cannot be easily cleaned up; thus, there is a considerable potential that groundwater pollution will continue long after actions have been taken to restrict application of the pesticide to land.

(f) Due to the potential widespread exposure to public drinking water supplies from pesticide applications to the land and the resultant risk to public health and welfare, the potential for pollution of groundwater due to pesticide use must be considered in the registration, renewal, and reregistration process.

(g) It is the purpose of this article to prevent further pesticide pollution of the groundwater aquifers of this state which may be used for drinking water supplies.

13142. For the purposes of this article, the following definitions apply:

(a) "Board" means the State Water Resources Control Board.

(b) "Groundwater protection data gap" means that, for a particular economic poison, the director, after study, has been unable to determine that each study required pursuant to subdivision (a) of Section 13143 has been submitted or that each study submitted pursuant to subdivision (a) of Section 13143 is valid, complete, and adequate.

(c) "Henry's Law constant" is an indicator of the escaping tendency of dilute solutes from water and is approximated by the ratio of the vapor pressure to the water solubility at the same temperature.

(d) "Soil adsorption coefficient" is a measure of the tendency of economic poisons, or their biologically active transformation products, to bond to the surfaces of soil particles.

(e) "Pesticide registrant" means a person that has registered an economic poison pursuant to this chapter.

(f) "Agricultural use" has the same meaning as defined in Section 11408.

(g) "Active ingredient" has the same meaning as defined in Section 136 of Title 7 of the United States Code.

(h) "Economic poison" has the same meaning as defined in Section 12753.

(i) "Degradation product" means a substance resulting from the transformation of an economic poison by physicochemical or biochemical means.

(j) "Pollution", for the purposes of this article, means the introduction into the groundwaters of the state of an active ingredient, other specified product, or degradation product of an

active ingredient of an economic poison above a level, with an adequate margin of safety, that does not cause adverse health effects.

(k) "Chemigation" means a method of irrigation whereby an economic poison is mixed with irrigation water before the water is applied to the crop or the soil.

(*l*) "Soil microbial zone" means the zone of the soil below which the activity of microbial species is so reduced that it has no significant effect on pesticide breakdown.

13143. (a) Not later than December 1, 1986, a person that has registered an economic poison in California for agricultural use shall submit to the director the information prescribed in this subdivision. The information shall be submitted for each active ingredient in each economic poison registered. The registrant shall submit all of the following information:

(1) Water solubility.

(2) Vapor pressure.

(3) Octanol-water partition coefficient.

(4) The soil adsorption coefficient.

(5) Henry's Law constant.

(6) Dissipation studies, including hydrolysis, photolysis, aerobic and anaerobic soil metabolism, and field dissipation, under California or similar environmental use conditions.

(7) Any additional information the director determines is necessary.

(b) The director also may require the information prescribed in subdivision (a) for other specified ingredients and degradation products of an active ingredient in any economic poison. The director shall also require this information when the State Department of Health Services or the board submits a written request for the information to the director, if the State Department of Health Services or the board specifies the reasons why they consider the information necessary. The director shall deny the request upon a written finding that, based on available scientific evidence, the request would not further the purposes of this article.

(c) All information submitted pursuant to subdivision (a) shall be presented in English and summarized in tabular form on no more than three sheets of paper with the actual studies, including methods and protocols attached. All information shall, at a minimum, meet the testing methods and reporting requirements provided by the Environmental Protection Agency Pesticide Assessment Guidelines, Subdivision D Series 60 to 64, inclusive, for product chemistry and Subdivision N Series 161 to 164, inclusive, for environmental fate, including information required for degradation products in specific studies. With prior approval from the director, registrants may use specified alternative protocols as permitted by the United States Environmental Protection Agency guidelines, if the director finds use of the protocol is consistent with, and accomplishes the objectives of, this article. Studies conducted on active ingredients in the

formulation of economic poisons shall meet the same testing methods as required for studies conducted on active ingredients. The department, in consultation with the board, may, in addition, require specified testing protocols that are specific to California soil and climatic conditions. The director may give a pesticide registrant an extension of up to two years if it determines that this additional time is necessary and warranted to complete the studies required in paragraph (6) of subdivision (a). No extension of the deadline for these studies shall go beyond December 1, 1989. When seeking the extension, the registrant shall submit to the director a written report on the current status of the dissipation studies for which the extension is being sought. For registrants granted an extension pursuant to this section, Section 13145 shall be effective upon the completion date established by the director.

(d) The director may grant the registrant an extension beyond the one authorized in subdivision (c), if all of the following conditions are met:

(1) The registrant submits a written request to the director for an extension beyond the one granted pursuant to subdivision (c). The request shall include the reasons why the extension is necessary and the findings produced by the study up to the time the request is made.

(2) The director finds that the registrant has made every effort to complete the studies required in paragraph (6) of subdivision (a) within the required time limits of the extension granted pursuant to subdivision (c) and that those studies could not be completed within the required time limits due to circumstances beyond the control of the registrant.

(3) The director establishes a final deadline, not to exceed one year beyond the time limit of the extension granted pursuant to subdivision (c), and a schedule of progress by which the registrant shall complete the studies required in paragraph (6) of subdivision (a).

(e) After December 1, 1986, no registration of any new economic poison shall be granted unless the applicant submits all of the information required by the director pursuant to this article and the director finds that the information meets the requirements of this article.

13144. (a) Not later than December 1, 1986, the department shall establish specific numerical values for water solubility, soil adsorption coefficient (Koc), hydrolysis, aerobic and anaerobic soil metabolism, and field dissipation. The values established by the department shall be at least equal to those established by the Environmental Protection Agency. The department may revise the numerical values when the department finds that the revision is necessary to protect the groundwater of the state. The numerical values established or revised by the department shall always be at least as stringent as the values being used by the Environmental

Protection Agency at the time the values are established or revised by the department.

(b) Not later than December 1, 1987, and annually thereafter, the director shall report the following information to the Legislature, the State Department of Health Services, and the board for each economic poison registered for agricultural use:

(1) A list of each active ingredient, other specified ingredient, or degradation product of an active ingredient of an economic poison for which there is a groundwater protection data gap.

(2) A list of each economic poison that contains an active ingredient, other specified ingredients, or degradation product of an active ingredient which is greater than one or more of the numerical values established pursuant to subdivision (a), or is less than the numerical value in the case of soil adsorption coefficient, in both of the following categories:

(A) Water solubility or soil adsorption coefficient (Koc).

(B) Hydrolysis, aerobic soil metabolism, anaerobic soil metabolism, or field dissipation.

(3) For each economic poison listed pursuant to paragraph (2) for which information is available, a list of the amount sold in California during the most recent year for which sales information is available and where and for what purpose the economic poison was used, when this information is available in the pesticide use report.

(c) The department shall determine to the extent possible, the toxicological significance of the degradation products and other specified ingredients identified pursuant to paragraph (2) of subdivision (b).

13145. (a) Any registrant of an economic poison identified in paragraph (1) of subdivision (b) of Section 13144 shall be subject to a fine of up to ten thousand dollars ($10,000) for each day the groundwater protection data gap exists. In determining the amount of the fine, the director shall consider both of the following:

(1) The extent to which the registrant has made every effort to submit valid, complete, and adequate information within the required time limits.

(2) Circumstances beyond the control of the registrant that have prevented the registrant from submitting valid, complete, and adequate information within the required time limits.

(b) If there is a dispute between the director and a registrant regarding the existence of a groundwater protection data gap and the director desires to levy a fine on the registrant pursuant to this section, the director shall submit the issues of the dispute to the subcommittee created pursuant to subdivision (b) of Section 13150. The subcommittee shall review the evidence submitted by the registrant and the director and make recommendations to the director on whether or not the groundwater data gap exists.

(c) The provisions of subdivisions (a) and (b) shall not apply to pesticide products whose registration has lapsed or has been

cancelled, or to products that have been granted a current extension pursuant to Section 13143.

(d) The director shall, by regulation, establish a list of economic poisons that have the potential to pollute groundwater. The list shall be entitled the Groundwater Protection List. Notwithstanding the provisions of Chapter 3.5 (commencing with Section 11340) of Division 3 of Title 2 of the Government Code, the director shall immediately place all economic poisons identified in paragraph (2) of subdivision (b) of Section 13144 on the Groundwater Protection List and shall regulate the use of these economic poisons if the economic poison is intended to be applied to or injected into the soil by ground-based application equipment or by chemigation, or the label of the economic poison requires or recommends that the application be followed, within 72 hours, by flood or furrow irrigation. The director shall adopt regulations to carry out the provisions of this article. The regulations shall include, but are not limited to, the following:

(1) Any person who uses an economic poison which has been placed on the Groundwater Protection List is required to report to the county agricultural commissioner the use of the economic poison on a form prescribed by the director. The reporting deadline shall conform to the deadline established for the reporting of the use of restricted materials.

(2) Dealers of economic poisons shall make quarterly reports to the director of all sales of economic poisons. This report shall include lists of all sales by purchases.

13146. (a) The director shall not register or renew the registration of an economic poison intended to be applied to or injected into the ground by ground-based application equipment or by chemigation after December 1, 1988, if there is a groundwater protection data gap for that economic poison, unless the registrant has been granted a current extension pursuant to Section 13143.

(b) The director shall not register or renew the registration of an economic poison intended for use with other than ground-based application equipment after December 1, 1989, if there is a groundwater protection data gap for that economic poison, unless the registrant has been granted a current extension pursuant to Section 13143.

(c) If a registrant does not comply with the information requirements of Section 13143, the department shall file the information requirements of Section 13143 in accordance with procedures provided in subparagraph (B) of paragraph (2) of subsection (c) of Section 136a of Title 7 of the United States Code. In order to carry out this section, the director has the same authority to require information from registrants of active pesticide ingredients that the administrator of the Environmental Protection Agency has pursuant to subparagraph (B) of paragraph (2) of subsection (c) of Section 136a of Title 7 of the United States Code.

On or before July 1, 1986, the director shall, by regulation, prescribe procedures for resolving disputes or funding the filing of the information requirements of Section 13143. The procedures may include mediation and arbitration. The arbitration procedures, insofar as practical, shall be consistent with the federal act, or otherwise shall be in accordance with the commercial arbitration rules established by the American Arbitration Association. The procedures shall be established so as to resolve any dispute with the timetable established in Section 13143.

(d) For an active ingredient or economic poison for which a registrant or registrants do not provide the information required pursuant to Section 13143, the director may determine the active ingredient or economic poison to be critical to agricultural production and the director may utilize assessments charged to those registrants of the active ingredient for which the information is required pursuant to Section 13143 in amounts necessary to cover the department's expenses in obtaining the information. The assessment shall be made pursuant to Section 12824. The director may also request an appropriation to be used in combination with assessments to obtain the required information.

13147. On or before December 1, 1987, and annually thereafter, the director shall request a budget appropriation in order to meet the reasonable and anticipated costs of conducting soil and water monitoring pursuant to Section 13148, a review of data submitted pursuant to Section 13143, and the administration of economic poisons placed on the Groundwater Protection List pursuant to this article.

13148. (a) In order to more accurately determine the mobility and persistence of the economic poisons identified pursuant to paragraph (2) of subdivision (b) of Section 13144 and to determine if these economic poisons have migrated to groundwaters of the state, the director shall conduct soil and groundwater monitoring statewide in areas of the state where the economic poison is primarily used or where other factors identified pursuant to Section 13143 and subdivision (b) of Section 13144, including physicochemical characteristics and use practices of the economic poisons, indicate a probability that the economic poison may migrate to the groundwaters of the state. The monitoring shall commence within one year after the economic poison is placed on the Groundwater Protection List and shall be conducted in accordance with standard protocol and testing procedures established pursuant to subdivision (b). Monitoring programs shall replicate conditions under which the economic poison is normally used in the area of monitoring. In developing a monitoring program, the director shall coordinate with other agencies that conduct soil and groundwater monitoring.

(b) Within 90 days after an economic poison is placed on the Groundwater Protection List pursuant to subdivision (d) of Section

13145, the director, in consultation with the board, shall develop a standard protocol and testing procedure for each economic poison identified pursuant to subdivision (d) of Section 13145.

(c) The director shall report all monitoring results to the State Department of Health Services and the board.

13149. (a) Within 90 days after an economic poison is found under any of the conditions listed in paragraph (1), (2), or (3), the director shall determine whether the economic poison resulted from agricultural use in accordance with state and federal laws and regulations, and shall state in writing the reasons for the determination.

(1) An active ingredient of an economic poison has been found at or below the deepest of the following depths:

(A) Eight feet below the soil surface.

(B) Below the root zone of the crop where the active ingredient was found.

(C) Below the soil microbial zone.

(2) An active ingredient of an economic poison has been found in the groundwaters of the state.

(3) The economic poison has degradation products or other specified ingredients which pose a threat to public health and which have been found under the conditions specified for active ingredients in either paragraph (1) or (2).

(b) Upon a determination by the director that an economic poison meets any of the conditions specified in paragraph (1), (2), or (3) of subdivision (a) as a result of agricultural use in accordance with state and federal laws and regulations, the director shall immediately notify the registrant of the determination and of the registrant's opportunity to request a hearing pursuant to subdivision (c).

(c) Any economic poison that meets any of the conditions in subdivision (b) shall be subject to the provisions of Section 13150, provided the registrant of the economic poison requests, within 30 days after the notice is issued, that the subcommittee conduct a hearing, as described in Section 13150. Notwithstanding any other provision of law, if the registrant does not request the hearing within 30 days after the notice is issued, the director shall cancel the registration of the economic poison.

(d) For the purposes of this section, any finding of an economic poison shall result from an analytical method approved by the department and shall be verified, within 30 days, by a second analytical method or a second analytical laboratory approved by the department.

13150. The director may allow the continued registration, sale, and use of an economic poison which meets any one of the conditions specified in Section 13149 if all of the following conditions are met:

(a) The registrant submits a report and documented evidence which demonstrate both of the following:

(1) That the presence in the soil of any active ingredient, other specified ingredient, or degradation product does not threaten to pollute the groundwaters of the state in any region within the state in which the economic poison may be used according to the terms under which it is registered.

(2) That any active ingredient, other specified ingredient, or degradation product that has been found in groundwater has not polluted, and does not threaten to pollute, the groundwater of the state in any region within the state in which the economic poison may be used according to the terms under which it is registered.

(b) A subcommittee of the director's pesticide registration and evaluation committee, consisting of one member each representing the director, the State Department of Health Services, and the board, holds a hearing, within 180 days after it is requested by the registrant, to review the report and documented evidence submitted by the registrant and any other information or data which the subcommittee determines is necessary to make a finding.

(c) The subcommittee, within 90 days after the hearing is conducted, makes any of the following findings and recommendations:

(1) That the ingredient found in the soil or groundwater has not polluted and does not threaten to pollute the groundwaters of the state.

(2) That the agricultural use of the economic poison can be modified so that there is a high probability that the economic poison would not pollute the groundwaters of the state.

(3) That modification of the agricultural use of the economic poison pursuant to paragraph (2) or cancellation of the economic poison will cause severe economic hardship on the state's agricultural industry, and that no alternative products or practices can be effectively used so that there is a high probability that pollution of the groundwater of the state will not occur. The subcommittee shall recommend a level of the economic poison that does not significantly diminish the margin of safety recognized by the subcommittee to not cause adverse health effects.

When the subcommittee makes a finding pursuant to paragraph (2) or (3), it shall determine whether the adverse health effects of the economic poison are carcinogenic, mutagenic, teratogenic, or neurotoxic.

(d) The director, within 30 days after the subcommittee issues its findings, does any of the following:

(1) Concurs with the subcommittee finding pursuant to paragraph (1) of subdivision (c) of Section 13149,

(2) Concurs with the subcommittee finding pursuant to paragraph (2) of subdivision (c) of Section 13149, and adopts modifications that result in a high probability that the economic poison would not pollute the groundwaters of the state,

(3) Concurs with the subcommittee findings pursuant to

paragraph (3) of subdivision (c), or determines that the subcommittee finding pursuant to paragraph (2) of subdivision (c) will cause severe economic hardship on the state's agricultural industry. In either case, the director shall adopt the subcommittee's recommended level or shall establish a different level, provided the level does not significantly diminish the margin of safety to not cause adverse health effects.

(4) Determines that, contrary to the finding of the subcommittee, no pollution or threat to pollution exists. The director shall state the reasons for his or her decisions in writing at the time any action is taken, specifying any differences with the subcommittee's findings and recommendations. The written statement shall be transmitted to the appropriate committees of the Senate and Assembly, the Department of Health Services, and the board.

When the director takes action pursuant to paragraph (2) or (3), he or she shall determine whether the adverse health effects of the economic poison are carcinogenic, mutagenic, teratogenic, or neurotoxic.

13151. Any economic poison identified pursuant to Section 13149 which fails to meet any of the conditions of Section 13150 shall be canceled.

13152. (a) The director shall conduct ongoing soil and groundwater monitoring of any economic poison whose continued use is permitted pursuant to paragraph (3) of subdivision (d) of Section 13150.

(b) Any economic poison monitored pursuant to this section that is determined, by review of monitoring data and any other relevant data, to pollute the groundwaters of the state two years after the director takes action pursuant to paragraph (3) of subdivision (d) of Section 13150 shall be canceled unless the director has determined that the adverse health effects of the economic poison are not carcinogenic, mutagenic, teratogenic, or neurotoxic.

(c) The director shall maintain a statewide data base of wells sampled for pesticide active ingredients. All agencies shall submit to the director, in a timely manner, the results of any well sampling for pesticide active ingredients and the results of any well sampling that detect any pesticide active ingredients.

(d) Not later than June 30, 1986, the director, the State Department of Health Services, and the board shall jointly establish minimum requirements for well sampling that will ensure precise and accurate results. The requirements shall be distributed to all agencies that conduct well sampling. All well sampling conducted after December 1, 1986, shall meet the minimum requirements established pursuant to this subdivision.

(e) The director, in consultation with the State Department of Health Services and the board, shall report the following information to the Legislature, the State Department of Health Services, and the board on or before December 1, 1986, and annually thereafter:

(1) The number of wells sampled for pesticide active ingredients, the location of the wells from where the samples were taken, the well numbers, if available, and the agencies responsible for drawing and analyzing the samples.

(2) The number of well samples with detectable levels of pesticide active ingredients, the location of the wells from which the samples were taken, the well numbers, if available, and the agencies responsible for drawing and analyzing the samples.

(3) An analysis of the results of well sampling described in paragraphs (1) and (2), to determine the probable source of the residues. The analysis shall consider factors such as the physical and chemical characteristics of the economic poison, volume of use and method of application of the economic poison, irrigation practices related to use of the economic poison, and types of soil in areas where the economic poison is applied.

(4) Actions taken by the director and the board to prevent economic poisons from migrating to groundwaters of the state.

SEC. 2. Reimbursement to local agencies and school districts for costs mandated by the state pursuant to this act shall be made pursuant to Part 7 (commencing with Section 17500) of Division 4 of Title 2 of the Government Code and, if the statewide cost of the claim for reimbursement does not exceed five hundred thousand dollars ($500,000), shall be made from the State Mandates Claims Fund, except that no reimbursement is required by this act pursuant to Section 6 of Article XIII B of the California Constitution for those costs which may be incurred by a local agency or school district because this act creates a new crime or infraction, changes the definition of a crime or infraction, changes the penalty for a crime or infraction, or eliminates a crime or infraction.

SEC. 3. Notwithstanding Section 2231.5 of the Revenue and Taxation Code, this act does not contain a repealer, as required by that section; therefore, the provisions of this act shall remain in effect unless and until they are amended or repealed by a later enacted act.

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B. GLOSSARY OF TERMS USED IN THE 1993 UPDATE REPORT

AB 1803 – (1983) A law that required the California Department of Health Services (DHS) to evaluate each public water system to determine its potential for contamination. The systems were required to conduct specified water analyses and to report those results to the DHS. Monitoring required by AB 1803 was completed in June 1989. Based on sampling results, the DHS may require a system to conduct periodic water analyses and to report to the DHS the results of the analyses on a quarterly basis.

AB 2021 – See *Pesticide Contamination Prevention Act.*

acaricide – A pesticide (miticide) used to control mites and ticks.

Action Level (AL) – Published by DHS's Office of Drinking Water, ALs are based mainly on health affects. ALs are advisory to water suppliers. Although not legally enforceable, the majority of water suppliers have complied with action levels as though they were Maximum Contaminant Levels (MCLs).

active ingredient – The chemical or chemicals in a pesticide formulation that are biologically active and are capable, in themselves, of preventing, destroying, repelling or mitigating insects, fungi, rodents, weeds, or other pests.

adsorption – In the context of this report, the surface retention of (in this case, pesticide) molecules of a gas, liquid, or dissolved substance to a solid in such a manner that the adsorbed chemical is slowly made available. Clay and soils high in organic content tend to adsorb pesticides in many instances.

Agricultural Commissioner – For each county in California, the person in charge of the County Department of Agriculture. Under supervision of DPR, the Commissioner enforces the laws and regulations pertaining to agricultural and structural pest control and all other pesticide uses.

agricultural use – (See also *legal agricultural use* and *legal agricultural use determination.*) The use of any pesticide or method or device for the control of plant or animal pests, or any other pests, or the use of any pesticide for the regulation of plant growth or defoliation of plants. It excludes the sale or use of pesticides in properly labeled packages or containers which are intended only for any of the following: home use, use in structural pest control, industrial or institutional use, the control of an animal pest under the written prescription of a veterinarian, local districts, or other public agencies which have entered into and operate under a cooperative agreement with the Dept. of Health Services pursuant to section 2426 of the Health and Safety Code. (Food and Agriculture Code, section 11408.)

analysis – The determination of the composition of a substance by laboratory methods. In this case, it includes the separation and measurement of a pesticide or its degradation product from the sample matrix.

aquifer – A geologic formation, group of formations, or part of a formation, that is water bearing and which transmits water in sufficient quantity to supply springs and pumping wells.

basin irrigation – A method of watering by confining irrigation water around the plant stem or trunk by means of a soil dam. Also called flood irrigation.

Birth Defect Prevention Act (BDPA) – (SB 950, 1984) A law requiring DPR to acquire certain toxicological data for registered pesticides in order to make a scientific determination that their uses will not cause significant adverse health effects. The BDPA prohibits the registration of any new pesticide active ingredient if required mandatory health effects studies are missing, incomplete, or invalid. Pesticide active ingredients already registered that are identified as having the potential to cause significant adverse health effects following a thorough review by DPR scientific staff will be canceled.

breakdown product – See *degradation product*.

chemigation – The application of pesticides through irrigation water, using irrigation techniques and equipment.

coding – A system whereby specific information concerning the analysis of a well water sample for the presence of pesticides is converted to a code of letters and numbers according to a key (see Appendix C, p. 106) in order to enter the data into the well inventory data base.

confirmed detection – For purposes of the well inventory data base, the detection of a compound in two discrete samples taken from the same well during the time period of a single monitoring survey.

data base record – Each chemical analysis of a well water sample for a pesticide residue or related chemical constitutes one record in the data base. Each record may contain up to 149 columns of data.

defoliant – A compound used to remove foliage from crop plants such as cotton, soybean, or tomato, usually to facilitate harvest.

degradation – The breakdown of a chemical by the action of microbes, water, air, sunlight, or other agents.

degradation product – (See also *metabolite*.) A substance resulting from the transformation of a pesticide active ingredient by biological processes (e.g., microbial action) or physical or chemical processes (e.g., hydrolysis, photolysis, photo oxidation).

desiccant – A compound that promotes drying or removal of moisture from plant tissues.

direct streaming – A pathway by which agricultural chemicals may reach ground water; the movement of pesticide residue in runoff surface water to subsurface soil and, ultimately, ground water, through dry wells, soil cracks, or other direct pathways.

discrete sample – Samples taken separately from a well; not a single sample split into smaller samples.

dry well – A small-diameter hole or pit dug into the ground and filled with gravel or other material for the disposal of surface water by infiltration into soil.

economic poison – A pesticide or plant growth regulator; in California, any of the following: any spray adjuvant, any substance, or mixture of substances which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest which may infest or be detrimental to vegetation, man, animals, or households, or be present in any agricultural or nonagricultural environment. Includes fungicides, herbicides, insecticides, nematicides, rodenticides, desiccants, defoliants, plant growth regulators, etc.

emulsifiable concentrate – A concentrated pesticide formulation containing organic solvent and emulsifier to facilitate suspension of the active ingredient when diluted with water.

established PMZ – A Pesticide Management Zone (PMZ) (see definition) listed in section 6802, Title 3 of the California Code of Regulations (3CCR).

flood irrigation – See *basin irrigation.*

formulation – The way in which a pesticide product, containing the active ingredient, the carrier, and other additives, is prepared for practical use. Includes preparation as wettable powder, granular, emulsifiable concentrate, etc.

fumigant – A chemical used in the form of a volatile liquid or a gas. Its vapors kill insects, nematodes, fungi, bacteria, seeds, roots, or entire plants; usually applied in an enclosure of some kind or in the soil.

fungicide – A chemical used to kill or inhibit fungi.

granular – A pesticide chemical mixed with or coating small pellets or sand-like materials, and applied with seeders, spreaders, or special equipment. Granular pesticides are often used to control or destroy soil pests.

ground water – Water and waterways below the earth's surface, in which all interconnected openings in soil and rock are filled (saturated) with water, that supplies wells and springs.

Ground Water Protection Advisories (GWPA) – Written information given by a licensed Pest Control Adviser, who has successfully completed the Ground Water Protection Training Program given by DPR, that must be submitted by permit applicants before the County Agricultural Commissioner can issue a use permit for allowed uses of a regulated pesticide in a Pesticide Management Zone (PMZ). The GWPA contains specific information for applying the regulated pesticide in a sensitive area (PMZ) in order to prevent or minimize the movement of pesticide residues to ground water.

Ground Water Protection List (GWPL) – A list, required by PCPA and established in section 6800 (3CCR), of pesticides having the potential to pollute ground water. The GWPL is divided into two sublists. Sublist (a) is comprised of chemicals that have been detected in

ground water as a result of legal, agricultural use. Pesticide active ingredients whose physicochemical properties exceed the specific numerical values (see definition) and that are labeled for soil application under certain conditions are placed on sublist (b) of the GWPL. Chemicals placed on the GWPL are subject to certain restrictions and reporting requirements.

Health Advisory Level (HAL) – An advisory number published by USEPA's Office of Drinking Water and Office of Water Regulations and Standards. Short-term (10 days or less), long-term (7 years or less), and lifetime exposure health advisories for non-carcinogens and suspected human carcinogens are included where data sufficient for derivation of the advisories exist. HALs are a guideline which include a margin of safety to protect human health. For lifetime HALs, water containing pesticides at or below the HAL is acceptable for drinking every day over the course of one's lifetime.

half-life – The time required for a given amount of a substance to be reduced by half due to chemical and/or biological processes.

herbicide – A pesticide used to control unwanted vegetation either before or after its emergence from the soil.

historical agricultural use – The documented use of a chemical, no longer registered for such use, that has been applied over time in a specific area for the production of an agricultural commodity.

hydrolysis – In the context of this report, alteration of a pesticide by water.

inert ingredient – An ingredient in a formulation which has no pesticidal action.

initial detection sample – For a single study and a particular well, the initial detection sample for a chemical will be the positive sample with the earliest sampling date and/or time. Replicate samples are coded in relation to the initial detection sample.

insecticide – A pesticide used to control an insect which may be present in any environment.

institutional use – Use within the confines of, or on property necessary for the operation of, buildings such as hospitals, factories, schools, libraries, auditoriums and office complexes.

large public water system well – A well supplying 200 or more service connections.

law – State laws (statutes and regulations) are the result of action by the California legislature.

leaching – A pathway by which agricultural chemicals may reach ground water; the process by which residues are dissolved in soil water and follow the movement of water through the soil matrix as it recharges a ground water aquifer.

legal, agricultural use – The application of a pesticide, according to its labeled directions and in accordance with federal and state laws and regulations, for agricultural use as defined in Food and Agricultural Code, section 11408. (See *agricultural use*.)

legal, agricultural use determination – A determination required by section Food and Agricultural Code (FAC) 13149 and based upon the following criteria: (1) the detection of a pesticide ingredient or its degradation product that has been verified according to DPR criteria; (2) a detection of the same pesticide ingredient or its degradation product in ground water, verified at a second site within a one-half mile radius of the original detection (a detection in soil at or below eight feet only needs to be verified at a single site); (3) the detected pesticide ingredient must be formulated in a product which has listed on its label one or more agricultural uses; (4) the application of the agricultural use product(s) in the vicinity of the reported detections should either be documented historically, confirmed by local interviews, or presumed by the identification of a target pest or commodity; (5) the Director may consider a preponderance of evidence as meeting these criteria.

macropore – Space in soil, occupied by air and water, that allows the ready movement of air and percolating water.

Maximum Contaminant Levels (MCLs) – MCLs are part of the drinking water quality standards adopted by DHS and by USEPA under the Safe Drinking Water Act. MCLs are formally established in regulation and are enforceable by the DHS on water suppliers.

Maximum Contaminant Level goals (MCL goals) – MCL goals are promulgated by the USEPA as the first step in establishing MCLs. MCL goals are purely health-based values and are set at "zero" for chemicals classified by the USEPA as "known" and "probable" human carcinogens.

metabolite – In the case of a pesticide, a compound derived from the action upon the pesticide within a living organism (plant, insect, higher animal, etc.). The action varies (oxidation, reduction, etc.) and the metabolite may be more toxic or less toxic than the parent compound. The same derivative may, in some cases, develop through exposure of the pesticide in the environment. (See also *degradation product*.)

Minimum Detection Limit (MDL) – The lowest concentration of analyte that a method of analysis can quantify reliably. The MDL is established in protocol for a study either as a result of a method validation study or by using accepted proven analytical methods (e.g., EPA methods).

mitigation measure – An activity to substantially reduce any adverse impact of a given condition.

model – Mathematical equations that represent certain processes. These equations can be implemented in a computer program in order to facilitate calculations and test model predictions against measured data.

modified use – See *use requirement*.

monitoring study – See *study*.

monitoring well – A well used principally for any of the following purposes: (1) observing ground water levels and flow conditions, (2) obtaining samples for determining ground water quality, or 3) evaluating hydraulic properties of water-bearing strata.

negative analysis – A well water sample in which pesticide residues were not detected at or above the minimum detection limit of the instruments used for analysis.

nematicide – A pesticide used to control nematodes.

nematode – Nematodes are microscopic, worm like animals that live saprophytically in water or soil, or as parasites of plants and animals. Plant parasitic nematodes are also known as eel worms.

non-crop areas – These areas include rights-of-way, golf courses, and cemeteries. There may be agricultural use of pesticides in non-crop areas, e.g., for weed control around buildings on a farm.

non-point source – Contamination which cannot be traced to a small, definable location (compare with *point source*), e.g., applications of agricultural chemical to crops.

organic matter – Plant and animal debris or remains found in the soil in all stages of decay. The major elements in organic matter are oxygen, hydrogen, and carbon.

parts per billion (ppb) – A way to express the concentration of a chemical in a liquid, a solid, or in air. Since one liter of water weighs one billion micrograms, one microgram of a chemical in one liter of water is equal to one ppb.

permit – Permits are issued by County Agricultural Commissioners for a specific site for the use of chemicals that have been designated as restricted pesticides. Restricted pesticides, for various reasons, are potentially more hazardous than other pesticides.

pest – Any of the following that is, or is liable to become, dangerous or detrimental to the agricultural or nonagricultural environment of the state: any insect, predatory animal, rodent, nematode, or weed; any form of terrestrial, aquatic, or aerial plant or animal, virus, fungus, bacteria, or other microorganisms (except viruses, fungi, or bacteria) on or in living humans or other living animals; anything that the Director of the California Department of Food and Agriculture or Director of the Department of Pesticide Regulation declares, by regulation, to be a pest.

Pest Control Adviser (PCA) – A person licensed by DPR and registered with the County Agricultural Commissioner who makes pest control recommendations. All agricultural use recommendations must be in writing and contain certain information. A PCA must complete continuing education requirements before his/her license may be renewed.

pesticide – See *economic poison.*

Pesticide Contamination Prevention Act (PCPA) - (AB 2021) A law, effective January 1, 1986, which added sections 13141 through 13152 to Division 7 of the FAC. The PCPA requires each registrant of an economic poison to submit specified information to the Director of DPR, provides for the establishment of the Ground Water Protection List, requires the Director to perform soil and water monitoring, provides for a specific response to the detection of pesticides in soil and ground water, and requires the Director to maintain a specified well sampling data base and to report certain information annually to the Legislature, the DHS, and the State Water Resources Control Board on well sampling.

Pesticide Detection Response Process (PDRP) - A process, established in sections 13149 through 13151 (FAC) by the PCPA, in which the detection of a pesticide residue in soil (at specific depths) or ground water, is investigated, evaluated, and, when necessary, mitigated. As part of the process, a determination must be made that the detection probably resulted from a legal agricultural-use application of the pesticide. As a result of this process, the use of a pesticide in California may be modified or canceled.

Pesticide Management Zone (PMZ) - A geographic surveying unit of approximately one square mile (a section) that is designated in regulation as sensitive to ground water pollution. The use of a pesticide inside a PMZ where it has been detected in ground water as a result of legal, agricultural use is subject to certain ground water protection restrictions and requirements. These include a mandatory Ground Water Protection Advisory which must be obtained before a restricted material's use permit can be issued.

pesticide residue - In this case, the amount of a pesticide active ingredient remaining in a soil or ground water sample at the time of analysis.

physicochemical - The types of behavior that a substance exhibits in chemical reactions are called its chemical properties; other characteristics that are typical of a substance are called its physical properties. Taken together, the chemical and physical properties of a substance are called its physicochemical properties.

plume - The elongated (generally cigar-shaped) pattern of a chemical in ground water arising from contamination originating at a spill or other point source.

point source - A source of contamination, such as a spill or at a waste site, that is initially deposited and concentrated in a small, well-defined area. The contamination can be traced to its point of origin by locating a specifically shaped pattern in the ground water called a plume.

positive detection - A well water sample in which the presence of a pesticide chemical is detected at or above the minimum detection limit of the analytical instruments used for analysis of the compound under investigation. A positive analysis may be designated as confirmed or unconfirmed.

preemergent treatment - Treatment made after a crop is planted but before it or the weeds emerge.

range - A single series or row of townships, each six miles square, extending parallel to, and

numbered east and west from, a survey base meridian line. (See *well numbering system.*)

recommended PMZ – A section of land that has been identified as sensitive to ground water pollution by specific pesticides and has been proposed to be adopted into section 6802 (3CCR).

record – See *data base record.*

registered pesticide – A pesticide product approved by the USEPA and DPR for use in California.

registrant – A person, or corporation, that has registered an economic poison for use in California and has obtained a certificate of registration from the Department.

regulation – These are adopted by state agencies to implement or clarify statutes enacted by the California Legislature. They can also be adopted in response to federal legislation, court decisions, changing technologies, and concerns for the health and well being of the residents of California.

related compounds – See *degradation products.*

replicate sample – A discrete sample taken from a well at the same time as the initial detection sample; not a single sample split into multiple samples.

restricted material – Compounds designated as "Restricted Materials" in section 6400 (3CCR), that for various reasons, are potentially more hazardous to people, animals, or the environment than other pesticides. As a result, the use of these materials is regulated more closely and is permitted only when additional precautionary measures are taken. Certain reporting requirements and dealer responsibilities apply to the use of restricted materials.

right-of-way – The strip of land over which facilities such as highways, railroads, or power lines are built.

sanitary seal – A slurry of cement or clay which fills the annular space between the well casing and the drilled hole, down to a certain depth, to protect the well against contamination or pollution by entrance of surface and/or shallow, subsurface waters.

section – A land unit of 640 acres or one square mile, equal to 1/36 of a township. (See *well numbering system.*)

selective pesticide – A pesticide that kills pest individuals, but spares much or most of the other fauna or flora, including beneficial species, through either differential toxic action or through the manner in which the pesticide is used (formulation, dosage, timing, placement, etc.)

slow-release formulation – The incorporation of a pesticide in a permeable covering that permits its release over a period of time at a reduced, but effective rate.

small public water system well – A well serving fewer than 200 connections.

soil adsorption coefficient (Koc) – A measure of the tendency of pesticide active ingredients, or their biologically active transformation products, to adhere to the surfaces of soil particles.

specific numerical values (SNV) – Certain numeric threshold values set for the following physical and chemical properties of pesticide active ingredients: water solubility, soil adsorption coefficient, hydrolysis, aerobic and anaerobic soil metabolism, and field dissipation. The PCPA associates these properties with the longevity and mobility of a chemical in the soil and requires the establishment of SNVs in regulation as a means of predicting which pesticides are likely to leach to ground water.

State Well Number – See *well numbering system.*

survey – In the context of this report, well monitoring conducted by an agency or private firm for a specified length of time in a designated area.

summary year – The time period, usually July 1 through the following June 30, during which sampling results for the presence of pesticides in California ground water are collected and processed for inclusion in the well inventory data base. These data are summarized in DPR's annual Well Inventory Report.

township – A public land surveying unit which is a square parcel of land, six miles on each side. The location of a township is established as being so many six-mile units east or west of a north-south line running through an initial point (called the "principal meridian") and so many six-mile units north or south of an east-west line running through another point (called the "baseline"; see also, *well numbering system*).

triazines – A chemical compound derived from any of three isomeric compounds, each having three carbon and three nitrogen atoms in a six-membered ring. Triazines are strong inhibitors of photosynthesis. Atrazine and simazine are triazines.

unconfirmed detection – For a particular well, the detection of a pesticide in a single sample during the time period of an individual monitoring study. Confirmation of the initial detection by a second positive sample was not possible because either (1) only a single sample was taken from the well or (2) analyses of all other samples taken from the well during the study were negative.

use requirement – Restrictions established in regulation for the use of certain pesticides. For example, section 6484.1 (3CCR) states that agricultural, outdoor institutional, and outdoor industrial uses of pesticides containing atrazine are prohibited in the Pesticide Management Zones listed in 6802(c) (3CCR).

vapor pressure – A property that indicates the rate of evaporation of a compound. The higher the vapor pressure, the more volatile the compound.

verified (DPR study) – The detection of a pesticide or a pesticide breakdown product in two

discrete samples taken from a single well during a 30-day time period, and analyzed either by the same laboratory using different analytical methods or by two laboratories using the same method. The analytical methods used must be approved by DPR. Verification of the presence of a compound in ground water by this criteria fulfills section 13149(d) (FAC) of the PCPA and may be used for regulatory purposes.

volatile – A compound is said to be volatile when it readily evaporates on exposure to air at ordinary temperatures.

water budgeting method – An irrigation plan basing the frequency of irrigations and the amount of water to be applied on a measurement of the amount of water lost by evaporation and plant transpiration (evapotranspiration) and other factors, including the root zone area of the crop and the capacity of the soil to hold water.

water solubility – The property of a substance to go into solution with water.

well head – The immediate area surrounding the top of a well.

well numbering system – The California well numbering system is based on a rectangular system commonly referred to as the Public Lands Survey. Under this system, all tracts of lands are tied to an initial point and identified as being in a township. A *township* is a square parcel of land six miles on each side. Its location is established as being so many six-mile units east or west of a north-south line running through the initial point (called the "principal meridian") and so many six-mile units north or south of an east-west line running through the point (called the "baseline"). The meridional lines parallel to, and east or west of, the principal meridian are called *range* lines. Every township is further divided into 36 parts called sections. A *section* is also described as a square parcel of land one mile on a side, each containing 640 acres. Each well in California is assigned a unique number (referred to as the State Well Number) by the Department of Water Resources (DWR). For well numbering purposes, each section of land is divided into sixteen 40-acre tracts. Once the well location is established in the 40 acre tract, it is assigned a sequence number which is assigned in chronological order by DWR personnel. The DWR maintains an index of state well numbers to prevent duplication.

wettable powder – A solid (powder) formulation that, on addition to water, forms a suspension.

C. FORMAT OF DATA BASE RECORDS

FORMAT OF RECORDS IN THE WELL INVENTORY DATA BASE:

Each laboratory analysis of a well water sample for the presence of a pesticide active ingredient or breakdown product comprises one record in the well inventory data base. The maximum record length is 136 characters.

An example of a well inventory coding sheet, showing the data fields and column numbers, is shown in Figure 1-C on the following page. A key to the codes used in the well inventory data base may be obtained from DPR by writing to the address listed on the title page of this report. An explanation of the record format follows.

Column Number	Explanation of Data Base Record Fields
1-2	County code: a minimum reporting requirement. This code is consistent with DPR Pesticide Use Report format.
3-14	State well number (township/range/section/tract/sequence number): a minimum reporting requirement. The state well number is based on the U.S. Geological Survey's Public Lands Survey Coordinate System (Davis and Foote, 1966). The DWR uses this system to numerically identify individual wells in California. Township lines (T, cols. 3-5) are oriented from north to south and are six miles long. Range lines (R, cols. 6-8) are oriented east to west and are six miles wide. A six-mile-by six-mile township is divided into 36 one-mile-by-one- mile sections (S, cols. 9-10), numbered consecutively from 1 to 36. Each section is again divided into 16 individual 40-acre tracts (Tr. col. 11) that are identified by letters (A through R, excluding I and O). Wells in a tract are further identified with a sequential number (cols. 12-14) in the order of identification by the DWR.
15	Base line and meridian: this minimum reporting requirement is included in the state well number. The base line/meridian divide the state into three areas: Humboldt, Mount Diablo, and San Bernardino, forming the basic structure for the Township/Range/Section numbering system.
16	In-house code.
17-20	Study number: numbers were assigned consecutively as studies were obtained.
21-24	Sampling agency code: a minimum reporting requirement.

WELL INVENTORY CODING SHEET

STATE OF CALIFORNIA
DEPARTMENT OF
PESTICIDE REGULATION

ENVIRON. MONITOR. & PEST MGMT.
ENVIRON. HAZARDS ASSESSMENT
1220 N STREET ROOM A-149

Page: _____

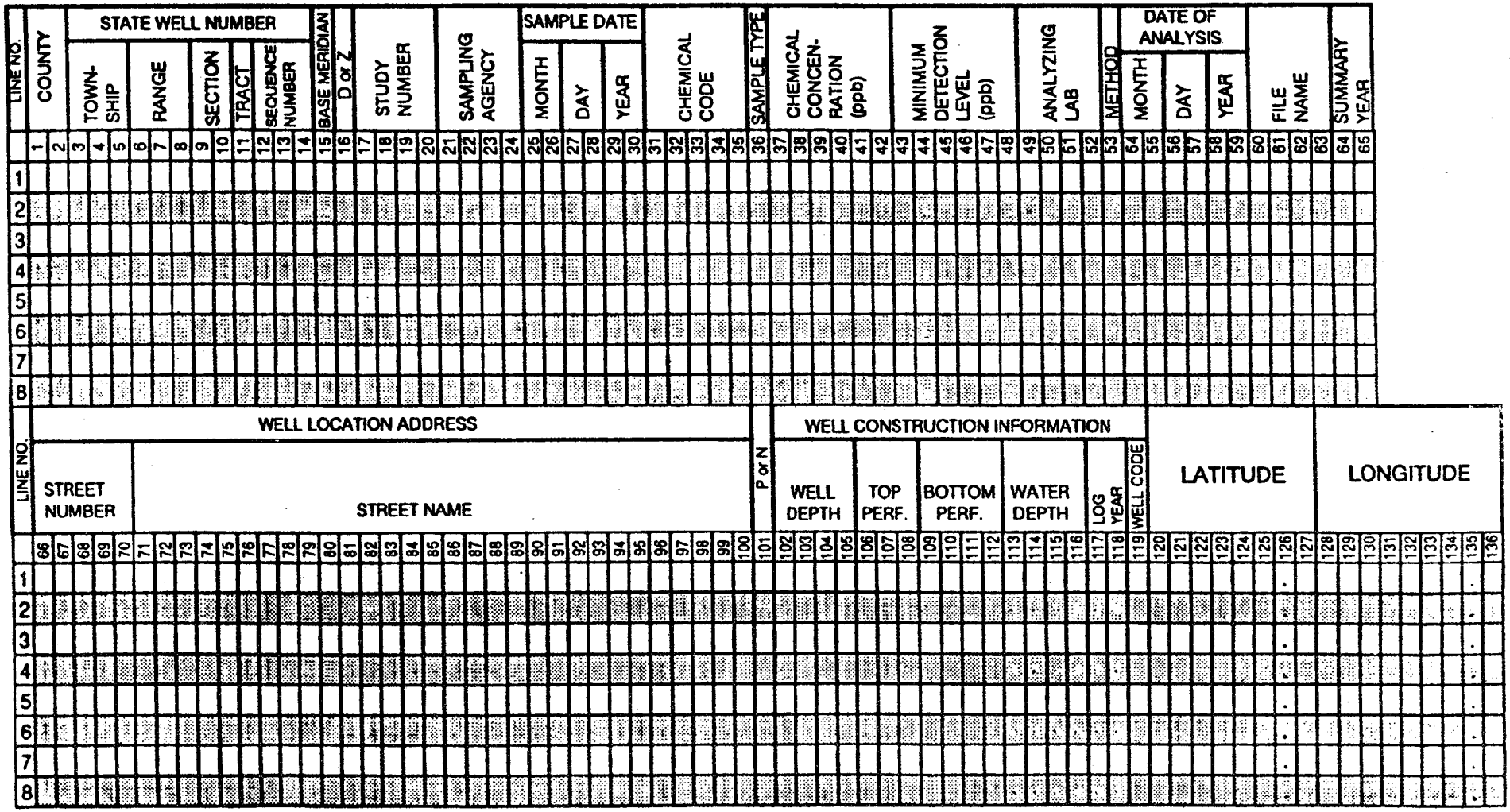

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Figure 1-C. Well inventory data base coding sheet.

Column Number	Explanation of Data Base Record Fields
25-30	Date of sample: a minimum reporting requirement. Day, month, and year of each sampling record is included. The middle month of an indicated period is used only when a season is designated as the sampling date; e.g., "all samples were taken in the spring of 1982." However, the precise sampling date is recorded for most studies.
31-35	Chemical code: a minimum reporting requirement. Each chemical is assigned a five-digit numerical code which corresponds to the chemical codes used in the Pesticide Use Reporting System maintained by the Information Systems Branch of DPR. Codes for breakdown products of pesticides are distinguished from their parent compound by the letter "B, C, D, N, or X" preceding the last four digits of the parent compound's code; e.g., 00259 = endosulfan, B0259 = endosulfan sulfate. Pesticides sampled for that have not been registered for use in California are assigned sequential numbers preceded by the letter "U"; e.g., U0012 = fenuron.
36	Sample-type: a minimum reporting requirement. Sample-type codes are used to signify whether an analysis is a positive or negative detection; whether a positive sample is the initial or replicate detection; and to denote whether the same laboratory and analyzing method were used for both the confirmation and initial detection samples.
37-42	Chemical concentration: a minimum reporting requirement. Analytical results are recorded in parts per billion (ppb). Trace amounts, non-detected, or less than the minimum detectable limit values are all recorded as non-detected.
43-48	Minimum detection limit (MDL): a minimum reporting requirement. The MDL for the chemical assay is recorded in ppb. The MDL for a given compound may vary by laboratory, date, or year, reflecting differences in analytical techniques.
49-52	Analyzing laboratory: a minimum reporting requirement.
53	Method of analysis: designates the origin of the protocol for the specific, analytical laboratory method.
54-59	Date of analysis: a minimum reporting requirement. Month/day/year.
60-63	File name: internal file designation.

Column Number	Explanation of Data Base Record Fields
64-65	Summary year: indicates the year of the Well Inventory Update Report for which the record was reported. Usually, a summary year is July 1 to the following June 30.
66-100	Well location information: a minimum reporting requirement. Designates the street name and number or descriptive address of the well.
101	Point or non-point: detections of pesticides in ground water that have been determined to be present due to a point-source (contamination emanating from a specific site, such as a spill or at a waste-site) or non-point source (not traceable to a single definable location) are designated by a P or N in this field. Detections that have not had a source determination are designated as –.
102-105	Well depth (in feet), as recorded on the well log.
106-108	Depth to top of perforation (in feet), as recorded on the well log.
109-112	Depth to bottom of perforation (in feet), as recorded on the well log; often corresponds to depth of completed well.
113-116	Water depth: the depth of standing water in the well at the time of sampling.
117-118	Log year: year the well was drilled (information obtained from well log, raw data, or verbally from a well owner).
119	Well code: a minimum reporting requirement. This code indicates well use; e.g., private domestic, irrigation, or both.
120-127	Latitude: the latitude is expressed in degrees (DD), minutes (MM), and seconds (SS). Seconds may be specified to the nearest tenth of a second. The format is DDMMSS.S. (The decimal point is implied and not included in a column.)
128-136	Longitude: the longitude is expressed in degrees (DDD), minutes (MM), and seconds (SS.s). Seconds may be specified to the nearest tenth of a second. The format is DDDMMSS.S. (The decimal point is implied and not included in a column.)

D. ANALYTICAL METHODS FOR THE VERIFICATION OF GROUND WATER CONTAMINATION BY PESTICIDES

VERIFICATION

All reports of pesticide residues in ground water are considered verified after the following has occurred:

(1) Two discrete samples from the same site have been taken by the Department, no longer than 30 days apart, and have been analyzed by a method approved by the Department and found to contain the substance under investigation. If only a degradation product of the substance under investigation is subsequently detected, then the degradation product itself must be detected in a second discrete sample. This first step of the verification process provides evidence that the well was contaminated and the residue was not due to contamination during sampling and transport or during lab processing and analysis.

(2) The residue has been detected by one laboratory using different analytical methods approved by the Department or by two different laboratories using an analytical method approved by the Department. This second step provides evidence that the residue was precisely identified and could not be due to lab contamination or chemist error.

Definition of Different Analytical Methods

Confirmation of a residue by a second analytical method is intended to increase the confidence in the positive detection of a chemical by the first analytical method. If the measurement procedures of the second method vary only slightly from the first method, it is likely that an erroneous identification in the first determination would also occur in the second. Therefore, the second method should be based on separation and/or detection processes as different from the first method as feasible.

The minimum changes needed in the first method to qualify it for consideration as a second method depend on the specificity of both methods. The following matrix lists the possible combinations where *detection and separation* is defined as a significant change in both detector and separation procedure, *detection* is a significant change in the detector only, and *detection or separation* is a significant change in the detector or separation procedure.

Minimum requirements for procedural changes in a first method to qualify it as a second method:

	Second Method	
First Method	*nonspecific*	*specific*
nonspecific	*detection & separation*	*detection only*
specific	*detection only*	*detection or separation*

Specific Methods

A specific method provides positive identification of the measured chemical. This unequivocal identification implies that the detection system can distinguish the target compound from all other compounds in a given mixture, with or without the need for an additional separation procedure. A method is also considered to be specific if all known interferences yield insignificant responses; i.e., the sensitivity for the interfering compound is less than 0.1 percent of the sensitivity for the target compound.

Examples for specific methods are spectroscopic techniques like mass spectroscopy (MS) and Fourier transform infrared (FTIR) spectroscopy, which are generally used together with separation techniques like gas chromatography (GC) or high performance liquid chromatography (HPLC).

Nonspecific Methods

All methods that respond to more than one chemical and which use detectors that cannot distinguish between these different chemicals are considered to be nonspecific. Analytical methods that incorporate nonspecific detectors rely completely on separation procedures for identification. The problem with nonspecific detectors is that they can only prove the absence of a chemical when no signal is registered at the proper conditions for the chemical in question. When a signal is measured, however, one can only say that it is likely that the signal is caused by that chemical. But it is not a proven fact, as another component of the unknown mixture might interfere and the detector cannot distinguish between the two.

This definition of nonspecific includes the majority of GC techniques. For example, nitrogen-phosphorus specific detectors used in GC analysis are specific only on the

atomic level; they can distinguish nitrogen and phosphorus atoms from other atoms, but they cannot distinguish between one nitrogen-containing chemical and another.

Significant Change

A significant change in detector means a change in detection principle (for GC, a change from a flame photometric detector [FPD] to a conductivity detector, for example). A significant change in the separation procedure is either a change in separation principle (from GC to HPLC, for example) or a change in the separation condition (i.e., using a different type of column), as long as this change will alter the sequence in which the compounds are registered.

Following are examples for the three types of minimum changes (detection and separation, detection only, and detection or separation), given in the previous matrix, that qualify as significant changes:

Case 1

When both the first and the second method are nonspecific, both the detector and the separation procedure have to be changed significantly. For example, a first method using GC separation and a FPD could use as a second method either a GC with a significantly different column and a nitrogen-phosphorus detector (changing separation conditions and detector) or an HPLC separation with a UV-detector (changing separation principle and detector).

Case 2

When only one of the methods is specific, just the detection principle has to be changed; the separation procedure may be kept the same (GC/FPD and GC/MS using the same column, for example).

Case 3

When both methods are specific, either the detector or the separation procedure may be changed. Examples for these cases are GC/MS and HPLC/MS (keeping the same detector) or GC/MS and GC/FTIR (keeping the same separation conditions).

In cases (2 and 3) where only a change in detector is needed, it is acceptable to use an integrated system where the effluent of the separation step is split and routed to two detectors. An example for this is GC/MS/FTIR, where the effluent of the GC is analyzed by MS and FTIR simultaneously. As this integrated analytical instrument uses two specific detectors, it counts as both first and second method.

Screening Methods

Special consideration has to be given to qualitative or semi-quantitative methods typically used for screening. Qualitative methods yield only detected/not detected results; semi-quantitative methods indicate the order of magnitude for the concentration of the identified chemical. Samples identified as positive will be forwarded for analysis by a quantitative method.

In this case, the qualitative screen is considered to be the first method. The quantitative method is then selected based on the above criteria for a second method. A second quantitative method (i.e., a third analysis method) is required only when verification is needed not only for the identity of the compound but also for its concentration. Analogously, a qualitative method may be used as a second method if verification of the concentration level is not required. A qualitative method cannot be used as a second method when the first method is qualitative also.

For example: a specific enzyme-linked immunosorbent assay (ELISA) may be used as a first method, even if it is used just as a detected/not detected screen. A nonspecific ELISA qualifies as a second detector for the effluent from an HPLC. Note, however, that any ELISA which shows significant cross-reactivity to other compounds is considered to be nonspecific and would also require a change in the separation procedure.

E. SUMMARY OF WELL SAMPLING SURVEYS INCLUDED IN THE 1993 UPDATE REPORT

I. California Department of Health Services

(Sanitary Engineering Branch)

Study No. 0023 Sampled for numerous chemicals in 43 counties: Alameda, Butte, Contra Costa, Del Norte, El Dorado, Fresno, Glenn, Humboldt, Inyo, Kern, Kings, Lake, Lassen, Los Angeles, Madera, Mariposa, Merced, Monterey, Nevada, Orange, Placer, Plumas, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Shasta, Sierra, Siskiyou, Solano, Sonoma, Stanislaus, Tehama, Tulare, Ventura, and Yuba County; January through June 1992. 1,851 wells sampled.

II. California Regional Water Quality Control Board, Jointly with Glenn County

(Central Valley Region)

Study No. 0271 aldrin, fenthion, chlordane, coumaphos, chlorthal-dimethyl, fensulfothion, DDD, DDT, DDVP, diazinon, dieldrin, disulfoton, chlorpyrifos, endosulfan, endrin, merphos, tetrachlorovinphos, azinphos-methyl, heptachlor, lindane, methoxychlor, methyl parathion, ethoprop, naled, phorate, mevinphos, ronnel, demeton, toxaphene, sulprofos, DDE, BHC (other than gamma isomer), 3-hydroxycarbofuran, endrin aldehyde, trichloronate, prothiofos, and heptachlor epoxide; Glenn County; January, February, May 1992. 7 wells sampled.

III. California Department of Water Resources (DWR)

Study No. 0272 diuron, and EPTC; Kern County; September and December 1989, April, July, August, September 1990, February and April 1991, and June 1992. 2 wells sampled.

IV. Department of Pesticide Regulation (DPR)

(Environmental Hazards Assessment Program [EHAP])

Study No. 0258 atrazine, bromacil, diuron, prometon, and simazine; Kern County; May 1992. 5 wells sampled.

Study No. 0259 atrazine, bromacil, diuron, prometon, and simazine; Kings County; May 1992. 4 wells sampled.

Study No. 0260 atrazine, bromacil, diuron, prometon, and simazine; Kings County; May 1992. 5 wells sampled.

Study No. 0261 atrazine, bromacil, diuron, prometon, and simazine; Madera County; May 1992. 4 wells sampled.

Study No. 0263	atrazine, bromacil, chlorthal-dimethyl, diuron, prometon, simazine, monomethyl 2,3,5,6-tetrachloroterephthalate, and 2,3,5,6-tetrachloro-terephthalic acid; San Luis Obispo County; May 1992. 6 wells sampled.
Study No. 0264	atrazine, bromacil, diuron, prometon, simazine, oryzalin, and oxyfluorfen; San Joaquin County; May 1992. 3 wells sampled.
Study No. 0266	atrazine, bromacil, diuron, prometon, prometryn, simazine, 2,4-D, cyanazine, metribuzin, and hexazinone; San Joaquin and Yuba Counties; June, July and September 1992, and May 1993. 16 wells sampled.
Study No. 0267	1,3-dichloropropene; Fresno County; June 1992. 6 wells sampled.
Study No. 0268	atrazine, bromacil, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, hexazinone, and bentazon; Alameda, Fresno, San Joaquin, Tulare, and Yuba counties; June and July 1992, May 1993. 43 wells sampled.
Study No. 0269	atrazine, bromacil, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Kern and Tulare Counties; June, October, and November 1992. 3 wells sampled.
Study No. 0270	atrazine, bromacil, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Los Angeles County; November 1992. 3 wells sampled.
Study No. 0273	atrazine, bromacil, diuron, prometon, prometryn, simazine, alachlor, cyanazine, metribuzin, and hexazinone; San Bernardino County; September 1992. 4 wells sampled.
Study No. 0274	atrazine, bromacil, diuron, lindane, methoxychlor, prometon, prometryn, simazine, 2,4-D, cyanazine, metribuzin, and hexazinone; Los Angeles County; September 1992. 2 wells sampled.
Study No. 0276	atrazine, bromacil, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Los Angeles, Orange, and Riverside Counties; November and December 1992, January and February 1993. 57 wells sampled.
Study No. 0278	atrazine, bromacil, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Stanislaus County; January 1992, January 1993. 4 wells sampled.
Study No. 0279	atrazine, bromacil, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Stanislaus County; October 1992. 3 wells sampled.
Study No. 0280	atrazine, bromacil, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Stanislaus County; October 1992. 5 wells sampled.

Study No. 0281 atrazine, bromacil, carbon disulfide, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Sonoma County; December 1992. 4 wells sampled.

Study No. 0282 atrazine, bromacil, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Stanislaus County; October 1992. 3 wells sampled.

Study No. 0283 atrazine, bromacil, diuron, prometon, prometryn, simazine, thiram, benomyl, cyanazine, metribuzin, and hexazinone; Humboldt County; November 1992 and March 1993. 5 wells sampled.

Study No. 0284 atrazine, bromacil, dimethoate, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Orange County; March 1993. 3 wells sampled.

Study No. 0285 atrazine, bromacil, diuron, prometon, prometryn, simazine, xylene, 2,4-D (dimethylamine salt), cyanazine, metribuzin, and hexazinone; San Mateo County; May 1993. 3 wells sampled.

Study No. 0286 atrazine, bromacil, diuron, methyl bromide, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Madera County; March 1993. 5 wells sampled.

Study No. 0287 atrazine, bromacil, diuron, methomyl, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; San Francisco County; March 1993. 2 wells sampled.

Study No. 0288 atrazine, bromacil, diuron, lindane, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Los Angeles County; May 1993. 2 wells sampled.

Study No. 0289 atrazine, bromacil, carbon disulfide, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Sonoma County; December 1992. 5 wells sampled.

Study No. 0290 atrazine, bromacil, carbon disulfide, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; San Luis Obispo County; December 1992. 6 wells sampled.

Study No. 0291 atrazine, bromacil, diazinon, diuron, molinate, prometon, prometryn, simazine, 2,4-D (dimethylamine salt), cyanazine, metribuzin, hexazinone and diazoxon; Butte, Colusa, Fresno, Glenn, Kern, Kings, Madera, Merced, Placer, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, Yolo, and Yuba counties; February, March, April, May, and June 1993. 95 wells sampled.

Study No. 0292 atrazine, bromacil, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, hexazinone, and bentazon; San Mateo and Santa Barbara Counties; May 1992 and May 1993. 9 wells sampled.

Study No. 0293 atrazine, bromacil, diuron, endosulfan, prometon, prometryn, simazine, cyanazine, metribuzin, hexazinone, 3-hydroxycarbofuran, and endosulfan II; Glenn County; March, April, and June 1993. 6 wells sampled.

Study No. 0294 atrazine, bromacil, diuron, prometon, prometryn, and simazine; Orange County; March 1993. 4 wells sampled.

Study No. 0295 atrazine, bromacil, carbon disulfide, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; San Luis Obispo County; December 1992. 4 wells sampled.

Study No. 0296 atrazine, bromacil, diuron, EPTC, prometon, and simazine; Kern County; April 1993. 6 wells sampled.

Study No. 0297 atrazine, simazine, deisopropyl-atrazine, and deethyl-atrazine; Fresno, Glenn, Kern, Los Angeles, Orange, Stanislaus, Tehama, and Tulare Counties; February and March 1993. 30 wells sampled.

Study No. 0298 atrazine, bromacil, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, hexazinone, and thiobencarb; Los Angeles, Riverside, and San Bernardino counties; September 1992 and May 1993. 18 wells sampled.

Study No. 0299 atrazine, bromacil, diuron, methyl bromide, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Tulare and Ventura Counties; September 1992, May and June 1993. 9 wells sampled.

Study No. 0300 atrazine, bromacil, diuron, prometon, prometryn, simazine, aldicarb, cyanazine, metribuzin, hexazinone, aldicarb sulfone, and aldicarb sulfoxide; Yolo County; May 1993. 6 wells sampled.

Study No. 0301 atrazine, bromacil, diuron, prometon, prometryn, simazine, xylene, cyanazine, metribuzin, and hexazinone; Fresno, Kern, Los Angeles, Monterey, San Bernardino, Santa Cruz, Sonoma, and Tulare counties; June, September 1992 and May, June 1993. 36 wells sampled.

Study No. 0305 atrazine, bromacil, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Kern County; June, October 1992. 4 wells sampled.

Study No. 0317 atrazine, bromacil, diuron, prometon, prometryn, simazine, cyanazine, metribuzin, and hexazinone; Merced County; January 1993. 4 wells sampled.

V. US Department of Agriculture (USDA)

Study No. 0262 carbaryl, chloropicrin, methyl bromide, thiram, chlorothalonil, benomyl, glyphosate (isopropylamine salt), oxyfluorfen, and triadimefon; Humboldt County; August 1991, September 1991, October 1991, January 1992, and April 1992. 9 wells sampled.

VI. Yolo County

Study No. 0275

atrazine, bromacil, carbofuran, chlordane, DBCP, diazinon, dicamba, diuron, dinoseb, endrin, ethylene dibromide, ethylene dichloride, heptachlor, lindane (gamma-BHC), methoxychlor, methyl bromide, naphthalene, molinate, prometon, prometryn, 1,2-dichloropropane, silvex, simazine, demeton, 1,3-dichloropropene, aldicarb, ortho-dichlorobenzene, toxaphene, xylene, 2,4-D, 2,4,5-T, chlorothalonil, alachlor, tetrachloroethylene, methyl isobutyl ketone (MIBK), terbutryn, thiobencarb, bentazon (sodium salt), dichlorprop, ortho-dichlorobenzene and other related, and heptachlor epoxide; Yolo County; May 1985 through April 1992. 31 wells sampled.

VII. Yuba County

Study No. 0277

atrazine, carbaryl, carbofuran, DBCP, diazinon, endrin, thylene dibromide, ethylene dichloride, lindane (gamma-BHC), methoxychlor, methyl bromide, naphthalene, 1,2-dichloropropane, silvex, simazine, 1,3-dichloropropene, ortho-dichlorobenzene, toxaphene, xylene, 2,4-D, tetrachloroethylene, methyl isobutyl ketone (MIBK), and ortho-dichlorobenzene and other related;Yuba County; January 1985 through March 1993. 47 wells sampled.

F. RESULTS BY COUNTY AND PESTICIDE

County: ALAMEDA

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	3	0	0	3
1,2-D (propylene dichloride)	3	0	0	3
1,3-dichloropropene (1,3-D)	3	0	0	3
atrazine	3	0	0	3
bentazon, sodium salt	3	0	0	3
bromacil	3	0	0	3
diuron	3	0	0	3
hexachlorobenzene	9	0	0	9
methyl bromide	3	0	0	3
naphthalene	3	0	0	3
ortho-dichlorobenzene	3	0	0	3
prometon	3	0	0	3
simazine	3	0	0	3
xylene	3	0	0	3
Totals (1)	12	0	0	12

County: BUTTE

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	18	0	0	18
1,2-D (propylene dichloride)	18	0	0	18
1,3-dichloropropene (1,3-D)	18	0	0	18
atrazine	7	0	0	7
bromacil	6	0	0	6
diuron	6	0	0	6
methyl bromide	18	0	0	18
molinate	6	0	0	6
naphthalene	18	0	0	18
ortho-dichlorobenzene	18	0	0	18
prometon	6	0	0	6
simazine	8	0	0	8
xylene	18	0	0	18
Totals (1)	26	0	0	26

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: COLUSA

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
2,4-D, dimethylamine salt	5	0	0	5
atrazine	9	0	0	9
bromacil	9	0	0	9
cyanazine	5	0	0	5
diuron	9	0	0	9
hexazinone	5	0	0	5
metribuzin	5	0	0	5
molinate	3	1	0	4
prometon	9	0	0	9
prometryn	5	0	0	5
simazine	9	0	0	9
Totals (1)	8	1	0	9

County: CONTRA COSTA

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	3	0	0	3
1,2-D (propylene dichloride)	3	0	0	3
1,3-dichloropropene (1,3-D)	3	0	0	3
2,4-D	3	0	0	3
alachlor	3	0	0	3
aldicarb	1	0	0	1
atrazine	3	0	0	3
bentazon, sodium salt	3	0	0	3
bromacil	3	0	0	3
carbofuran	1	0	0	1
chlordane	3	0	0	3
chlorothalonil	3	0	0	3
dbcp	3	0	0	3
diazinon	3	0	0	3
dimethoate	3	0	0	3
diuron	3	0	0	3
endothall	2	0	0	2
endrin	3	0	0	3
ethylene dibromide	3	0	0	3
glyphosate, isopropylamine salt	1	0	0	1
heptachlor	3	0	0	3
heptachlor epoxide	3	0	0	3
lindane (gamma-bhc)	3	0	0	3
methoxychlor	3	0	0	3
methyl bromide	3	0	0	3
molinate	3	0	0	3
naphthalene	3	0	0	3
ortho-dichlorobenzene	3	0	0	3
prometryn	3	0	0	3
silvex	3	0	0	3
simazine	3	0	0	3
thiobencarb	3	0	0	3
toxaphene	3	0	0	3
xylene	3	0	0	3
Totals (1)	3	0	0	3

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: DEL NORTE

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
endrin	1	0	0	1
lindane (gamma-bhc)	1	0	0	1
methoxychlor	1	0	0	1
toxaphene	1	0	0	1
Totals (1)	1	0	0	1

County: EL DORADO

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	9	0	0	9
1,2-D (propylene dichloride)	12	0	0	12
1,3-dichloropropene (1,3-D)	9	0	0	9
methyl bromide	9	0	0	9
naphthalene	9	0	0	9
ortho-dichlorobenzene	9	0	0	9
xylene	12	0	0	12
Totals (1)	12	0	0	12

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: FRESNO

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	56	0	0	56
1,2-D (propylene dichloride)	55	1	0	56
1,3-dichloropropene (1,3-D)	62	0	0	62
2,4,5-t	6	0	0	6
2,4-D	43	0	0	43
3-hydroxycarbofuran	30	0	0	30
alachlor	31	0	0	31
aldicarb	34	0	0	34
aldicarb sulfone	30	0	0	30
aldicarb sulfoxide	30	0	0	30
aldrin	24	0	0	24
atrazine	65	0	1	66
bentazon, sodium salt	49	0	0	49
bromacil	60	0	1	61
carbaryl	30	0	0	30
carbofuran	38	0	0	38
chlordane	38	0	0	38
chlorothalonil	4	0	0	4
cyanazine	10	0	0	10
dalapon	6	0	0	6
dbcp	48	94	0	142
deethyl-atrazine	1	0	0	1
deisopropyl-atrazine	0	0	1	1
demeton	6	0	0	6
diazinon	36	0	0	36
diazoxon	4	0	0	4
dicamba	6	0	0	6
dieldrin	24	0	0	24
dimethoate	32	0	0	32
dinoseb	6	0	0	6
disulfoton	6	0	0	6
diuron	24	1	0	25
endrin	38	0	0	38
ethylene dibromide	135	2	0	137
glyphosate, isopropylamine salt	38	0	0	38
heptachlor	35	0	0	35
heptachlor epoxide	35	0	0	35
hexazinone	13	0	0	13
lindane (gamma-bhc)	35	0	0	35
methiocarb	29	0	0	29
methomyl	30	0	0	30
methoxychlor	38	0	0	38
methyl bromide	56	0	0	56
metribuzin	19	0	0	19
mevinphos	6	0	0	6
molinate	38	0	0	38
naphthalene	55	1	0	56
ortho-dichlorobenzene	56	0	0	56
oxamyl	30	0	0	30
prometon	31	0	0	31
prometryn	45	0	0	45
propoxur	30	0	0	30
silvex	43	0	0	43
simazine	59	0	2	61
simetryn	6	0	0	6
terbutryn	6	0	0	6
thiobencarb	32	0	0	32
toxaphene	35	0	0	35
xylene	61	0	0	61
Totals (1)	82	96	4	182

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: GLENN

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	7	0	0	7
1,2-D (propylene dichloride)	7	0	0	7
1,3-dichloropropene (1,3-D)	7	0	0	7
2,4-D, dimethylamine salt	1	0	0	1
aldrin	7	0	0	7
atrazine	14	1	1	16
azinphos-methyl	4	0	0	4
bhc (other than gamma isomer)	7	0	0	7
bromacil	13	0	0	13
chlordane	7	0	0	7
chlorpyrifos	4	0	0	4
chlorthal-dimethyl	1	0	0	1
coumaphos	4	0	0	4
cyanazine	7	0	0	7
ddd	7	0	0	7
dde	7	0	0	7
ddt	7	0	0	7
ddvp	4	0	0	4
deethyl-atrazine	2	0	1	3
deisopropyl-atrazine	3	0	0	3
demeton	4	0	0	4
diazinon	4	0	0	4
dieldrin	7	0	0	7
disulfoton	4	0	0	4
diuron	13	0	0	13
endosulfan	9	3	0	12
endosulfan II	6	0	0	6
endosulfan sulfate	10	2	0	12
endrin	7	0	0	7
endrin aldehyde	7	0	0	7
ethoprop	4	0	0	4
fensulfothion	4	0	0	4
fenthion	4	0	0	4
heptachlor	7	0	0	7
heptachlor epoxide	7	0	0	7
hexazinone	7	0	0	7
lindane (gamma-bhc)	7	0	0	7
merphos	4	0	0	4
methoxychlor	7	0	0	7
methyl bromide	7	0	0	7
methyl parathion	4	0	0	4
metribuzin	7	0	0	7
mevinphos	4	0	0	4
molinate	6	0	0	6
naled	4	0	0	4
naphthalene	7	0	0	7
ortho-dichlorobenzene	7	0	0	7
phorate	4	0	0	4
prometon	12	0	1	13
prometryn	7	0	0	7
prothiofos	4	0	0	4
ronnel	4	0	0	4
simazine	15	0	1	16
sulprofos	4	0	0	4
tetrachlorvinphos	4	0	0	4
toxaphene	6	1	0	7
trichloronate	4	0	0	4
xylene	7	0	0	7
Totals (1)	21	5	3	29

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: HUMBOLDT

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	1	0	0	1
1,2-D (propylene dichloride)	1	0	0	1
1,3-dichloropropene (1,3-D)	1	0	0	1
atrazine	4	0	0	4
benomyl	11	1	0	12
bromacil	3	0	0	3
carbaryl	6	0	0	6
chloropicrin	7	0	0	7
chlorothalonil	8	0	0	8
cyanazine	4	0	0	4
diuron	4	0	0	4
glyphosate, isopropylamine salt	6	0	0	6
hexazinone	4	0	0	4
methyl bromide	8	0	0	8
metribuzin	4	0	0	4
naphthalene	1	0	0	1
ortho-dichlorobenzene	1	0	0	1
oxyfluorfen	6	0	0	6
prometon	4	0	0	4
prometryn	4	0	0	4
simazine	4	0	0	4
thiram	7	4	0	11
triadimefon	7	0	0	7
xylene	1	0	0	1
Totals (1)	9	5	0	14

County: INYO

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
atrazine	13	0	0	13
bromacil	13	0	0	13
dbcp	13	0	0	13
dimethoate	13	0	0	13
ethylene dibromide	13	0	0	13
molinate	13	0	0	13
prometryn	13	0	0	13
simazine	13	0	0	13
xylene	13	0	0	13
Totals (1)	13	0	0	13

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: KERN

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	6	0	0	6
1,2-D (propylene dichloride)	23	2	0	25
1,3-dichloropropene (1,3-D)	6	0	0	6
2,4,5-t	2	0	0	2
2,4-D	30	0	0	30
alachlor	3	0	0	3
aldicarb	8	0	0	8
aldrin	2	0	0	2
atrazine	64	0	0	64
benefin	2	0	0	2
bentazon, sodium salt	37	0	0	37
bhc (other than gamma isomer)	2	0	0	2
bromacil	45	0	0	45
captan	2	0	0	2
carbofuran	8	0	0	8
carbophenothion	2	0	0	2
chlordane	28	0	0	28
chlorothalonil	16	0	0	16
cyanazine	10	0	0	10
dalapon	2	0	0	2
dbcp	34	15	0	49
ddd	3	0	0	3
dde	3	0	0	3
ddt	3	0	0	3
deethyl-atrazine	0	1	1	2
deisopropyl-atrazine	2	0	0	2
demeton	2	0	0	2
diazinon	20	0	0	20
dicamba	2	0	0	2
dicofol	2	0	0	2
dieldrin	2	0	0	2
dimethoate	20	0	0	20
dinoseb	3	0	0	3
disulfoton	2	0	0	2
diuron	23	1	0	24
dmpa	2	0	0	2
endosulfan	2	0	0	2
endosulfan sulfate	2	0	0	2
endrin	28	0	0	28
endrin aldehyde	2	0	0	2
eptc	4	1	0	5
ethylene dibromide	49	0	0	49
glyphosate, isopropylamine salt	8	0	0	8
heptachlor	28	0	0	28
heptachlor epoxide	28	0	0	28
hexazinone	6	0	0	6
lindane (gamma-bhc)	28	0	0	28
methoxychlor	28	0	0	28
methyl bromide	24	0	0	24
metribuzin	8	0	0	8
mevinphos	2	0	0	2
molinate	32	0	0	32
naphthalene	6	0	0	6
nitrofen	2	0	0	2
ortho-dichlorobenzene	24	0	0	24
pcnb	2	0	0	2

Table continued, page 130.

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

prometon	25	0	0	25
prometryn	28	0	0	28
silvex	30	0	0	30
simazine	63	1	0	64
simetryn	2	0	0	0
terbutryn	2	0	0	2
thiobencarb	30	0	0	30
toxaphene	28	0	0	28
trifluralin	1	0	0	1
xylene	28	0	0	28
Totals (1)	72	20	1	93

County: KINGS

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
2,4-D, dimethylamine salt	1	0	0	1
atrazine	10	0	0	10
bromacil	10	0	0	10
cyanazine	1	0	0	1
dbcp	2	0	0	2
diuron	10	0	0	10
ethylene dibromide	2	0	0	2
hexazinone	1	0	0	1
metribuzin	1	0	0	1
prometon	10	0	0	10
prometryn	1	0	0	1
simazine	10	0	0	10
Totals (1)	12	0	0	12

County: LAKE

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
atrazine	7	0	0	7
simazine	7	0	0	7
Totals (1)	7	0	0	7

County: LASSEN

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	9	0	0	9
1,2-D (propylene dichloride)	9	0	0	9
1,3-dichloropropene (1,3-D)	9	0	0	9
methyl bromide	9	0	0	9
naphthalene	9	0	0	9
ortho-dichlorobenzene	9	0	0	9
xylene	9	0	0	9
Totals (1)	9	0	0	9

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: LOS ANGELES

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	255	0	0	255
1,2-D (propylene dichloride)	260	0	0	260
1,3-dichloropropene (1,3-D)	258	0	0	258
2,4-D	117	0	0	117
alachlor	111	0	0	111
aldicarb	56	0	0	56
atrazine	318	2	19	339
bentazon, sodium salt	51	0	0	51
bromacil	200	0	1	201
carbofuran	63	0	0	63
chlordane	140	0	0	140
chlorothalonil	112	0	0	112
cyanazine	50	0	0	50
dalapon	47	0	0	47
dbcp	133	9	0	142
deethyl-atrazine	5	1	9	15
deisopropyl-atrazine	14	0	1	15
diazinon	3	0	0	3
dimethoate	149	0	0	149
dinoseb	33	0	0	33
diuron	102	0	2	104
endrin	172	0	0	172
ethylene dibromide	139	3	0	142
glyphosate, isopropylamine salt	10	0	0	10
heptachlor	136	0	0	136
heptachlor epoxide	136	0	0	136
hexazinone	50	0	0	50
lindane (gamma-bhc)	172	0	0	172
methoxychlor	174	0	0	174
methyl bromide	258	0	0	258
metribuzin	49	0	0	49
molinate	278	0	0	278
naphthalene	261	0	0	261
ortho-dichlorobenzene	258	0	0	258
picloram	47	0	0	47
prometon	50	0	0	50
prometryn	201	0	0	201
silvex	116	0	0	116
simazine	331	0	9	340
thiobencarb	280	0	0	280
toxaphene	168	0	0	168
trifluralin	15	0	0	15
xylene	260	0	0	260
Totals (1)	390	14	22	426

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: MADERA

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	4	0	0	4
1,2-D (propylene dichloride)	4	0	0	4
1,3-dichloropropene (1,3-D)	4	0	0	4
2,4-D	11	0	0	11
alachlor	11	0	0	11
aldrin	11	0	0	11
atrazine	24	0	0	24
bentazon, sodium salt	11	0	0	11
bromacil	24	0	0	24
chlordane	11	0	0	11
cyanazine	9	0	0	9
dbcp	12	0	0	12
diazinon	15	0	0	15
diazoxon	4	0	0	4
dieldrin	11	0	0	11
dimethoate	4	0	0	4
diuron	13	0	0	13
endrin	11	0	0	11
ethylene dibromide	13	0	0	13
glyphosate, isopropylamine salt	12	0	0	12
heptachlor	11	0	0	11
heptachlor epoxide	11	0	0	11
hexazinone	9	0	0	9
lindane (gamma-bhc)	11	0	0	11
methoxychlor	11	0	0	11
methyl bromide	8	1	0	9
metribuzin	9	0	0	9
molinate	11	0	0	11
naphthalene	4	0	0	4
ortho-dichlorobenzene	4	0	0	4
prometon	13	0	0	13
prometryn	20	0	0	20
silvex	11	0	0	11
simazine	24	0	0	24
thiobencarb	11	0	0	11
toxaphene	11	0	0	11
xylene	4	0	0	4
Totals (1)	24	1	0	25

County: MARIPOSA

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	6	0	0	6
1,2-D (propylene dichloride)	6	0	0	6
1,3-dichloropropene (1,3-D)	6	0	0	6
dbcp	6	0	0	6
ethylene dibromide	6	0	0	6
methyl bromide	6	0	0	6
naphthalene	6	0	0	6
ortho-dichlorobenzene	6	0	0	6
xylene	6	0	0	6
Totals	6	0	0	6

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: MERCED

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	7	0	0	7
1,2-D (propylene dichloride)	7	0	0	7
1,3-dichloropropene (1,3-D)	7	0	0	7
2,4-D	9	0	0	9
alachlor	7	0	0	7
atrazine	21	0	1	22
bentazon, sodium salt	8	0	0	8
bromacil	19	0	0	19
carbofuran	3	0	0	3
chlordane	10	0	0	10
chlorothalonil	6	0	0	6
cyanazine	8	0	0	8
dbcp	10	9	0	19
diazinon	10	0	0	10
diazoxon	4	0	0	4
dimethoate	6	0	0	6
diuron	13	0	0	13
endrin	10	0	0	10
ethylene dibromide	11	0	0	11
glyphosate, isopropylamine salt	10	0	0	10
heptachlor	10	0	0	10
heptachlor epoxide	10	0	0	10
hexazinone	13	0	0	13
lindane (gamma-bhc)	10	0	0	10
methoxychlor	10	0	0	10
methyl bromide	7	0	0	7
metribuzin	13	0	0	13
molinate	9	0	0	9
naphthalene	7	0	0	7
ortho-dichlorobenzene	7	0	0	7
prometon	12	0	1	13
prometryn	14	0	0	14
silvex	9	0	0	9
simazine	21	0	1	22
thiobencarb	9	0	0	9
toxaphene	10	0	0	10
xylene	7	0	0	7
Totals	28	9	1	38

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: MONTEREY

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	14	0	0	14
1,2-D (propylene dichloride)	14	0	0	14
1,3-dichloropropene (1,3-D)	14	0	0	14
3-hydroxycarbofuran	1	0	0	1
alachlor	1	0	0	1
aldicarb	1	0	0	1
aldicarb sulfone	1	0	0	1
aldicarb sulfoxide	1	0	0	1
atrazine	5	0	0	5
bromacil	5	0	0	5
carbaryl	1	0	0	1
carbofuran	1	0	0	1
chlordane	1	0	0	1
cyanazine	1	0	0	1
diazinon	4	0	0	4
dimethoate	4	0	0	4
diuron	1	0	0	1
endrin	1	0	0	1
glyphosate, isopropylamine salt	1	0	0	1
heptachlor	1	0	0	1
heptachlor epoxide	1	0	0	1
hexazinone	1	0	0	1
lindane (gamma-bhc)	1	0	0	1
methiocarb	1	0	0	1
methomyl	1	0	0	1
methoxychlor	1	0	0	1
methyl bromide	14	0	0	14
metribuzin	1	0	0	1
molinate	4	0	0	4
naphthalene	14	0	0	14
ortho-dichlorobenzene	14	0	0	14
oxamyl	1	0	0	1
prometon	1	0	0	1
prometryn	5	0	0	5
propoxur	1	0	0	1
simazine	5	0	0	5
thiobencarb	4	0	0	4
toxaphene	1	0	0	1
xylene	15	0	0	15
Totals	18	0	0	18

County: NEVADA

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	1	0	0	1
1,2-D (propylene dichloride)	1	0	0	1
1,3-dichloropropene (1,3-D)	1	0	0	1
methyl bromide	1	0	0	1
naphthalene	1	0	0	1
ortho-dichlorobenzene	1	0	0	1
xylene	1	0	0	1
Totals	1	0	0	1

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: ORANGE

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	130	0	0	130
1,2-D (propylene dichloride)	130	0	0	130
1,3-dichloropropene (1,3-D)	130	0	0	130
2,4-D	26	0	0	26
alachlor	25	0	0	25
aldicarb	26	0	0	26
atrazine	172	12	2	186
bentazon, sodium salt	26	0	0	26
bromacil	186	0	1	187
carbofuran	24	0	0	24
chlordane	26	0	0	26
cyanazine	17	0	0	17
dbcp	25	2	0	27
deethyl-atrazine	1	0	0	1
deisopropyl-atrazine	1	0	0	1
diazinon	170	0	0	170
dimethoate	3	1	0	4
diuron	18	0	3	21
endrin	26	0	0	26
ethylene dibromide	27	0	0	27
glyphosate, isopropylamine salt	25	0	0	25
heptachlor	26	0	0	26
heptachlor epoxide	26	0	0	26
hexazinone	17	0	0	17
lindane (gamma-bhc)	26	0	0	26
methoxychlor	26	0	0	26
methyl bromide	130	0	0	130
metribuzin	17	0	0	17
molinate	171	0	0	171
naphthalene	130	0	0	130
ortho-dichlorobenzene	130	0	0	130
prometon	21	0	0	21
prometryn	186	1	0	187
silvex	26	0	0	26
simazine	157	20	10	187
thiobencarb	4	0	0	4
toxaphene	26	0	0	26
xylene	4	0	0	4
Totals	164	20	10	194

County: PLACER

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	1	0	0	1
1,2-D (propylene dichloride)	1	0	0	1
1,3-dichloropropene (1,3-D)	1	0	0	1
atrazine	1	0	0	1
bromacil	1	0	0	1
diuron	1	0	0	1
methyl bromide	1	0	0	1
molinate	1	0	0	1
naphthalene	1	0	0	1
ortho-dichlorobenzene	1	0	0	1
prometon	1	0	0	1
simazine	1	0	0	1
xylene	1	0	0	1
Totals	2	0	0	2

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: PLUMAS

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	6	0	0	6
1,2-D (propylene dichloride)	6	0	0	6
1,3-dichloropropene (1,3-D)	6	0	0	6
methyl bromide	6	0	0	6
naphthalene	6	0	0	6
ortho-dichlorobenzene	6	0	0	6
xylene	6	0	0	6
Totals	6	0	0	6

County: RIVERSIDE

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	14	0	0	14
1,2-D (propylene dichloride)	15	3	0	18
1,3-dichloropropene (1,3-D)	14	0	0	14
2,4-D	26	0	0	26
alachlor	37	0	0	37
aldicarb	30	0	0	30
atrazine	58	0	0	58
bentazon, sodium salt	27	0	0	27
bromacil	50	0	4	54
carbofuran	41	0	0	41
chlordane	35	0	0	35
chlorothalonil	31	0	0	31
cyanazine	17	0	0	17
dbcp	49	8	0	57
diazinon	37	0	0	37
dimethoate	37	0	0	37
diuron	14	0	3	17
endrin	35	0	0	35
ethylene dibromide	57	0	0	57
glyphosate, isopropylamine salt	35	0	0	35
heptachlor	35	0	0	35
heptachlor epoxide	35	0	0	35
hexazinone	17	0	0	17
lindane (gamma-bhc)	35	0	0	35
methoxychlor	35	0	0	35
methyl bromide	14	0	0	14
metribuzin	17	0	0	17
molinate	41	0	0	41
naphthalene	20	0	0	20
ortho-dichlorobenzene	14	0	0	14
prometon	17	0	0	17
prometryn	54	0	0	54
silvex	26	0	0	26
simazine	50	1	7	58
thiobencarb	52	0	0	52
toxaphene	35	0	0	35
xylene	14	0	0	14
Totals	71	11	7	89

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: SACRAMENTO

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	182	0	0	182
1,2-D (propylene dichloride)	184	0	0	184
1,3-dichloropropene (1,3-D)	182	0	0	182
2,4,5-t	23	0	0	23
2,4-D	25	0	0	25
2,4-D, dimethylamine salt	5	0	0	5
aldrin	23	0	0	23
atrazine	8	0	0	8
bhc (other than gamma isomer)	23	0	0	23
bromacil	5	0	0	5
chlordane	23	0	0	23
dbcp	3	0	0	3
ddd	23	0	0	23
dde	23	0	0	23
ddt	23	0	0	23
dieldrin	23	0	0	23
diuron	5	0	0	5
endosulfan	23	0	0	23
endosulfan sulfate	23	0	0	23
endrin	25	0	0	25
endrin aldehyde	23	0	0	23
ethylene dibromide	3	0	0	3
heptachlor	23	0	0	23
heptachlor epoxide	23	0	0	23
lindane (gamma-bhc)	25	0	0	25
methoxychlor	25	0	0	25
methyl bromide	184	0	0	184
naphthalene	182	0	0	182
ortho-dichlorobenzene	184	0	0	184
prometon	5	0	0	5
silvex	25	0	0	25
simazine	8	0	0	8
toxaphene	25	0	0	25
xylene	180	0	0	180
Totals	212	0	0	212

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: SAN BERNARDINO

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	21	0	0	21
1,2-D (propylene dichloride)	21	1	0	22
1,3-dichloropropene (1,3-D)	21	0	0	21
2,4-D	61	0	0	61
alachlor	14	0	0	14
aldicarb	11	0	0	11
atrazine	91	0	0	91
bentazon, sodium salt	59	0	0	59
bromacil	21	0	0	21
carbofuran	59	0	0	59
chlordane	64	0	0	64
chlorothalonil	11	0	0	11
cyanazine	12	0	0	12
dbcp	113	52	0	165
diazinon	10	0	0	10
dimethoate	10	0	0	10
diuron	10	1	1	12
endrin	63	0	0	63
ethylene dibromide	136	0	0	136
glyphosate, isopropylamine salt	81	0	0	81
heptachlor	64	0	0	64
heptachlor epoxide	63	0	0	63
hexazinone	12	0	0	12
lindane (gamma-bhc)	63	0	0	63
methoxychlor	63	0	0	63
methyl bromide	21	0	0	21
metribuzin	12	0	0	12
molinate	83	0	0	83
naphthalene	30	0	0	30
ortho-dichlorobenzene	21	0	0	21
prometon	12	0	0	12
prometryn	21	0	0	21
silvex	60	0	0	60
simazine	87	1	3	91
thiobencarb	86	0	0	86
toxaphene	63	0	0	63
xylene	24	2	0	26
Totals	165	54	5	224

County: SAN DIEGO

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	2	0	0	2
1,2-D (propylene dichloride)	2	0	0	2
1,3-dichloropropene (1,3-D)	2	0	0	2
dbcp	3	0	0	3
ethylene dibromide	3	0	0	3
methyl bromide	2	0	0	2
naphthalene	2	0	0	2
ortho-dichlorobenzene	2	0	0	2
xylene	2	0	0	2
Totals	4	0	0	4

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: SAN FRANCISCO

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	2	0	0	2
1,2-D (propylene dichloride)	2	0	0	2
1,3-dichloropropene (1,3-D)	2	0	0	2
2,4-D	2	0	0	2
3-hydroxycarbofuran	2	0	0	2
alachlor	2	0	0	2
aldicarb	2	0	0	2
aldicarb sulfone	2	0	0	2
aldicarb sulfoxide	2	0	0	2
atrazine	4	0	0	4
bentazon, sodium salt	2	0	0	2
bromacil	4	0	0	4
carbaryl	2	0	0	2
carbofuran	2	0	0	2
chlordane	2	0	0	2
chlorothalonil	2	0	0	2
cyanazine	2	0	0	2
dbcp	2	0	0	2
diazinon	2	0	0	2
dimethoate	2	0	0	2
diuron	2	0	0	2
endrin	2	0	0	2
ethylene dibromide	2	0	0	2
glyphosate, isopropylamine salt	2	0	0	2
heptachlor	2	0	0	2
heptachlor epoxide	2	0	0	2
hexazinone	2	0	0	2
lindane (gamma-bhc)	2	0	0	2
methiocarb	2	0	0	2
methomyl	3	1	0	4
methoxychlor	2	0	0	2
methyl bromide	2	0	0	2
metribuzin	2	0	0	2
molinate	2	0	0	2
naphthalene	2	0	0	2
ortho-dichlorobenzene	2	0	0	2
oxamyl	2	0	0	2
prometon	2	0	0	2
prometryn	4	0	0	4
silvex	2	0	0	2
simazine	4	0	0	4
thiobencarb	2	0	0	2
toxaphene	2	0	0	2
xylene	2	0	0	2
Totals	3	1	0	4

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: SAN JOAQUIN

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2-D (propylene dichloride)	15	0	0	15
2,4-D	6	0	0	6
atrazine	23	0	0	23
bentazon, sodium salt	6	0	0	6
bromacil	22	0	1	23
dbcp	6	14	0	20
diuron	23	0	0	23
ethylene dibromide	1	0	0	1
hexazinone	8	0	0	8
metribuzin	8	0	0	8
oryzalin	2	0	0	2
oxyfluorfen	2	0	0	2
prometon	23	0	0	23
simazine	23	0	0	23
xylene	15	0	0	15
Totals	28	14	1	43

County: SAN LUIS OBISPO

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	9	0	0	9
1,2-D (propylene dichloride)	9	0	0	9
1,3-dichloropropene (1,3-D)	9	0	0	9
2,4-D	2	0	0	2
alachlor	3	0	0	3
atrazine	24	0	0	24
bentazon, sodium salt	2	0	0	2
bromacil	19	0	0	19
carbofuran	4	0	0	4
carbon disulfide	10	0	0	10
chlordane	5	0	0	5
chlorthal-dimethyl	6	0	0	6
cyanazine	10	0	0	10
dbcp	8	0	0	8
diazinon	6	0	0	6
diuron	19	0	0	19
endrin	5	0	0	5
ethylene dibromide	8	0	0	8
glyphosate, isopropylamine salt	1	0	0	1
heptachlor	5	0	0	5
heptachlor epoxide	5	0	0	5
hexazinone	10	0	0	10
lindane (gamma-bhc)	5	0	0	5
methoxychlor	5	0	0	5
methyl bromide	9	0	0	9
metribuzin	10	0	0	10
molinate	8	0	0	8
mtp (monomethyl 2,3,5,6-tetrachloroterephthalate	6	0	0	6
naphthalene	9	0	0	9
ortho-dichlorobenzene	9	0	0	9
prometon	16	0	0	16
prometryn	13	0	0	13
silvex	2	0	0	2
simazine	24	0	0	24
thiobencarb	8	0	0	8
toxaphene	8	0	0	8
tpa (2,3,5,6-tetrachloroterephthalic acid)	5	1	1	6
xylene	9	0	0	9
Totals	26	1	1	28

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: SAN MATEO

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	3	0	0	3
1,2-D (propylene dichloride)	3	0	0	3
1,3-dichloropropene (1,3-D)	3	0	0	3
2,4-D	2	0	0	2
2,4-D, dimethylamine salt	3	0	0	3
alachlor	1	0	0	1
atrazine	7	0	0	7
bentazon, sodium salt	5	0	0	5
bromacil	7	0	0	7
chlordane	1	0	0	1
cyanazine	6	0	0	6
dbcp	1	0	0	1
diazinon	1	0	0	1
dimethoate	1	0	0	1
diuron	6	0	0	6
endrin	1	0	0	1
ethylene dibromide	1	0	0	1
heptachlor	1	0	0	1
heptachlor epoxide	1	0	0	1
hexachlorobenzene	8	0	0	8
hexazinone	6	0	0	6
lindane (gamma-bhc)	1	0	0	1
methoxychlor	1	0	0	1
methyl bromide	3	0	0	3
metribuzin	6	0	0	6
molinate	1	0	0	1
naphthalene	12	0	0	12
ortho-dichlorobenzene	3	0	0	3
prometon	6	0	0	6
prometryn	7	0	0	7
silvex	2	0	0	2
simazine	7	0	0	7
thiobencarb	1	0	0	1
toxaphene	1	0	0	1
xylene	6	0	0	6
Totals	24	0	0	24

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: SANTA BARBARA

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	18	0	0	18
1,2-D (propylene dichloride)	18	0	0	18
1,3-dichloropropene (1,3-D)	18	0	0	18
2,4-D	12	0	0	12
3-hydroxycarbofuran	1	0	0	1
alachlor	15	0	0	15
aldicarb	15	0	0	15
aldicarb sulfone	7	0	0	7
aldicarb sulfoxide	7	0	0	7
atrazine	26	0	0	26
bentazon, sodium salt	18	0	0	18
bromacil	21	0	0	21
carbaryl	7	0	0	7
carbofuran	20	0	0	20
chlordane	24	0	0	24
chlorothalonil	1	0	0	1
cyanazine	6	0	0	6
dbcp	20	0	0	20
diazinon	20	0	0	20
dimethoate	8	0	0	8
diuron	13	0	0	13
endrin	19	0	0	19
ethylene dibromide	20	0	0	20
glyphosate, isopropylamine salt	14	0	0	14
heptachlor	24	0	0	24
heptachlor epoxide	24	0	0	24
hexazinone	6	0	0	6
lindane (gamma-bhc)	19	0	0	19
methiocarb	7	0	0	7
methomyl	7	0	0	7
methoxychlor	19	0	0	19
methyl bromide	18	0	0	18
metribuzin	6	0	0	6
molinate	17	0	0	17
naphthalene	18	0	0	18
ortho-dichlorobenzene	18	0	0	18
oxamyl	7	0	0	7
prometon	6	0	0	6
prometryn	21	0	0	21
propoxur	7	0	0	7
silvex	12	0	0	12
simazine	26	0	0	26
thiobencarb	17	0	0	17
toxaphene	19	0	0	19
xylene	18	0	0	18
Totals	31	0	0	31

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: SANTA CLARA

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	59	0	0	59
1,2-D (propylene dichloride)	59	0	0	59
1,3-dichloropropene (1,3-D)	58	0	0	58
2,4-D	2	0	0	2
alachlor	1	0	0	1
aldicarb	2	0	0	2
atrazine	2	0	0	2
bentazon, sodium salt	2	0	0	2
bromacil	2	0	0	2
carbofuran	2	0	0	2
chlordane	1	0	0	1
dbcp	6	0	0	6
diazinon	2	0	0	2
endrin	3	0	0	3
ethylene dibromide	6	0	0	6
glyphosate, isopropylamine salt	2	0	0	2
heptachlor	1	0	0	1
heptachlor epoxide	1	0	0	1
lindane (gamma-bhc)	3	0	0	3
methoxychlor	3	0	0	3
methyl bromide	58	0	0	58
molinate	2	0	0	2
naphthalene	54	0	0	54
ortho-dichlorobenzene	58	0	0	58
prometryn	2	0	0	2
silvex	2	0	0	2
simazine	2	0	0	2
thiobencarb	2	0	0	2
toxaphene	3	0	0	3
xylene	52	0	0	52
Totals	63	0	0	63

County: SANTA CRUZ

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	27	0	0	27
1,2-D (propylene dichloride)	27	0	0	27
1,3-dichloropropene (1,3-D)	27	0	0	27
atrazine	3	0	0	3
bromacil	3	0	0	3
cyanazine	3	0	0	3
diuron	3	0	0	3
hexazinone	3	0	0	3
methyl bromide	27	0	0	27
metribuzin	3	0	0	3
naphthalene	27	0	0	27
ortho-dichlorobenzene	27	0	0	27
prometon	3	0	0	3
prometryn	3	0	0	3
simazine	3	0	0	3
xylene	28	1	1	30
Totals	28	1	1	30

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: SHASTA

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	1	0	0	1
1,2-D (propylene dichloride)	1	0	0	1
1,3-dichloropropene (1,3-D)	1	0	0	1
methyl bromide	1	0	0	1
naphthalene	1	0	0	1
ortho-dichlorobenzene	1	0	0	1
xylene	1	0	0	1
Totals	1	0	0	1

County: SIERRA

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	3	0	0	3
1,2-D (propylene dichloride)	3	0	0	3
1,3-dichloropropene (1,3-D)	3	0	0	3
methyl bromide	3	0	0	3
naphthalene	3	0	0	3
ortho-dichlorobenzene	3	0	0	3
xylene	3	0	0	3
Totals	3	0	0	3

County: SISKIYOU

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	4	0	0	4
1,2-D (propylene dichloride)	4	0	0	4
1,3-dichloropropene (1,3-D)	4	0	0	4
2,4-D	1	0	0	1
alachlor	1	0	0	1
chlordane	1	0	0	1
endrin	1	0	0	1
heptachlor	1	0	0	1
heptachlor epoxide	1	0	0	1
lindane (gamma-bhc)	1	0	0	1
methoxychlor	1	0	0	1
methyl bromide	4	0	0	4
naphthalene	4	0	0	4
ortho-dichlorobenzene	4	0	0	4
silvex	1	0	0	1
toxaphene	1	0	0	1
xylene	4	0	0	4
Totals	5	0	0	5

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: SOLANO

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	3	0	0	3
1,2-D (propylene dichloride)	3	0	0	3
1,3-dichloropropene (1,3-D)	3	0	0	3
2,4-D, dimethylamine salt	2	0	0	2
atrazine	2	0	0	2
bromacil	2	0	0	2
carbofuran	1	0	0	1
diuron	2	0	0	2
hexachlorobenzene	6	0	0	6
methyl bromide	3	0	0	3
naphthalene	3	0	0	3
ortho-dichlorobenzene	3	0	0	3
prometon	2	0	0	2
simazine	2	0	0	2
xylene	3	0	0	3
Totals	10	0	0	10

County: SONOMA

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	14	0	0	14
1,2-D (propylene dichloride)	14	0	0	14
1,3-dichloropropene (1,3-D)	14	0	0	14
2,4-D	1	0	0	1
atrazine	21	0	0	21
bromacil	15	0	0	15
carbon disulfide	9	0	0	9
chlordane	3	0	0	3
cyanazine	9	0	0	9
diuron	15	0	0	15
endrin	4	0	0	4
glyphosate, isopropylamine salt	2	0	0	2
heptachlor	4	0	0	4
heptachlor epoxide	3	0	0	3
hexazinone	8	0	0	8
lindane (gamma-bhc)	4	0	0	4
methoxychlor	4	0	0	4
methyl bromide	14	0	0	14
metribuzin	9	0	0	9
naphthalene	14	0	0	14
ortho-dichlorobenzene	14	0	0	14
prometon	15	0	0	15
prometryn	9	0	0	9
silvex	1	0	0	1
simazine	21	0	0	21
toxaphene	4	0	0	4
xylene	20	0	0	20
Totals	30	0	0	30

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: STANISLAUS

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	26	0	0	26
1,2-D (propylene dichloride)	26	0	0	26
1,3-dichloropropene (1,3-D)	26	0	0	26
2,4,5-t	7	0	0	7
2,4-D	31	0	0	31
alachlor	29	0	0	29
aldicarb	1	0	0	1
aldrin	16	0	0	16
atrazine	85	1	0	86
bentazon, sodium salt	31	0	0	31
bromacil	46	0	0	46
carbofuran	15	0	0	15
chlordane	40	0	0	40
chlorothalonil	1	0	0	1
cyanazine	19	0	0	19
dalapon	7	0	0	7
dbcp	20	14	0	34
deethyl-atrazine	2	0	0	2
deisopropyl-atrazine	2	0	0	2
demeton	14	0	0	14
diazinon	17	0	0	17
diazoxon	4	0	0	4
dicamba	7	0	0	7
dieldrin	16	0	0	16
dimethoate	13	0	0	13
dinoseb	7	0	0	7
disulfoton	14	0	0	14
diuron	19	0	1	20
endrin	40	0	0	40
ethylene dibromide	26	0	0	26
glyphosate, isopropylamine salt	15	0	0	15
heptachlor	40	0	0	40
heptachlor epoxide	40	0	0	40
hexazinone	19	0	0	19
lindane (gamma-bhc)	40	0	0	40
methoxychlor	40	0	0	40
methyl bromide	26	0	0	26
metribuzin	32	0	0	32
mevinphos	14	0	0	14
molinate	37	0	0	37
naphthalene	26	0	0	26
ortho-dichlorobenzene	26	0	0	26
prometon	32	1	0	33
prometryn	46	0	0	46
silvex	31	0	0	31
simazine	85	0	1	86
simetryn	14	0	0	14
terbutryn	14	0	0	14
thiobencarb	23	0	0	23
toxaphene	40	0	0	40
xylene	26	0	0	26
Totals	83	16	1	100

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: SUTTER

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
		0	0	
atrazine	6	0	0	6
bromacil	6	0	0	6
diuron	6	0	0	6
hexazinone	1	0	0	1
metribuzin	1	0	0	1
molinate	5	0	0	5
prometon	6	0	0	6
simazine	6	0	0	6
Totals	6	0	0	6

County: TEHAMA

Pesticides or Breakdown Product	(2) Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	1	0	0	1
1,2-D (propylene dichloride)	1	0	0	1
1,3-dichloropropene (1,3-D)	1	0	0	1
atrazine	1	0	2	3
deethyl-atrazine	1	0	2	3
deisopropyl-atrazine	2	1	1	3
methyl bromide	1	0	0	1
naphthalene	1	0	0	1
ortho-dichlorobenzene	1	0	0	1
simazine	3	0	0	3
xylene	1	0	0	1
Totals	2	1	2	4

(2) One well had both verified and unverified detections.

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: TULARE

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	23	0	0	23
1,2-D (propylene dichloride)	23	0	0	23
1,3-dichloropropene (1,3-D)	23	0	0	23
2,4-D	21	0	0	21
3-hydroxycarbofuran	7	0	0	7
acephate	1	0	0	1
alachlor	1	0	0	1
aldicarb	8	0	0	8
aldicarb sulfone	7	0	0	7
aldicarb sulfoxide	7	0	0	7
atrazine	49	0	2	51
bentazon, sodium salt	37	0	0	37
bromacil	44	1	3	48
carbaryl	7	0	0	7
carbofuran	7	0	0	7
chlordane	7	0	0	7
cyanazine	18	0	0	18
dbcp	50	23	0	73
deethyl-atrazine	1	0	2	3
deisopropyl-atrazine	0	0	3	3
diazinon	20	0	0	20
dimethoate	20	0	0	20
diuron	27	0	1	28
endrin	7	0	0	7
ethylene dibromide	66	1	0	67
glyphosate, isopropylamine salt	7	0	0	7
hexazinone	18	0	0	18
methiocarb	7	0	0	7
methomyl	7	0	0	7
methoxychlor	7	0	0	7
methyl bromide	27	0	0	27
metribuzin	18	0	0	18
molinate	20	0	0	20
naphthalene	25	0	0	25
ortho-dichlorobenzene	23	0	0	23
oxamyl	7	0	0	7
prometon	28	0	0	28
prometryn	38	0	0	38
propoxur	7	0	0	7
silvex	21	0	0	21
simazine	44	1	6	51
thiobencarb	20	0	0	20
xylene	29	0	0	29
Totals	79	24	9	112

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: VENTURA

Pesticides or Breakdown Product	(3) Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	15	0	0	15
1,2-D (propylene dichloride)	15	0	0	15
1,3-dichloropropene (1,3-D)	15	0	0	15
2,4,5-t	1	0	0	1
2,4-D	3	0	0	3
3-hydroxycarbofuran	1	0	0	1
alachlor	6	0	0	6
aldicarb	4	0	0	4
aldicarb sulfone	1	0	0	1
aldicarb sulfoxide	1	0	0	1
aldrin	3	0	0	3
atrazine	16	0	4	20
bentazon, sodium salt	2	0	0	2
bromacil	19	0	1	20
carbaryl	1	0	0	1
carbofuran	5	0	0	5
chlordane	6	0	0	6
cyanazine	5	0	0	5
dbcp	16	0	0	16
diazinon	15	0	0	15
dieldrin	3	0	0	3
dimethoate	15	0	0	15
diuron	9	1	0	9
endrin	6	0	0	6
ethylene dibromide	16	0	0	16
heptachlor	7	0	0	7
heptachlor epoxide	7	0	0	7
hexazinone	5	0	0	5
lindane (gamma-bhc)	6	0	0	6
methiocarb	1	0	0	1
methomyl	1	0	0	1
methoxychlor	6	0	0	6
methyl bromide	20	0	0	20
metribuzin	5	0	0	5
molinate	15	0	0	15
naphthalene	15	0	0	15
ortho-dichlorobenzene	15	0	0	15
oxamyl	1	0	0	1
prometon	5	0	0	5
prometryn	20	0	0	20
propoxur	1	0	0	1
silvex	2	0	0	2
simazine	19	0	1	20
thiobencarb	15	0	0	15
toxaphene	6	0	0	6
xylene	15	0	0	15
Totals	24	1	4	28

(3) One well had both verified and unverified detections.

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: YOLO

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2-D (propylene dichloride)	25	1	0	26
1,3-dichloropropene (1,3-D)	13	0	0	13
2,4,5-t	1	0	0	1
2,4-D	6	0	0	6
2,4-D, dimethylamine salt	5	0	0	5
alachlor	19	1	0	20
aldicarb	15	1	0	16
aldicarb sulfone	6	0	0	6
aldicarb sulfoxide	6	0	0	6
atrazine	43	1	0	44
bentazon, sodium salt	2	0	0	2
bromacil	25	0	0	25
carbofuran	20	0	0	20
chlordane	4	0	0	4
chlorothalonil	1	0	0	1
cyanazine	7	0	0	7
dbcp	22	0	0	22
demeton	1	0	0	1
diazinon	6	0	0	6
dicamba	1	0	0	1
dichlorprop	1	0	0	1
dinoseb	23	0	0	23
diuron	29	0	0	29
endrin	9	0	0	9
ethylene dibromide	21	2	0	23
ethylene dichloride	16	0	0	16
heptachlor	3	0	0	3
heptachlor epoxide	3	0	0	3
hexazinone	17	0	0	17
lindane (gamma-bhc)	9	0	0	9
methoxychlor	9	0	0	9
methyl bromide	26	0	0	26
methyl isobutyl ketone (MIBK)	18	0	0	18
metribuzin	17	0	0	17
molinate	6	0	0	6
naphthalene	11	1	0	12
ortho-dichlorobenzene	9	1	0	10
ortho-dichlorobenzene, other related	9	0	0	9
prometon	24	0	0	24
prometryn	12	0	0	12
silvex	8	0	0	8
simazine	42	0	2	44
terbutryn	2	0	0	2
tetrachloroethylene	21	2	0	23
thiobencarb	1	0	0	1
toxaphene	9	0	0	9
xylene	21	1	0	22
Totals	42	6	2	50

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

County: YUBA

Pesticides or Breakdown Product	Number of Wells With:			Total Wells Sampled
	No Detections	Unverified Detections	Verified Detections	
1,2,4-trichlorobenzene	13	0	0	13
1,2-D (propylene dichloride)	56	0	0	56
1,3-dichloropropene (1,3-D)	51	0	0	51
2,4-D	14	0	0	14
atrazine	26	0	0	26
bentazon, sodium salt	5	1	6	12
bromacil	23	0	0	23
carbaryl	26	0	0	26
carbofuran	2	0	0	2
cyanazine	4	0	0	4
dbcp	1	0	0	1
diazinon	18	0	0	18
diuron	23	0	0	23
endrin	3	0	0	3
ethylene dibromide	1	0	0	1
ethylene dichloride	41	0	0	41
hexazinone	4	0	0	4
lindane (gamma-bhc)	3	0	0	3
methoxychlor	3	0	0	3
methyl bromide	52	0	0	52
methyl isobutyl ketone (MIBK)	16	0	0	16
metribuzin	4	0	0	4
molinate	1	0	0	1
naphthalene	45	0	0	45
ortho-dichlorobenzene	52	0	0	52
ortho-dichlorobenzene, other related	39	0	0	39
prometon	23	0	0	23
prometryn	4	0	0	4
silvex	4	0	0	4
simazine	25	0	0	25
tetrachloroethylene	42	0	0	42
toxaphene	3	0	0	3
xylene	55	0	0	55
Totals	77	1	6	84

(1) The total is not additive; rather, it is a total of the unique items existing in a category.

G. SECTION ONE, TABLES ONE THROUGH FIVE

Table 1. Numerical Summary of Well Sampling Results Included in the Well Inventory Database, By Report Year, For Data Reported Through June 30, 1993.

CATEGORY	REPORT YEAR 1986	1987	1988	1989	1990	1991	1992	1993	TOTAL
Total Wells Sampled	8,987	574	3,074	752	2,784	1,557	4,741	2,324	18,440
Wells with No Detections	6,583	317	2,791	543	2,550	1,351	3,985	1,945	14,587
Wells with Detections	2,404	257	283	209	234	206	756	379	3,853
Wells with Verified Detections	44	29	4	140	93	133	67	80	547
Total Counties Sampled	53	20	41	33	53	30	52	46	58
Counties with No Detections	30	6	24	11	27	11	24	25	14
Counties with Wells with Detections	23	14	17	22	26	19	28	21	44
Counties with Wells Having Verified Detections	5	3	3	16	8	14	9	17	29
Total Pesticides and Related Compounds Analyzed	160	79	167	96	191	186	125	112	286
Pesticides and Related Compounds with No Detections	144	64	142	81	164	166	85	83	211
Pesticides and Related Compounds with Detections	16	15	25	15	27	20	40	29	75
Pesticides and Related Compounds with Verified Detections	8	6	5	9	6	9	5	10	20
Pesticides and Related Compounds Detected in Ground Water as the Result of Legal, Agricultural Use	9	8	1	7	6	7	5	11	14

(a) Verified, and unverified detections are included in the total.

(b) Detections are designated as verified if residues of a compound are detected in one sample as a result of an analytical method approved by the Department and verified, within 30 days in a second discrete sample taken from the well, by a second analytical method or a second analytical laboratory approved by the Department.

(c) The total is not additive. It is a total of the unique items existing in a category (e.g., a single well that had sampling data reported in the 1986, 1988, and 1990 reports is counted one time only).

(d) Legal, agricultural use is the application of a pesticide, according to its labelled directions and in accordance with federal and state laws and regulations. Agricultural use is defined in Food and Agricultural Code Section 11408.

Table 2. Pesticide active ingredients and breakdown products with analytical results added to the well inventory data base for the 1993 report year, by total number of counties and wells sampled and number of wells with verified and unverified detections. Results are for data reported during the period July 1, 1992 through June 30, 1993.

Chemical Name	Number of Counties Sampled	Number of Wells Sampled (1)	Wells with Unverified Detections	Wells with Verified Detections (2)
1,2,4-trichlorobenzene	38	976		
1,2-dichloropropane (propylene dichloride, 1,2-D)	40	1094	8	
1,3-dichloropropene (1,3-D)	39	1035		
2,4,5-t	6	40		
2,4-D	23	454		
2,4-D, dimethylamine salt	7	22		
3-hydroxycarbofuran	6	42		
acephate	1	1		
alachlor	20	322	1	
aldicarb	15	215	1	
aldicarb sulfone	7	54		
aldicarb sulfoxide	7	54		
aldrin	7	86		
atrazine	36	1271	19	32
azinphos-methyl	1	4		
benefin	1	2		
benomyl	1	12	1	
bentazon, sodium salt	21	393	1	6
bhc (other than gamma isomer)	3	32		
bromacil	34	938	4	12
captan	1	2		
carbaryl	8	80		
carbofuran	19	316		
carbon disulfide	2	19		
carbophenothion	1	2		
chlordane	23	480		
chloropicrin	1	7		
chlorothalonil	12	196		
chlorpyrifos	1	4		
chlorthal-dimethyl	2	7		
coumaphos	1	4		
cyanazine	24	240		
dalapon	4	62		
dbcp	25	846	241	
ddd	3	33		
dde	3	33		
ddt	3	33		

Table 2, continued.

Chemical Name	Number of Counties Sampled	Number of Wells Sampled (1)	Wells with Unverified Detections	Wells with Verified Detections (2)
ddvp	1	4		
deethyl-atrazine	8	30		15
deisopropyl-atrazine	8	30		6
demeton	5	27		
diazinon	21	419		
diazoxon	4	16		
dicamba	4	16		
dichlorprop	1	1		
dicofol	1	2		
dieldrin	7	86		
dimethoate	17	340	1	
dinoseb	5	72		
disulfoton	4	26		
diuron	32	482	4	13
dmpa	1	2		
endosulfan	3	37	3	
endosulfan II	1	6		
endosulfan sulfate	3	37	2	
endothall	1	2		
endrin	25	520		
endrin aldehyde	3	32		
eptc	1	5	1	
ethoprop	1	4		
ethylene dibromide	25	773	8	
ethylene dichloride	2	57		
fensulfothion	1	4		
fenthion	1	4		
glyphosate, isopropylamine salt	18	270		
heptachlor	22	467		
heptachlor epoxide	22	465		
hexachlorobenzene	3	23		
hexazinone	26	262		
lindane (gamma-bhc)	24	510		
merphos	1	4		
methiocarb	6	47		
methomyl	6	50	1	
methoxychlor	25	522		
methyl bromide	39	1083	1	
methyl isobutyl ketone (MIBK)	2	34		
methyl parathion	1	4		
metribuzin	26	283		
mevinphos	4	26		

Table 2, continued.

Chemical Name	Number of Counties Sampled	Number of Wells Sampled (1)	Wells with Unverified Detections	Wells with Verified Detections (2)
molinate	26	814	1	
mtp (monomethyl 2,3,5,6-tetrachloroterephthalate)	1	6		
naled	1	4		
naphthalene	39	1047	2	
nitrofen	1	2		
ortho-dichlorobenzene	39	1047	1	
ortho-dichlorobenzene, other related	2	48		
oryzalin	1	2		
oxamyl	6	48		
oxyfluorfen	2	8		
pcnb	1	2		
phorate	1	4		
picloram	1	47		
prometon	31	426	1	2
prometryn	27	778	1	
propoxur	5	46		
prothiofos	1	4		
ronnel	1	4		
silvex	22	437		
simazine	36	1264	21	44
simetryn	3	22		
sulprofos	1	4		
terbutryn	4	24		
tetrachloroethylene	2	65	2	
tetrachlorvinphos	1	4		
thiobencarb	19	600		
thiram	1	11	4	
toxaphene	24	509	1	
tpa (2,3,5,6-tetrachloroterephthalic acid)	1	6		1
triadimefon	1	7		
trichloronate	1	4		
trifluralin	2	16		
xylene	41	992	3	2
Totals	**46**	**2,324**	**299**	**80**

(1) Most wells were sampled for more than one compound.

(2) Two or more compounds were detected in 39 of the 80 wells with verified detections.

Table 3. Summary of wells with verified detections of residues, by county and pesticide. Results are for data reported during the period July 1, 1992 through June 30, 1993.

County	atrazine	bentazon	bromacil	deethyl atrazine	deisopropyl atrazine	diuron	prometon	simazine	TPA (1)	xylene	Total discrete wells, by county (2)
Fresno	1		1		1	1		2			4
Glenn	1			1			1	1			3
Kern				1							1
Los Angeles	19		1	9	1	2		9			22
Merced	1						1	1			1
Orange	2		1			3		10			10
Riverside			4			3		7			7
San Bernardino						2		4		1	5
San Joaquin			1								1
San Luis Obispo									1		1
Santa Cruz										1	1
Stanislaus						1		1			1
Tehama	2			2	1						2
Tulare	2		3	2	3	1		7			9
Ventura	4		1					1			4
Yolo								2			2
Yuba		6									6
Total discrete wells, by chemical	**32**	**6**	**12**	**15**	**6**	**13**	**2**	**45**	**1**	**2**	

(1) TPA = 2,3,5,6-tetrachloroterephthalic acid

(2) More than one compound was detected some wells.

▒▒ indicates detections due to point source.

Table 4. Comparison, by county, of total wells sampled versus number of wells with unverified, verified, and negative detections. Results are for data reported during the period July 1, 1992 through June 30, 1993.

County	Total Wells Sampled	Wells With Unverified Detections	Wells With Verified Detections	Wells With No Detections
Alameda	12			12
Butte	26			26
Colusa	9	1		8
Contra Costa	3			3
Del Norte	1			1
El Dorado	12			12
Fresno	182	96	4	82
Glenn	29	5	3	21
Humboldt	15	5		10
Inyo	13			13
Kern	93	20	1	72
Kings	12			12
Lake	7			7
Lassen	9			9
Los Angeles	426	14	22	390
Madera	25	1		24
Mariposa	6			6
Merced	38	9	1	28
Monterey	18			18
Nevada	1			1
Orange	194	20	10	164
Placer	2			2
Plumas	6			6
Riverside	89	11	7	71
Sacramento	212			212
San Bernardino	224	54	5	165
San Diego	4			4
San Francisco	4	1		3
San Joaquin	43	14	1	28
San Luis Obispo	28		1	27
San Mateo	24			24
Santa Barbara	31			31
Santa Clara	63			63
Santa Cruz	30	1	1	28
Shasta	1			1

Table 4, continued.

County	Total Wells Sampled	Wells With Unverified Detections	Wells With Verified Detections	Wells With No Detections
Sierra	3			3
Siskiyou	5			5
Solano	10			10
Sonoma	30			30
Stanislaus	100	16	1	83
Sutter	6			6
Tehama	4		2	2
Tulare	112	24	9	79
Ventura	28		4	24
Yolo	50	6	2	42
Yuba	84	1	6	77
Totals	**2,324**	**299**	**80**	**1,945**

Table 5. Status, as of June 30, 1993, of all reported detections of pesticide active ingredients and breakdown products in ground water that were added to the Department of Pesticide Regulation (DPR) well inventory data base during the period July 1, 1992 through June 30, 1993.

Compound Detected, Registration Status, Type of Pesticide	Total Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (ppb)	Comments
alachlor active registration (AR) herbicide	20 counties 322 wells	Yolo, 1	0.57 to 0.58	USEPA MCL 2.0	Residues were found in an unsealed, improperly constructed well.
aldicarb AR acaricide, insecticide	15 counties 215 wells	Yolo, 1	1.1	CAL 10.0	Not detected (ND) in follow-up samples taken from the original, positive well or other, nearby wells.
atrazine AR herbicide	36 counties 1271 wells	Fresno, 1 Glenn, 2 Los Angeles, 21 Merced, 1 Orange, 16 Stanislaus, 1 Tehama, 2 Tulare, 2 Ventura, 4 Yolo, 1	0.1 to 1.0	DHS MCL 3.0	Residues in one Glenn County well, 18 Los Angeles County wells, two Orange County wells, two Tehama County wells, two Tulare County wells, and four Ventura County wells were determined by DPR to be due to non-point source, legal agricultural use. Detections in one Fresno County well, one Los Angeles County well, one Merced County well, six Orange County wells, and one Yolo County well are currently under investigation (CUI) by DPR. Positive, unverified samples taken from in one well in Glenn County, one well in Los Angeles County, one well in Stanislaus County, and two Orange County wells were not verified in other samples taken from the wells. No further sampling was conducted for positive, unverified samples reported for one well in Los Angeles County and six wells in Orange County because the wells are located in sections that have already been proposed as Pesticide Management Zones (PMZs).
benomyl AR fungicide	1 county 12 wells	Humboldt, 1	190.0	none established	ND in follow-up monitoring.

USEPA MCL: Maximum Contaminant Level (MCL) adopted by the U.S. Environmental Protection Agency (USEPA) under the Safe Drinking Water Act. MCLs are enforceable by the California Department of Health Services (DHS) on water suppliers.

CAL: California State Action Levels (CALs) are published by DHS's Office of Drinking Water and are based mainly on health affects. CALs are advisory to water suppliers. Although not legally enforceable, the majority of water suppliers have complied with CALs as though they were MCLs.

DHS MCL: MCL adopted by DHS under the Safe Drinking Water Act. MCLs are formally established in regulation and are enforceble by DHS on water suppliers.

Table 5. continued.

Compound Detected, Registration Status, Type of Pesticide	Total Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (ppb)	Comments
bentazon AR herbicide	21 counties 393 wells	Yuba, 7	0.12 to 3.0	DHS MCL 18.0	Source of residues determined by DPR to be due to historical applications of bentazon to rice paddies. Regulations were adopted in January 1992 that prohibit the use of bentazon on rice.
bromacil AR herbicide	34 counties 943 wells	Fresno, 1 Los Angeles, 1 Orange, 2 Riverside, 5 San Joaquin, 1 Tulare, 5 Ventura, 1	0.1 to 1.5	USEPA HAL 90.0 lifetime	Source of residues in one Orange County well, four Riverside County wells, and two Tulare County wells was determined by DPR to be due to non-point souce, legal agricultural use. Detections in Fresno, Los Angeles, San Joaquin, and Ventura Counties, and in one Tulare County well are CUI. Detections in a single sample in one Orange County well, one Riverside County well, and two Tulare County wells, were not verified in other samples taken from the wells.
DBCP (1,2-dibromo-3-chloropropane) not registered for use in California (NR) soil fumigant	25 counties 846 wells	Fresno, 94 Kern, 15 Los Angeles, 9 Merced, 9 Orange, 2 Riverside, 8 San Bernardino, 53 San Joaquin, 14 Stanislaus, 14 Tulare, 23	0.01 to 2.63	DHS MCL 0.2	Use suspended in 1979. Source of residues considered by DPR to be from non-point source, legal agricultural use.
deethyl-atrazine metabolite	8 counties 30 wells	Glenn, 1 Kern, 2 Los Angeles, 12 Tehama, 2 Tulare, 3	0.1 to 0.52	none established	Metabolite of the active ingredient, atrazine.

USEPA HAL: An advisory number. Health Advisory Levels (HAL) are published by USEPA's Office of Drinking Water and Office of Water Regulations and Standards. Short-term, long-term, and lifetime exposure health advisories for noncarcinogens and suspected human carcinogens are included where data sufficient for derivation of advisories exist. HALs are a guideline which include a margin of safety to protect human health. For lifetime HALs, water containing particles at or below the HAL is acceptable for drinking every day over the course of one's lifetime.

Table 5, continued.

Compound Detected, Registration Status, Type of Pesticide	Total Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (ppb)	Comments
deisopropyl-atrazine metabolite	8 counties 30 wells	Fresno, 1 Los Angeles, 6 Orange, 1 Tehama, 2 Tulare, 3	0.1 to 1.8	none established	This molecule, also called deisopropyl-simazine, is a metablolite of the active ingredients, atrazine and simazine.
1,2-dichloropropane (1,2-D) NR fumigant	40 counties 1,094 wells	Fresno, 1 Kern, 2 Riverside, 3 San Bernardino, 1 Yolo, 1	0.2 to 56.0	DHS MCL 5.0	Source of residues considered by DPR to be from non-point source, agricultural use. Regulations were adopted in 1985 that prohibit the use or sale of pesticides in California in which 1,2-D exceeds 0.5% of the total formulation.
dimethoate AR insecticide, acaricide	17 counties 340 wells	Orange, 1	0.4	CAL 140.0	ND in follow-up sampling.
diuron AR herbicide	32 counties 478 wells	Fresno, 2 Kern, 1 Los Angeles, 2 Orange, 3 Riverside, 3 San Bernardino, 2 Stanislaus, 1 Tulare, 2 Ventura, 1	0.1 to 0.96	USEPA HAL 10.0	Source of residues in Los Angeles, Orange, Riverside, and San Bernardino County wells was determined by DPR to be due to non-point source, legal agricultural use. Detections in one well each in Fresno, Kern, Stanislaus, and Tulare Counties are CUI. Detections in a single sample in one well in Fresno County, one well in Tulare County, and one well in Ventura County were not verified in other samples taken from the wells.
endosulfan AR insecticide, acaricide	3 counties 37 wells	Glenn, 3	0.054 to 34.7	CISWP, NWQO sources of drinking water = 0.9 other waters = 2.0	ND in follow-up sampling.

CISWP, NWQO: California Inland Surface Waters Plan, Numerical Water Quality Objectives. Water quality objectives designed to protect beneficial uses of water and prevent nuisance within a certain area are found in the Water Qualiy Control Plans of the SWRCB and Regional Boards. The numbers listed are for the sum of endosulfan-alpha and -beta and endosulfan sulfate.

Table 5, continued.

Compound Detected, Registration Status, Type of Pesticide	Total Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (ppb)	Comments
endosulfan sulfate breakdown product	3 counties 37 wells	Glenn, 2	0.22 to 0.48	CISWP, NWQO sources of drinking water = 0.9 other waters = 2.0	Breakdown product of the active ingredient endosulfan. ND in follow-up sampling.
EPTC (eptam) AR herbicide	1 county 5 wells	Kern, 1	5.6 to 170.0	none established	ND in follow-up sampling.
ethylene dibromide (EDB) NR fumigant, insecticide, nematicide	25 counties 773 wells	Fresno, 2 Los Angeles, 3 Tulare, 1 Yolo, 2	0.01 to 0.17	DHS MCL 0.02	Not registered for use in California since January 1987. Source of residues considered by DPR to be due to non-point source, legal agricultural use.
methomyl AR insecticide	6 counties 50 wells	San Francisco, 1	0.8	USEPA HAL 200.0	ND in follow-up sampling.
methyl bromide AR fumigant	39 counties 1,083 wells	Madera, 1	1.3	USEPA HAL 10.0	ND in follow-up sampling.
molinate AR herbicide	26 counties 814 wells	Colusa, 1	2.4	DHS MCL 20.0	Detections in a single sample not verified in other samples taken from the well, or in samples taken from other, nearby wells.
naphthalene AR insecticidal fumigant	39 counties 1,047 wells	Fresno, 1 Yolo, 1	1.0	USEPA HAL 20.0	Naphthalene no longer registered for agricultural use; referred to the State Water Resources Control Board (SWRCB).
ortho-dichlorobenzene (1,2-dichlorobenzene) NR herbicide, insecticide, soil fumigant	39 counties 1,047 wells	Yolo, 1	12.0	CAL 130.0 (for sum of 1, 2- and 1, 3- dichlorobenzene)	Referred to SWRCB.

Table 5, continued.

Compound Detected, Registration Status, Type of Pesticide	Total Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (ppb)	Comments
prometon AR herbicide	31 counties 426 wells	Glenn, 1 Merced, 1 Stanislaus, 1	0.16 to 0.67	USEPA HAL 100.0	Detections in Glenn and Merced Counties CUI. Detection in a single sample in Stanislaus County was not verified in follow-up samples taken from the well.
prometryn AR herbicide	27 counties 774 wells	Orange, 1	0.1	none established	ND in follow-up sampling.
simazine AR herbicide	36 counties 1,268 wells	Fresno, 2 Glenn, 1 Kern, 1 Los Angeles, 11 Merced, 1 Orange, 27 Riverside, 8 San Bernardino, 4 Stanislaus, 1 Tulare, 7 Ventura, 1 Yolo, 2	0.1 to 1.14	DHS MCL 10.0	Source of residues in one well in Fresno County, 9 wells in Los Angeles County, 10 wells in Orange County, 7 wells in Riverside County, 4 wells in San Bernardino County, and 2 wells in Tulare County were determined by DPR to be non-point source, legal agricultural use. Detections in one well in Fresno County, one well in Glenn County, one well in Merced County, 7 wells in Orange County, one well in Stanislaus County, 4 wells in Tulare County, one well in Ventura County, and two wells in Yolo County are CUI. Two wells in Orange County were ND in follow-up sampling. Detections in a single sample in one well in Kern County, 2 wells in Los Angeles County, and one well in Riverside County were not verified in other samples taken from the wells. Source of residues in one well only in one area of Tulare County is unknown. No further sampling was conducted for positive, unverified samples reported for eight wells in Orange County because the wells are located in sections that have already been proposed as PMZs.
tetrachloroethylene NR insecticide	2 counties 65 wells	Yolo, 2	0.5 to 2.5	DHS MCL 5.0	NR for use since June 1990. Referred to SWRCB.
thiram AR fungicide seed protectant animal repellant	1 county 11 wells	Humboldt, 4	5.0 to 17.0	NAS SNARL 35.0	ND in follow-up monitoring.

NAS SNARL: National Academy of Science (NAS) suggested no-adverse-response level (SNARL). Human health-related criteria published by the NAS.

Table 5, continued.

Compound Detected, Registration Status, Type of Pesticide	Total Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (ppb)	Comments
toxaphene NR insecticide	24 counties 509 wells	Glenn, 1	57.0	USEPA MCL 3.0	NR for use since December 1987. Referred to SWRCB.
TPA (2,3,5,6-tetrachloro-terephthalic acid) metabolite	1 county 6 wells	San Luis Obispo, 1	1.28 to 4.0	USEPA HAL 4000.0 lifetime	Breakdown product of the active ingredient chorthal-dimethyl. Residues considered by DPR to be the result of non-point source, legal agricultural use.
xylene AR solvent	41 counties 992 wells	San Bernardino, 2 Santa Cruz, 2 Yolo, 1	1.2 to 140.0	DHS MCL 1750.0	Detections due to point-source contamination. Other components of gasoline were detected in analyses of samples from the San Bernardino and the Santa Cruz wells. The Yolo County well is located at a landfill and is under investigation by the Yolo County Environmental Health Department (YCEHD). The YCEHD has reported that pesticides are not believed to be the source of residues in the well.