TABLE OF CONTENTS

SAMPLING FOR PESTICIDE RESIDUES IN CALIFORNIA WELL WATER

1995 Update of the Well Inventory Data Base

For Sampling Results Reported From July 1, 1994 to June 30,1995

Tenth 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

by

DPR Portion: D. Bartkowiak, K. Newhart, M. Pepple, J. Troiano, D. Weaver
SWRCB Portion: Staff

California Environmental Protection Agency
Department of Pesticide Regulation
Environmental Monitoring and Pest Management Branch
Environmental Hazards Assessment Program
1020 N Street, Sacramento, California 95814

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EXECUTIVE SUMMARY

About The The Pesticide Contamination Prevention Act

The pesticide contamination prevention Act (PCPA) was enacted in 1985 to prevent further pesticide pollution of the State's ground water.

- The PCPA requires:
  - The Department of Pesticide Regulation (DPR) to maintain a statewide database of wells sampled for active ingredients of pesticide products.
  - Agencies (government and private) to report the results of any well sampling for the active ingredients of pesticides.
  - DPR to review findings of pesticide contamination and undertake necessary mitigation.
  - DPR, in consultation with the California Department of Health Services (CDHS) and the State Water Resources Control Board (SWRCB), to annually make this report to the Legislature, the CDHS, the State Office of Environmental Health Hazard Assessment, and the SWRCB.

The Well Inventory Database

- The well inventory database was developed by DPR (then a division of the California Department of Food and Agriculture) in 1983, before the passage of the PCPA.
- The purposes of the database were to centralize information on the occurrence of nonpoint source contamination of ground water by the agricultural use of pesticides and to facilitate graphical, numerical, and spatial analyses of the data.
- To meet the requirements of the PCPA, sampling results from both point source and nonpoint source contaimiation are included in the database.

What happens when detections are reported to DPR

- When a pesticide is found in ground water a well-defined process established by the PCPA is triggered. This process allows for comprehensive review of the detection.
- DPR refers detections to the SWRCB if the pesticide is:
  - not currently registered for use;
  - registered for other than agricultural, outdoor industrial, or outdoor institutional uses; or
  - found in ground water and determined not to be due to legal agricultural use.

- DPR attempts to verify the detection of pesticides that are currently registered for agricultural use by conducting a well sampling study. There are specific criteria for verification of a detection. If a detection is verified, a determination is made as to whether the contamination occurred because of legal agricultural use of the chemical.
- Detections may not be verified for one of several reasons, including:
    - Follow-up sampling has not yet been completed by DPR, or follow-up sampling was not conducted by DPR. The detection may have been referred to the SWRCB, there may be no wells available for sampling, or permission to sample could not be obtained from the well owner.
    - Analyses of all other samples taken by DPR in response to the positive sample were negative for the compound under investigation.

General Information about Sampling Results in the Well Inventory Database

- A summary of the data in the database by report year is given in Table 1.
- The data can be used to:
    - Display the geographic distribution of well sampling.
    - Display the geographic distribution of pesticide residues in sampled wells.
    - Identify areas potentially sensitive to contamination by the legal agricultural use of pesticides.
- There are limitations on interpreting the data, including:
    - The data indicate which pesticides are present in well water among those pesticides for which analyses were performed. They do not represent a complete survey of ground water quality throughout the state nor do they represent sampling for all pesticides.
    - Sampling by agencies other than DPR is not necessarily related to suspected agricultural sources of contamination.

The Data In This Report

This is the tenth report, and the third update to the 1992 cumulative report on the entire contents of the database.

- Data were submitted to DPR from July 1, 1994 to June 30, 1995.
- Data are the results of 49 studies conducted by three agencies.
- Data are from studies that were conducted from 1993 to 1995.

Summary of Data

- 93,236 records (chemical analyses) were added to the database for this report.
- 3,322 wells were sampled in 47 counties.
- 166 pesticide active ingredients and breakdown products were analyzed for.
- 27 compounds were reported with positive detections.

Detections Referred to the SWRCB

Detections of eight chemiclas, including three chemicals where historical agricultural applications are considered by DPR to be the source of residues in ground water were reported the the SWRCB. The three chemicals and the number of wells with detections are:

1,2-dibromo-3-chloropropane (DBCP): 304 wells
1,2-dichloropropane (1,2-D): 11 wells, and
ethylene dibromide (EDB): 15 wells.

Summary of Verified Detections

- Six herbicides had verified detections:

atrazine	diuron	prometon
bromacil	hexazinone	simazine

- Three breakdown products of active ingredients had verified detections:
  deethyl-atrazine deisopropyl-atrazine (DIPA)
  2,3,5,6-tetrachloroterephthalic acid
- Verified detections were made in 213 wells in 17 counties (See Section I, Figure I-1).
- Detections were found in three types of wells
  private drinking-water wells (174)
  public drinking water wells (18)
  non-drinking-water wells (21)

First-time Verified Detections Were Made for the Following Chemicals and Counties:

- Atrazine in Contra Costa, San Bernardino, and San Joaquin.
- Bromacil in Contra Costa and Stanislaus.
- Simazine in Contra Costa.
- Prometon in Colusa, Contra Costa, Los Angeles, and Solano.

First-time Verified Detections of Hexazinone in California Ground Water

- Tulare County (four wells): Determined by DPR to be due to a possible point source contamination originating from the Teapot Dome Landfill.
- Solano County (one well): Only one of six sampled wells had a verified detection of hexazinone, and no further action will be taken.

Legal Agricultural Use Determinations

- After well sampling and land use surveys are completed a determination is made as to whether the detection of the pesticide residues in ground water could have been due to legal agricultural use. Specific criteria must be met for this determination to be made.
- Six compounds were found in ground water as a result of legal agricultural use:

atrazine	diuron	simazine
bromacil	prometon	DIPA

- 122 wells had contamination due to legal agricultural use.
- Nine counties had contamination due to legal agricultural use:

Fresno	Orange	Tehama
Los Angeles	Riverside	Tulare
Merced	San Bernardino	Yolo

- First-time determinations were made for:

  Prometon in Los Angeles County.

  Diuron in both Merced and Tehama counties.

Pesticide Management Zone (PMZ)

- A PMZ is a land area where a pesticide has been detected in ground water, and where it has been determined that the contamination was due to legal agricultural use. PMZs are established in regulation to prevent further contamination of ground water. The use of certain chemicals is restricted in these areas. PMZs exist for atrazine, bromacil, diuron, prometon, and simazine.
- After evaluation of data, a total of 92 PMZs will be established in regulation in the following counties:

Fresno	Orange	Tehama	Ventura
Los Angeles	Riverside	Tulare	Yolo
Merced	San Bernardino		

- Three previously adopted PMZs will be removed from regulation. It was determined that these PMZs had been established based on unverified detections.

  One atrazine PMZ in Stanislaus County.
  One bromacil PMZ in Tehama County.
  One bromacil PMZ in Tulare County.

Factors That Contribute To Ground Water Contamination

DPR environmental scientists continue their work to understand the factors that contribute to ground water contamination by pesticides used in agriculture. They conduct field studies on pesticide movement, investigate contaminated wells, compile extensive databases, and review the work of other scientists. The knowledge gained from these activities is used to develop pesticide use practices that prevent further ground water contamination. For the past several years, EHAP scientists have been developing an approach that integrates climatic, soil, and geographic data in analyses of their combined influence on the movement of pesticides to ground water.

During the past year, EHAP scientists conducted well monitoring studies and field investigations in Fresno and Tulare counties as they continued to examine this method of identifying areas that are vulnerable to ground water pollution by the agricultural use of pesticides. This method may provide a basis for development of regional agricultural management practices to reduce ground water contamination by pesticides.

The State And Regional Water Boards

The SWRCB and nine RWQCBs are responsible for protecting the beneficial uses of water in California and for controlling all discharges of waste into waters of the State. Actions taken by the SWRCB to prevent economic poisons from migrating to ground water include:

- Development and implementation of water quality plans.
- Cooperating with DPR in areas relating to pesticides and water quality.
- Consultation and collaboration with various agencies and groups on studies and workshops relating to pesticides, water quality, and ground water.
- Submittal of a workplan to U.S. Environmental Protection Agency pursuant to the Clean Water Act for 1995 funding for pesticides and ground water-related work.
- Adapting the Pesticide Use Retrieval System database queries of 1990 and 1991.
- Staff of the nine RWQCBs perform site contamination assessment investigations, development and implementation of remediation plans (including soil and ground water clean-up), and monitoring.

Table I. Summary of well sampling results included in the Department of Pesticide Regulation's (DPR) well inventory database, by report year, for data reported through June 30, 1995.

CATEGORY	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	TOTAL[d]
Total **wells** sampled	8987	574	3074	752	2784	1557	4741	2324	2839	3322	19725
no detections	6583	317	2791	543	2550	1351	3985	1945	2414	2769	15547
detections [a]	2404	257	283	209	234	206	756	379	425	552	4178
verified detections [b]	44	29	4	140	93	133	67	80	37	213[e]	789
Total **counties** sampled	53	20	41	33	53	30	52	46	50	47	58
no detections	30	6	24	11	27	11	24	25	30	19	14
detections [a]	23	14	17	22	26	19	28	21	20	28	44
verified detections [b]	5	3	3	16	8	14	9	17	10	17	31
Total **pesticides and related compounds** analyzed	160	79	167	96	191	186	125	112	114	166	291
no detections	144	64	142	81	164	166	85	83	95	139	202
detections [a]	16	15	25	15	27	20	40	29	19	27	89
verified detections [b]	8	6	5	9	6	9	5	10	6	9	22
Pesticides and related compounds detected in ground water as the result of legal, agricultural use [c]	9	8	1	7	6	7	5	11	8[f]	9[g]	15 [h]

(a) Includes verified and unverified detections.
(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 DPR 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 DPR.
(c) Legal, agricultural use is the application of a pesticide, according to its labelled directions and in accordance with all laws and regulations. Agricultural use is defined in Food and Agricultural code Section 11408.
(d) The total is not additive. A single well that had sampling data reported in the 1986, 1988, and 1990 reports is counted one time only.
(e) The large increase in verified detections from previous years is due, primarily, to two studies conducted by DPR in Fresno and Tulare counties.
(f) The 1994 Update to the Well Inventory Data Base was incorrect. There were 8 compounds detected in ground water as the result of legal, agricultural use: 1,2-dichloropropane (1,2-D), 1,2-dibromo-3-chloropropane (DBCP), atrazine, bromacil, diuron, ethylene dibromide (EDB), prometon, and simazine.
(g) The 9 compounds are: 1,2-D, atrazine, bromacil, DBCP, deethyl-atrazine, diuron, EDB, prometon, and simazine.
(h) The 15 compounds are: 1,2-D, aldicarb, aldicarb sulfone, aldicarb sulfoxide, atrazine, bentazon, bromacil, DBCP, deethyl-atrazine, deisopropyl-atrazine, diuron, EDB, prometon, simazine, and 2,3,5,6-tetrachloroterephthalic acid. Aldicarb, atrazine, bentazon, bromacil, diuron, prometon, and simazine have been reviewed through the Pesticide Detection Response Process. DPR considers the remaining chemicals to have reached ground water as a result of legal, agricultural use.

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 report presents data reported to DPR from July 1, 1994 through June 30, 1995. This is the tenth report and the third 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.

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 township, range, and section in the database, listing results in this manner in the 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.

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In addition, we acknowledge the staff of cooperating federal, state, local, and private agencies for contributing their data, time, and efforts which make this report possible.

DISCLAIMER

The mention of commercial products, their source, or their use, in this report is not to be construed as either an actual or implied endorsement of such product.

TABLE OF CONTENTS

LIST OF TABLES

SECTION I:

LIST OF FIGURES

TABLE OF ACRONYMS AND ABBREVIATIONS

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. Also known as the Pesticide Contamination Prevention Act.
AR	active registration
BDPA	The Birth Defect Prevention Act of 1984 (SB 950)
Cal/EPA	California Environmental Protection Agency
3CCR	Title 3, California Code of Regulations
CDHS	California Department of Health Services
CUI	currently under investigation
1,2-D	1,2-dichloropropane; propylene dichloride
2,4-D	2,4-dichlorophenoxyacetic acid
DBCP	1,2-dibromo-3-chloropropane
DDD	1,1-Dichloro-2,2-bis(*p*-chlorophenyl) ethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphentytrichloroethane
DPR	Department of Pesticide Regulation
DRASTIC	model used to predict areas vulnerable to ground water contamination
DWR	California Department of Water Resources
EDB	ethylene dibromide
EHAP	Environmental Hazards Assessment Program (Part of DPR)
ELISA	enzyme-linked immunosorbent assay

EMPM	Environmental Monitoring and Pest Management Branch
ETo	reference evapotranspiration
FAC	Food and Agricultural Code
GC	gas chromatography
GWPA	ground water protection advisory
GWPL	Groundwater Protection List
HAL	health advisory level
MCL	maximum contaminant level
MDL	minimum detection limit
MRR	minimum reporting requirement
MTP	monomethyl 2,3,5,6-tetrachloroterephthalate
ND	not detected
NR	not registered as a pesticidal active ingredient in California
PCA	pest control advisor
PCPA	Pesticide Contamination Prevention Act of 1985 (AB 2021)
PDRP	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
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
U.S. EPA	U. S. Environmental Protection Agency
USGS	U. S. Geological Survey

I. WELL INVENTORY DATABASE

I. WELL INVENTORY DATABASE

INTRODUCTION

This report presents information about California water wells that were sampled for the presence of pesticide residues. The sampling results were compiled from July 1, 1994 through June 30, 1995 by the Department of Pesticide Regulation (DPR, a department within the California Environmental Protection Agency [Cal/EPA]). 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 (RWQCBs), to prevent pesticides from entering ground water (Sections II and IV). Also included in this report is a discussion of factors contributing to the movement of pesticides to ground water as a result of legal agricultural use (Section III).

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 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 database in order to archive 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 database were described in the report *Agricultural Pesticide Residues in California Well Water: Development and Summary of a Well Inventory Database for Non-Point Sources* (Cardozo *et al.*, 1985).

On January 1, 1986, the Pesticide Contamination Prevention Act (PCPA, see Appendix A), added sections 13141 through 13152 to Division 7 of the Food and Agricultural Code (FAC). The PCPA requires DPR to maintain a statewide database of wells sampled for pesticide active ingredients (FAC section 13152[c]) and to report annually to the

Legislature, the SWRCB, the California Department of Health Services (CDHS), and Cal/EPA's Office of Environmental Health Hazard Assessment, specific information from the database, 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 report pursuant to the PCPA, *Sampling for Pesticide Residues in California Well Water: 1986 Well Inventory Database* (Brown, *et al.*, 1986), presented data from the original database, plus 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 wells with pesticide detections are attributed to non-point sources.

The well inventory is a unique archive of ground water sampling data for a single state. Although databases 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 repository on an ongoing basis.

This report is the tenth report and the third update of the report, *Sampling for Pesticide Residues in California Well Water: 1992 Well Inventory Data Base, Cumulative Report 1986-1992* (Maes, *et al.*, 1992). Each update discussed well sampling data submitted to DPR by other agencies for inclusion in the well inventory database for the report year, as well as the results of DPR investigations of detections of pesticides currently registered for agricultural use.

The data included in the well inventory for the 1995 report are not the results of a single study. Rather, they are the result of 49 separate monitoring surveys, designed and conducted by three agencies for various purposes, and do not represent a comprehensive study of ground water contamination in the state by agricultural-use pesticides. The data indicate only which pesticides are present in California well water in areas where samples were taken. The data do not represent a statewide investigation for pesticides based on use.

This report is organized into several sections. Section I contains a summary of database by total wells sampled and verified detections, the status of detected pesticides, and a summary of database by positive, unverified samples. Section II describes the actions taken by DPR to prevent pesticides from entering ground water. Section III describes factors contributing to pesticide movement to ground water as a result of agricultural use. Section IV contains a summary of actions taken by the SWRCB and the RWQCBs to prevent pesticides from

migrating to ground water. Included in the appendices are the Pesticide Contamination Prevention Act and Memorandum of Understanding between DPR and the SWRCB (Appendix A), a glossary of terms used (Appendix B), a summary of studies included in this report referenced by study number (Appendix C), a summary of sampling results by county and pesticide (Appendix D), criteria for verification of samples (Appendix E), and a description of the materials and methods and the format of database records (Appendix F).

CONTENTS OF THE WELL INVENTORY DATABASE

Format for Reporting Results

The 1992 cumulative report was a comprehensive summary of all sampling results added to the database since its inception in November 1983, and the first report to discuss the 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, precise and comprehensive criteria were established for verifying detections of pesticide residues in ground water (Biermann, 1989) as specified by the PCPA (FAC section 13149[3][d]). Since then, only wells with verified detections of pesticide residues are subject to DPR regulatory action. Accordingly, detections are summarized in this section by (1) total number of wells sampled and total number of wells with verified detections and (2) total number of positive, unverified samples. A yearly summary of all well sampling results included in the well inventory is given in Table I-1.

Criteria for Classifying Records Added to the Well Inventory Database

Each record in the well inventory database represents a well water sample analyzed for a pesticide residue. Each record was classified according to those analytical results as follows:

(1) Well water samples in which pesticide residues were not detected based on the minimum detection limit (MDL) of the method used for analysis were designated as ***negative***.

(2) Samples in which pesticide residues were detected at or above the MDL were classified into one of 3 categories:

(a) ***unconfirmed***: Pesticide residues were detected in only one 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 only a single sample was taken from the well or analyses of all other samples taken from the well during the survey were negative for the compound under investigation.

(b) ***confirmed, unverified***: Pesticide residues were detected in two discrete samples taken from a single well during the time period of a single monitoring survey. A confirmed detection is unverified unless it meets the criteria of a verified detection.

(c) ***verified:*** 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 by a second analytical method or a second analytical laboratory approved by DPR. Criteria have been set by DPR (Biermann, 1989; see Appendix E) for determining whether the detection of a pesticide or its breakdown product(s) in ground water meets 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.

SUMMARY OF 1995 DATABASE BY TOTAL WELLS SAMPLED AND VERIFIED DETECTIONS

RESULTS BY REPORTING AGENCY

Sampling Distribution

The results from 49 well sampling surveys were added to the well inventory database from July 1, 1994 through June 30, 1995. The surveys were conducted from 1993 through 1995. The data represent a total of 3,322 wells in 47 counties that were sampled for 166 pesticide active ingredients and breakdown products. A brief summary of the data included in the database, by sampling agency, is shown in Table I-2.

Table I-2. Summary of records added to the Department of Pesticide Regulation's well inventory database, by reporting agency, for the reporting period July 1, 1994 through June 30, 1995.

Sampling Agency	Wells Sampled	Counties Sampled	Chemicals Analyzed	Positive Detections	Records Added to Database
DPR	615	30	44	1096 [(b)]	9736
CDHS	2713	40	139	1358	79532
DWR[(a)]	34	2	87	2	3968

(a) Department of Water Resources

(b) 962 of DPR's 1096 positive detections were verified.

Some wells were sampled by more than one agency. A summary of each study is presented in Appendix C.

Of the 3,322 wells sampled, 2,747 (83%) were public drinking water wells, 481 (14%) were private drinking water wells, 62 (2%) were non-drinking water wells, and the use of 32 (1%) wells was unknown.

Type of Wells with Verified Detections

Verified detections were made in a total of 213 wells. Of those, 174 (82%) were private drinking water wells, 18 (8%) were public drinking water wells, and 21 (10%) were non-drinking water wells.

RESULTS BY PESTICIDE

Sampling Distribution

Sampling results for 166 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 I-3.

The sampling frequency varied among the pesticides. For example, the most frequently sampled pesticides, atrazine and simazine, were each analyzed for in over 2,200 wells. Additionally, 29 chemicals were each sampled for in 1000-2000 wells; 23 chemicals in 500-999 wells; and 113 chemicals in less than 500 wells.

Pesticides with First-time, Verified Detections

Hexazinone residues were detected and verified in California groundwater for the first time in Solano and Tulare counties.

Wells with Verified Detections

Overall, 9 compounds were found in the 213 wells with verified detections. Two or more compounds were found in 139 wells (65%). Simazine was found most frequently (verified in 142 wells), followed by diuron (126 wells), bromacil (71 wells), deisopropyl-atrazine (60 wells), atrazine (19 wells), prometon (8 wells), hexazinone (5 wells), and deethyl-atrazine and 2,3,5,6-tetrachloroterephthalic acid (TPA) in 2 wells each. A summary of wells with verified detections, by county and pesticide, is given in Table I-4. California counties with verified detections of pesticides in ground water are shown in Figure I-1.

RESULTS BY COUNTY

Sampling Distribution

Sampling results were reported for 47 of California's 58 counties for the 1995 report. A summary, by county, of the pesticides for which analyses were performed (including number of wells with negative, positive, and verified detections, and total number of wells sampled for each compound) appears in Appendix D. A summary, by county, of pesticides analyzed for and number of wells sampled versus number of wells with verified, negative, and unverified detections is given in Table I-5.

The number of pesticides analyzed in each county ranged from 5 (Calaveras and El Dorado) to 117 (Merced). On average, 47 compounds were sampled in the 47 counties (Table I-5).

The number of wells sampled in each county ranged from 1 (Calaveras, Humboldt, Marin, and Napa) to 569 (Los Angeles). Of the 3,322 total wells sampled, over half (1,959) were located in 5 counties: Los Angeles (569 wells), Fresno (486 wells), Tulare (368), San Bernardino (303), and Orange (233). Variations in the number of wells sampled is due primarily to the differences in study design and sampling programs among the sampling agencies.

Counties with Verified Detections

Verified detections were made in 17 counties. The sampling results are summarized in Table I-4 by county and pesticide.

Two EHAP studies accounted for a large portion of the verified detections reported in Fresno and Tulare counties. The first study, using a statistical model to identify areas that are vulnerable to ground water contamination (study 369) took place in Fresno and Tulare counties. There were 74 wells with verified detections (35% of the total 213 wells statewide). In the second study, adjacent section monitoring (study 368), verified detections were made in 69 wells in Tulare County (32% of the total 213 wells statewide). A breakdown of the number of wells with verified detections for these two studies, by county and pesticide is shown in Table I-6.

Counties with First-time, Verified Detections

Hexazinone residues were detected and verified in Solano and Tulare counties. These are the first verified detections of hexazinone in California groundwater.

Verified detections of pesticides previously found in other areas of California were made in the following counties for the first time: atrazine in Contra Costa, San Bernardino, and San Joaquin; bromacil in Contra Costa and Stanislaus; simazine in Contra Costa; and prometon in Colusa, Contra Costa, Los Angeles, and Solano.

Table I-6. Number of wells with verified detections from two studies conducted by EHAP in Fresno and Tulare counties. The first study was to investigate the use of statistical modeling to identify areas that are vulnerable to ground water contamination, the second was adjacent section monitoring. A large portion of the verified detections in these counties were made during these two studies.

	Statistical Model Study		Adjacent Section Monitoring
CHEMICAL	Fresno County Wells	Tulare County Wells	Tulare County Wells
Atrazine	1	1	4
Bromacil	13	5	30
Diuron	26	5	54
Simazine	39	9	50
DIPA	42	15	0
TPA	2	2	0
Prometon	0	0	2
Hexazinone	0	0	2
Wells with verified detections	56 of 68 (82%)	18 of 115 (16%)	69 of 115 (60%)

STATUS OF PESTICIDES AND PESTICIDE BREAKDOWN PRODUCTS WITH VERIFIED DETECTIONS INCLUDED IN THE 1995 UPDATE TO THE DATABASE

The counties and number of wells with verified detections are shown in Table I-4.

Atrazine (Key 1, Figure I-1)
Atrazine is a herbicide. For use reported in 1993, 80% of the total 45,850 pounds applied was accounted for in corn and right-of-way uses (DPR, 1993). Atrazine was reviewed through the Pesticide Detection Response Process (PDRP), including review by a subcommittee of the Pesticide Registration and Evaluation Committee (PREC), pursuant to FAC sections 13149 through 13151. DPR adopted regulations which prohibit the use of pesticides containing atrazine within an atrazine Pesticide Management Zone (PMZ). 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.

Detections of atrazine residues were verified in 19 wells in 8 counties out of 2,208 wells sampled in 42 counties. Concentrations of verified detected residues ranged from 0.05 to 0.7 parts per billion (ppb). The CDHS and U. S. EPA maximum contaminant level (MCL, see glossary) for atrazine is 3 ppb.

Bromacil (Key 2, Figure I-1)
Bromacil is an herbicide. For use reported in 1993, 96% of the total 124,893 pounds used was accounted for in citrus and right-of-way uses (DPR, 1993). Bromacil was reviewed through the PDRP, including review by a subcommittee of the PREC. DPR adopted regulations which prohibit the agricultural, outdoor institutional, or outdoor industrial uses of bromacil in non-crop areas and on right-of-ways within bromacil PMZs. Bromacil was also made a restricted material for which a permit is required for crop uses in a bromacil PMZ. The permit can only be issued if growers submit a ground water protection advisory written by a licensed pest control advisor (PCA) who has completed an approved ground water protection course within the previous two years.

Bromacil residues were verified in 71 wells in 8 counties out of 1,387 wells sampled in 38 counties. Concentrations of verified detections ranged from 0.05 to 23.0 ppb. The U. S. EPA Integrated Risk Information Reference dose (IRIS RfD) for bromacil is 91 ppb.

Deethyl-atrazine (Key 3, Figure I-1)
Deethyl-atrazine (DEA) is a metabolite of the pesticide active ingredient atrazine. DEA was verified in 2 wells in Tulare County out of 286 wells sampled in 13 counties. Concentrations of verified detections ranged from 0.11 to 0.48 ppb. MCLs have not been set for DEA, but its toxicity is believed to be similar to that of atrazine.

Deisopropyl-atrazine (Key 4, Figure I-1)
Deisopropyl-atrazine (DIPA) is a metabolite of the pesticide active ingredient atrazine. The structure of DIPA is analogous to the simazine metabolite deethyl-simazine. Therefore DIPA is used to describe the analogous metabolites of atrazine and simazine. DIPA was verified in 60 wells of 287 wells sampled in 13 counties. Concentrations of verified detections ranged from 0.1 to 6.0 ppb. MCLs have not been set for DIPA, but its toxicity is believed to be similar to that of atrazine. In 6 wells, the verified detected concentration of DIPA exceeded the MCL of 3 ppb for atrazine set by CDHS and U. S. EPA. When a detection exceeds the MCL, the well owner, county agricultural commissioner, county health department, county environmental health department, and in the case of a public water system well, the Department of Health Services, are notified.

Diuron (Key 5, Figure I-1)
Diuron is a herbicide. For use reported in 1993, 75% of the total 1,090,684 pounds was applied to citrus, grapes, nut crops, and right-of-ways (DPR, 1993). Diuron was reviewed through the PDRP, including review by a subcommittee of the PREC. DPR adopted regulations that prohibit the agricultural, outdoor institutional, or outdoor industrial uses of diuron in non-crop areas or on right-of-ways within diuron PMZs. Diuron was also made a restricted material for which a permit is required for crop uses in a diuron PMZ. The permit can only be issued if growers submit a ground water protection advisory written by a licensed PCA who has completed an approved ground water protection course within the previous two years.

Diuron residues were verified in 126 wells in 7 counties out of 954 wells sampled in 35 counties. Concentrations of verified detections ranged from 0.05 to 2.9 ppb. The U. S. EPA IRIS RfD for diuron is 10 ppb.

Hexazinone (Key 6, Figure I-1)
Hexazinone is a herbicide. For use reported in 1993, 98% of the total 151,017 pounds was applied to alfalfa, forestland, and right-of-ways (DPR, 1993). Hexazinone has not been reviewed through the PDRP.

Hexazinone residues were verified for the first time in California in 4 wells in Tulare County and 1 well in Solano County out of 616 wells sampled in 31 counties. Concentrations of verified detections ranged from 0.064 to 0.24 ppb. The U. S. EPA IRIS RfD for hexazinone is 230 ppb.

Prometon (Key 7, Figure I-1)
Prometon is a herbicide. For use reported in 1993, 71% of the total 41 pounds was applied for landscape maintenance and right-of-way uses (DPR, 1993). Prometon was reviewed through the PDRP, including review by a subcommittee of the PREC. 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 8 wells in 6 counties out of 668 wells sampled in 32 counties. These were the first verified detections of prometon in Colusa, Contra Costa, Los Angeles, and Solano counties. Concentrations of verified detections ranged from 0.05 to 0.55 ppb. The U. S. EPA IRIS RfD for prometon is 110 ppb.

Simazine (Key 8, Figure I-1)
Simazine is a herbicide. For use reported in 1993, 91% of the total 1,129,947 pounds was applied to grape, citrus, fruit and nut crops, and right-of-ways (DPR, 1993). Simazine was reviewed through the PDRP, including review by a subcommittee of the PREC. DPR adopted regulations that prohibit the agricultural, outdoor industrial, or outdoor institutional use of pesticides containing simazine in non-crop areas or on right-of-ways within simazine PMZs. Simazine was also made a restricted material for which a permit is required for crop uses in a simazine PMZ. A permit can only be issued if growers submit a ground water protection advisory written by a licensed PCA who has completed an approved ground water protection course within the previous two years.

Simazine residues were verified in 142 wells in 9 counties out of 2,203 wells sampled in 42 counties. This was the first verified detection of simazine in Contra Costa County. Concentrations of verified detections ranged from 0.05 to 0.86 ppb. Both the CDHS and U. S. EPA MCL for simazine is 4 ppb.

2,3,5,6-tetrachloroterephthalic acid (TPA) (Key 9, Figure I-1)
TPA is a breakdown product of the herbicide chlorthal-dimethyl. The most common use for chlorthal-dimethyl in California is for preemergence weed control in broccoli and onions. This use accounted for 74% of the total 660,448 pounds of chlorthal-dimethyl use reported in 1993 (DPR, 1993). Verified detections were made in 2 wells in Fresno County, and the concentrations ranged from 0.11 to 6.88 ppb. Although no MCL has been set for TPA, the U. S. EPA IRIS RfD for its parent compound chlorthal-diimethyl is 3500 ppb.

SUMMARY OF DATABASE BY POSITIVE, UNVERIFIED SAMPLES

Positive, unverified samples are reviewed or investigated in one of two ways. If the detected compound is not registered for agricultural use in California, follow-up sampling is not conducted by DPR and the detection is referred to the SWRCB. Compounds registered for agricultural use in California are investigated by DPR. The study to investigate the initial detection may lead to other verified detections, or all subsequent samples may be negative for pesticide residues. Negative follow-up samples may result from delays (sometimes years) in reporting the initial detection to DPR.

A summary of the status of all positive samples (verified and unverified) added to the database for this report is given in Table I-7. Of the 93,236 records added to the well inventory for this report, there were 1,494 (1.6%) positive, unverified detections, taken from 491 wells in 27 counties for a total of 27 pesticide active ingredients or breakdown products. Nine compounds with unverified detections also had verified detections.

Of the 1,494 unverified samples, 1,338 (89%) were for chemicals currently not registered or not registered for agricultural use. The chemicals were 1,2-D, DBCP, EDB, coumaphos, demeton, merphos, naphthalene, *ortho*-dichlorobenzene, and xylene. These detections have been reported to the SWRCB. Detections of the following are referred to the SWRCB: pesticides that are not currently registered for use, pesticides registered for other than agricultural, outdoor industrial, or outdoor institutional uses, and pesticides in ground water which are determined not to be the result of legal agricultural use. The SWRCB and nine RWQCBs are responsible for protecting the beneficial uses of water in California and for controlling all discharges of waste into waters of the State.

Reported unverified detections of 8 compounds, which are registered for agricultural use, were investigated by DPR: 2,4-D, aldicarb, aldicarb sulfoxide (a breakdown product of aldicarb), bentazon, carbaryl, glyphosate, naled, propoxur, and tetrachlorovinphos. The results of these investigations are described in Table I-7.

Detections of the pesticide metabolites or breakdown products DEA, DIPA, and TPA accounted for 91 (6%) of all unverified detections. Often, these results are reported by the analytical laboratory but were not specifically requested by the sampling agency. In these cases, verification analyses were not performed. The remaining 4% of unverified samples were due to other reasons, including detection by the first laboratory at a concentration at or below the MDL of the verifying laboratory.

INTERPRETING THE DATA

The information contained in the well inventory database can be used to:

1. Display the geographic distribution of well sampling.
2. Display the geographic distribution of pesticide residues in sampled wells.
3. Identify areas potentially sensitive to contamination by legal, agricultural applications of pesticides.
4. Design studies for future sampling.

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

1. The data indicate which pesticides are present in well water among those pesticides for which analyses were performed. They do not represent a complete survey of ground water quality throughout the state nor do they represent sampling for all pesticides used.

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

This report discusses data submitted to DPR from July 1, 1994 to June 30, 1995. The data are results of 49 studies, designed and conducted by three agencies for varying purposes.

SUMMARY

From July 1, 1994 through June 30, 1995, results were reported for 3,322 wells, located in 47 counties, that were sampled for an overall total of 166 pesticide active ingredients or breakdown products. The data represent 49 well sampling surveys conducted by three agencies from 1993 through 1995.

Of the 166 compounds, 27 pesticide active ingredients or breakdown products were reported detected in 552 wells in 28 counties. Verified detections were made of 9 compounds in 213 wells in 17 counties. Two or more compounds were found in 139 of the 213 wells (65%). Of the 213 wells with verified detections, 174 (82%) were private drinking water wells, 18 (8%) were public drinking water wells, and 21 (10%) were non-drinking water wells.

Of the 9 compounds with verified detections, simazine was found most frequently (verified in 142 wells), followed by diuron (126 wells), bromacil (71 wells), deisopropyl-atrazine (60 wells), atrazine (19 wells), prometon (8 wells), hexazinone (5 wells), deethyl-atrazine (2 wells), and TPA (2 wells).

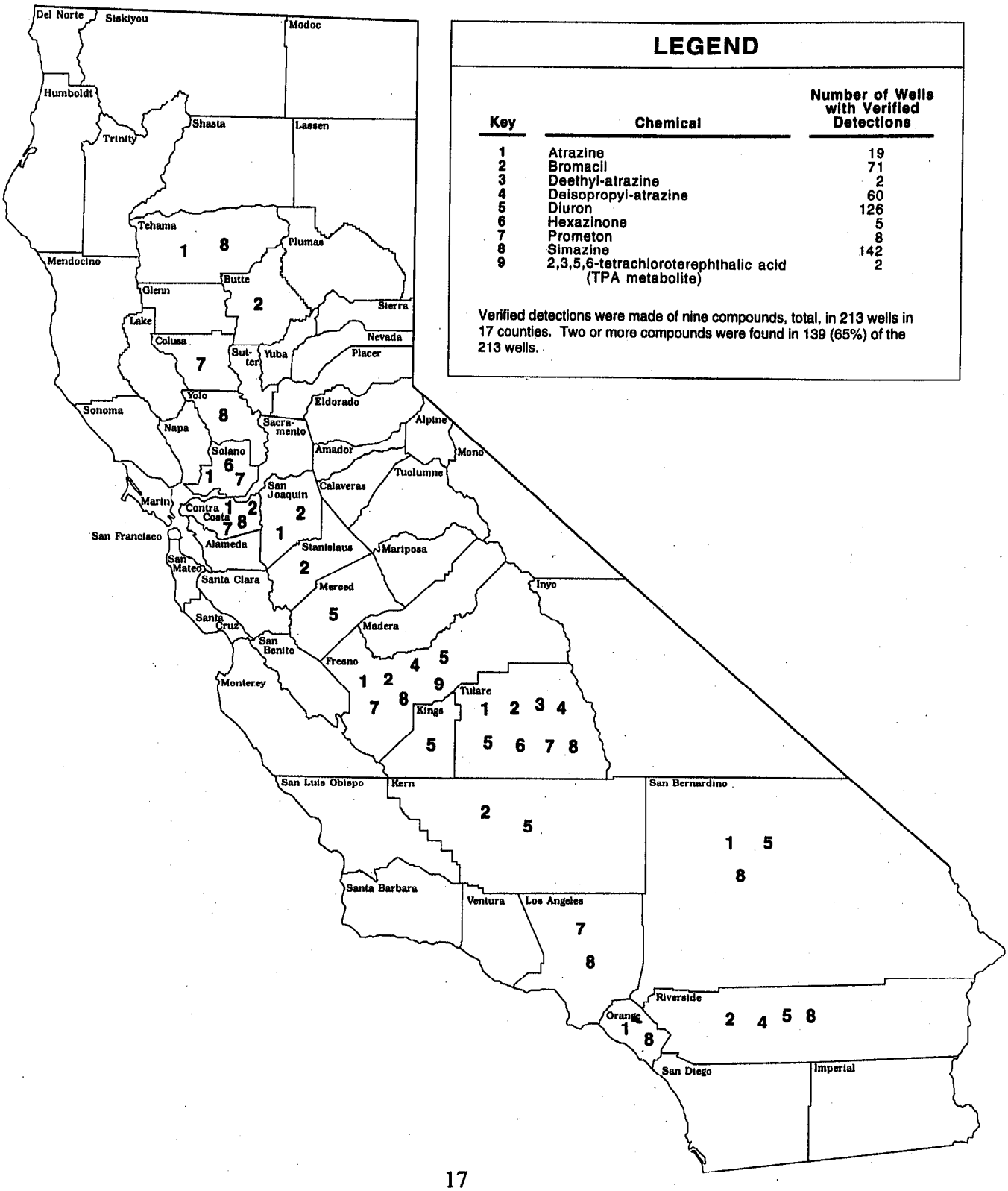
For the first time, verified detections of the herbicide hexazinone were made in California in Solano and Tulare counties. Verified detections of pesticides previously found in other areas of California were made in the following counties for the first time: atrazine in Contra Costa, San Bernardino, and San Joaquin; bromacil in Contra Costa and Stanislaus; prometon in Colusa, Contra Costa, Los Angeles, and Solano; and simazine in Contra Costa.

Table I-1. Summary of well sampling results included in the Department of Pesticide Regulation's (DPR) well inventory data base, by report year, for data reported through June 30, 1995.

CATEGORY	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	TOTAL[d]
Total **wells** sampled	8987	574	3074	752	2784	1557	4741	2324	2839	3322	19725
no detections	6583	317	2791	543	2550	1351	3985	1945	2414	2769	15547
detections [a]	2404	257	283	209	234	206	756	379	425	552	4178
verified detections [b]	44	29	4	140	93	133	67	80	37	213[e]	789
Total **counties** sampled	53	20	41	33	53	30	52	46	50	47	58
no detections	30	6	24	11	27	11	24	25	30	19	14
detections [a]	23	14	17	22	26	19	28	21	20	28	44
verified detections [b]	5	3	3	16	8	14	9	17	10	17	31
Total **pesticides and related compounds** analyzed	160	79	167	96	191	186	125	112	114	166	291
no detections	144	64	142	81	164	166	85	83	95	139	202
detections [a]	16	15	25	15	27	20	40	29	19	27	89
verified detections [b]	8	6	5	9	6	9	5	10	6	9	22
Pesticides and related compounds detected in ground water as the result of legal, agricultural use [c]	9	8	1	7	6	7	5	11	8[f]	9[g]	15 [h]

(a) Includes verified and unverified detections.
(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 DPR 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 DPR.
(c) Legal, agricultural use is the application of a pesticide, according to its labelled directions and in accordance with all laws and regulations. Agricultural use is defined in Food and Agricultural code Section 11408.
(d) The total is not additive. A single well that had sampling data reported in the 1986, 1988, and 1990 reports is counted one time only.
(e) The large increase in verified detections from previous years is due, primarily, to two studies conducted by DPR in Fresno and Tulare counties.
(f) The 1994 Update to the Well Inventory Data Base was incorrect. There were 8 compounds detected in ground water as the result of legal, agricultural use: 1,2-dichloropropane (1,2-D), 1,2-dibromo-3-chloropropane (DBCP), atrazine, bromacil, diuron, ethylene dibromide (EDB), prometon, and simazine.
(g) The 9 compounds are: 1,2-D, atrazine, bromacil, DBCP, deethyl-atrazine, diuron, EDB, prometon, and simazine.
(h) The 15 compounds are: 1,2-D, aldicarb, aldicarb sulfone, aldicarb sulfoxide, atrazine, bentazon, bromacil, DBCP, deethyl-atrazine, deisopropyl-atrazine, diuron, EDB, prometon, simazine, and 2,3,5,6-tetrachloroterephthalic acid. Aldicarb, atrazine, bentazon, bromacil, diuron, prometon, and simazine have been reviewed through the Pesticide Detection Response Process. DPR considers the remaining chemicals to have reached ground water as a result of legal, agricultural use.

Figure I-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, 1994 through June 30, 1995.



LEGEND

Key	Chemical	Number of Wells with Verified Detections
1	Atrazine	19
2	Bromacil	71
3	Deethyl-atrazine	2
4	Deisopropyl-atrazine	60
5	Diuron	126
6	Hexazinone	5
7	Prometon	8
8	Simazine	142
9	2,3,5,6-tetrachloroterephthalic acid (TPA metabolite)	2

Verified detections were made of nine compounds, total, in 213 wells in 17 counties. Two or more compounds were found in 139 (65%) of the 213 wells.

Table I-3. Pesticide active ingredients and breakdown products with analytical results added to the well inventory data base for the 1995 report year, by total number of counties and wells sampled and number of wells with verified and unverified detections. Most wells are sampled for more than one compound. Results are for data reported from July 1, 1994 through June 30, 1995.

CHEMICAL	Number of Counties Sampled	Number of Wells Sampled	Wells with Unverified Detections	Wells with Verified Detections
1,1,2,2-tetrachloroethane	36	1357		
1,2,4-trichlorobenzene	34	1293		
1,2-dichloropropane (propylene dichloride)	38	1396	11	
1,3-dichloropropene (1,3-D)	36	1329		
2,3,7,8-tcdd (dioxin)	11	148		
2,4,5-t	17	101		
2,4,6-trichlorophenol	1	2		
2,4-D	32	1137	1	
2,4-dinitrophenol	1	2		
3-hydroxycarbofuran	22	584		
4(2,4-DB), dimethylamine salt	5	41		
acenapthene	4	201		
acephate	2	34		
alachlor	30	1537		
aldicarb	25	864	1	
aldicarb sulfone	23	780		
aldicarb sulfoxide	23	780	5	
aldrin	28	828		
ametryne	4	7		
aminocarb	3	34		
atraton	5	40		
atrazine	42	2208	11	19
azinphos-ethyl	2	2		
azinphos-methyl	12	68		
barban	3	35		
benefin	3	18		
benomyl	2	34		
bentazon, sodium salt	29	897	1	
bhc (other than gamma isomer)	8	228		
bromacil	38	1387	2	71
butachlor	27	555		
butylate	2	5		
captafol	2	34		
captan	5	52		
carbaryl	26	681	2	
carbofuran	29	1054		
carbon disulfide	1	6		
carbophenothion	4	19		
chloramben	4	9		
chlordane	32	1305		
chlorobenzilate	2	5		
chloroneb	2	5		
chloropicrin	2	34		

Table I-3 continued CHEMICAL	Number of Counties Sampled	Number of Wells Sampled	Wells with Unverified Detections	Wells with Verified Detections
chlorothalonil	27	637		
chlorpropham	7	42		
chlorpyrifos	4	7		
chlorthal-dimethyl	9	231		
coumaphos	4	37	1	
cyanazine	31	615		
cycloate	3	6		
dalapon	26	970		
dbcp	29	1665	304	
dcpa acid metabolites	2	30		
ddd	8	228		
dde	11	246		
ddt	8	228		
ddvp	7	46		
deethyl-atrazine	13	286	10	2
deisopropyl-atrazine	13	287	78	60
demeton	12	79	1	
diazinon	35	871		
dicamba	23	452		
dichlorprop, butoxyethanol ester	5	34		
dicofol	3	18		
dieldrin	28	816		
dimethoate	31	806		
dinoseb	27	1037		
diphenamid	5	40		
diquat dibromide	22	694		
disulfoton	13	82		
diuron	35	954	8	126
dmpa	3	16		
endosulfan	10	262		
endosulfan II	2	34		
endosulfan sulfate	10	261		
endothall	24	612		
endrin	33	1314		
endrin aldehyde	10	263		
epn	1	1		
eptc	4	7		
ethion	3	35		
ethoprop	3	37		
ethyl parathion	7	232		
ethylene dibromide	29	1607	15	
fenamiphos	6	41		
fensulfothion	4	37		
fenthion	3	35		
fenuron	3	35		
fluometuron	3	34		
fonofos	8	28		
glyphosate, isopropylamine salt	22	709	1	
heptachlor	32	1310		
heptachlor epoxide	32	1322		
hexachlorobenzene	26	1127		

Table I-3 continued CHEMICAL	Number of Counties Sampled	Number of Wells Sampled	Wells with Unverified Detections	Wells with Verified Detections
hexazinone	31	616	3	5
lindane (gamma-bhc)	32	1304		
linuron	3	35		
malathion	6	235		
maneb	2	33		
mcpa, dimethylamine salt	1	1		
mcpp	1	1		
merphos	4	7	1	
metam-sodium	2	33		
methidathion	1	3		
methiocarb	21	223		
methiocarb sulfone	1	3		
methiocarb sulfoxide	1	3		
methomyl	25	656		
methoxychlor	31	1275		
methyl bromide	35	1343		
methyl parathion	6	232		
metolachlor	29	542		
metribuzin	36	806		
mevinphos	9	58		
mexacarbate	3	34		
molinate	29	1252		
monuron	3	35		
monuron-tca	2	34		
mtp (monomethyl 2,3,5,6-tetrachloroterephthalate)	2	178		
naled	4	37	1	
naphthalene	34	1336	3	
napropamide	5	8		
neburon	3	35		
nitrofen	3	18		
ortho-dichlorobenzene	35	1344	2	
oxamyl	26	1003		
paraquat bis(methylsulfate)	10	89		
paraquat dichloride	12	123		
parathion	7	232		
pcnb	3	18		
pendimethalin	1	2		
permethrin	2	5		
permethrin, other related	2	5		
phorate	5	38		
phosalone	1	3		
phosmet	1	3		
picloram	25	1021		
prometon	32	668	3	8
prometryn	39	1415		
propachlor	25	489		
propazine	7	45		
propham	3	35		
propoxur	20	228	1	
prothiofos	2	34		
ronnel	4	37		

Table I-3 continued CHEMICAL	Number of Counties Sampled	Number of Wells Sampled	Wells with Unverified Detections	Wells with Verified Detections
secbumeton	3	35		
siduron	3	35		
silvex	31	1121		
simazine	42	2203	17	142
simetryn	9	60		
sulprofos	2	34		
swep	3	35		
tebuthiuron	3	6		
terbuthylazine	2	34		
terbutryn	9	60		
tetrachlorvinphos	5	42	1	
tetradifon	1	1		
thiobencarb	27	1213		
thiram	1	7		
toxaphene	33	1304		
tpa (2,3,5,6-tetrachloroterephthalic acid)	2	178	1	2
triadimefon	4	7		
trichloronate	2	34		
trifluralin	2	5		
vernolate	4	7		
xylene	35	1390	6	
ziram	2	33		
Total	47	3322	439	213

Table I-4. Summary of wells with verified detections of pesticide residues, by county and chemical. Results are for data reported from July 1, 1994 through June 30, 1995.

County	atrazine	bromacil	deethyl-atrazine	deisopropyl-atrazine	diuron	hexazinone	prometon	simazine	TPA	Total
Butte		1								1
Colusa							1[a]			1
Contra Costa	1[a]	1[a]					1[a]	1[a]		2
Fresno	2	19		43	32		1	48	2	68
Kern		1			3					3
Kings					1					1
Los Angeles							2[a]	2		2
Merced					2					2
Orange	4							4		5
Riverside		2		2	2			3		3
San Bernadino	1[a]				2			3		3
San Joaquin	1[a]	1								1
Solano	1					1[b]	1[a]			1
Stanislaus		1[a]								1
Tehama	2							1		3
Tulare	7	45	2	15	84	4[b]	2	79		115
Yolo								1		1
Total	19	71	2	60	126	5	8	142	2	213

(a) First time verified detection of this chemical in this county
(b) These are the first verified detections of hexazinone in California.

Table I-5. Summary, by county, of total number of pesticides sampled for, and total number of wells sampled versus number of wells with unverified, verified, and negative detections. Wells may have both unverified and verified detections. Results are for data reported from July 1, 1994 through June 30, 1995.

County	Total Pesticides Sampled	Total Wells Sampled	Wells with Unverified Detections	Wells with Verified Detections	Wells with No Detections
Alameda	63	33			33
Butte	19	16		1	15
Calaveras	5	1			1
Colusa	16	11		1	10
Contra Costa	61	10	2	2	8
Del Norte	87	16	2		14
El Dorado	5	6			6
Fresno	71	486	134	68	302
Glenn	9	4			4
Humboldt	10	1			1
Imperial	10	5	1		4
Inyo	22	6			6
Kern	81	169	21	3	145
Kings	63	16	1	1	15
Lake	19	7			7
Los Angeles	57	569	12	2	555
Madera	63	16	1		15
Marin	8	1			1
Mariposa	43	28			28
Mendocino	21	7			7
Merced	117	45	14	2	30
Monterey	71	57	2		55
Napa	8	1			1
Orange	71	233	1	5	228
Placer	6	3			3
Riverside	58	132	16	3	114
Sacramento	36	51			51
San Benito	10	4			4
San Bernardino	72	303	49	3	253
San Diego	51	23	1		22
San Joaquin	63	102	28	1	74
San Luis Obispo	60	67	1		66
San Mateo	46	34	2		32
Santa Barbara	95	30	1		29
Santa Clara	64	105	1		104
Santa Cruz	44	24	1		23
Siskiyou	85	18			18
Solano	79	20	2	1	18
Sonoma	39	40			40
Stanislaus	67	123	40	1	82
Sutter	19	6			6
Tehama	12	12	1	3	9
Tulare	98	368	103	115	218
Tuolumne	50	32			32
Ventura	91	54	1		53
Yolo	10	16	1	1	15
Yuba	66	10			10
Total	166	3322	439	213	2770

Table I-7. Status, as of June 30, 1995, 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 database during the period July 1, 1994 through June 30, 1995.

Compound Detected Registration Status Type of Compound	Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (ppb)[a]	Comments
1,2-dichloropropane (1,2-D or propylene dichloride) Not registered for use in California (NR) fumigant	38 counties 1396 wells	Del Norte, 2 Fresno, 2 Kern, 2 Riverside, 3 San Joaquin, 1 San Mateo, 1	0.5 - 6.1	DHS & USEPA MCL 5	Source of residues was determined by DPR to be due to historical non-point source, legal 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. Referred to SWRCB.
2,4-D herbicide Active registration for use in California (AR)	32 counties 1137 wells	Santa Clara, 1	0.3	DHS & USEPA MCL 7	No 2,4-D residues were detected in follow up sampling conducted by DRP. Removed from PDRP.
aldicarb AR insecticide	25 counties 864 wells	Solano, 1	7.2	USEPA MCL 7 (b)	No aldicarb residues were detected in the original and 5 other wells during follow up sampling conducted by DPR. Removed from PDRP.
aldicarb sulfoxide breakdown product of aldicarb	23 counties 780 wells	Contra Costa, 1 Merced, 4	0.5 - 23	USEPA MCL 7 (b)	No aldicarb sulfoxide residues were detected during follow up sampling conducted by DPR in both Contra Costa and Merced counties. Both detections were removed from the PDRP.

(a): Marshack, J.B. A Compilaton of Water Quality Goals. and personal communication. Definitions of the various Water Quality Criteria are given below.
(b) Provisional value. The final value for the USEPA MCL is 7.0 ppb and the effective date has been postponed.

DHS MCL: Maximum Contaminant Level (MCL) adopted by DHS under the Safe Drinking Water Act. MCLs are formally established in regulation and are enforceable by DHS on water suppliers.

USEPA IRIS RfD: USEPA Integrated Risk Information System (IRIS) Reference Dose (RfD): health advisories published by USEPA's Office of Water. Does not consider cancer risk.

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

Table I-7 continued

Compound Detected Registration Status Type of Compound	Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (ppb)[a]	Comments
atrazine AR herbicide	42 counties 2208 wells	Contra Costa, 1 Fresno, 3 Merced, 1 Monterey, 2 Orange, 4 San Bernardino, 1 San Joaquin, 1 Solano, 1 Tehama, 2 Tulare, 12 Yolo, 1	0.05 - 0.7	DHS & USEPA MCL 3	Source of residues in the number of wells in the following counties was determined by DPR to be due to non-point source legal agricultural use: Fresno 1, Merced 1, Orange 4, Tehama 2, Tulare 6. Detections that are currently under investigation (CUI) by DPR are: Contra Costa 1, Fresno 2, Monterey 2, San Joaquin 1, Tulare 1. No further action was taken on detections in wells in the following counties because either no additional wells were available for sampling or the reported residues were not found during follow up sampling conducted by DPR: San Bernardino 1, Solano 1, Tulare 6, Yolo 1.
bentazon, sodium salt AR herbicide	29 counties 897 wells	Ventura, 1	2.0	DHS MCL 18	No bentazon residues were detected in the original and 5 other wells during follow up sampling conducted by DPR. Removed from the PDRP.
bromacil AR herbicide	38 counties 1387 wells	Butte, 1 Contra Costa, 1 Fresno, 20 Kern, 1 Orange, 1 Riverside, 2 San Joaquin, 1 Stanislaus, 1 Tulare, 45	0.05 - 23	USEPA IRIS RfD 91	Source of residues in the number of wells in the following counties was determined by DPR to be due to non-point source legal agricultural use: Fresno 7, Riverside 2, Tulare 39. Detections that are CUI by DPR: Butte 1, Contra Costa 1, Fresno 13, Kern 1, San Joaquin 1, Tulare 6. No further action was taken on detections in wells the following counties because either no additional wells were available for sampling or the reported residues were not found during follow up sampling conducted by DPR: Orange 1, Stanislaus 1.
carbaryl AR insecticide	26 counties 681 wells	Solano, 1 Ventura, 1	10 - 55	USEPA IRIS RfD 700	No carbaryl residues were detected in the original and 5 other wells during follow up sampling conducted by DPR in both Solano and Ventrua counties. Both detections removed from the PDRP.

Table I-7 continued

Compound Detected Registration Status Type of Compound	Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (ppb)[a]	Comments
coumaphos NR insecticide	4 counties 37 wells	Merced, 1	1	none	Use suspended 1/8/83. Referred to SWRCB.
dbcp (1,2-dibrome-3-chloropropane) NR soil fumigant	29 counties 1665 wells	Fresno, 112 Kern, 19 Los Angeles, 8 Madera, 1 Merced, 9 Riverside, 9 San Bernardino, 47 San Joaquin, 26 Stanislaus, 40 Tulare, 33	0.01 - 3.9	DHS & USEPA MCL 0.2	Use suspended in 1979. Source of residues considered by DPR to be from historical non-point source, legal agricultural use. Referred to SWRCB
deethyl-atrazine (DEA) breakdown of atrazine	13 counties 286 wells	Contra Costa, 2 Fresno, 3 San Bernardino, 1 San Joaquin, 1 Solano, 1 Tulare, 4	0.052 - 0.48	none atrazine DHS MCL 3	Detections that are CUI by DPR: Contra Costa 2, Fresno 3, Tulare 2. No further action was taken on detections in wells in the following counties because either no additional wells were available for sampling or the reported residues were not found during follow up sampling conducted by DPR: San Bernardino 1, San Joaquin 1, Solano 1, Tulare 2
deisopropyl-atrazine (DIPA) breakdown of atrazine	13 counties 287 wells	Contra Costa, 1 Fresno, 57 Riverside, 3 San Bernardino, 2 Tulare, 75	0.05 - 6	none atrazine DHS MCL 3	Source of residues in the number of wells in the following counties was determined by DPR to be due to non-point source legal agricultural use: Riverside 3, Tulare 3. Detections that are CUI by DPR are: Contra Costa 1, Fresno 53, Tulare 17. No further action was taken on detections in wells in the following counties because either no additional wells were available for sampling or the reported residues were not found during follow up sampling conducted by DPR: Fresno 4, San Bernardino 2, Tulare 55.

Table I-7 continued

Compound Detected Registration Status Type of Compound	Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (ppb)[a]	Comments
demeton NR insecticide (acaricide)	12 counties 79 wells	Merced, 1	1	none	Not registered since 2/87. Referred to SWRCB
diuron AR herbicide	35 counties 954 wells	Fresno, 34 Kern, 3 Kings, 1 Merced, 2 Riverside, 2 San Bernardino, 2 Tulare, 89	0.05 - 2.9	USEPA IRIS RfD 14	Source of residues in the number of wells in the following counties was determined by DPR to be due to non-point source legal agricultural use: Fresno 6, Merced 2, Riverside 2, San Bernardino 1, Tulare 74. Detections that are CUI by DPR: Fresno 26, Kern 2, Tulare 2. No further action was taken on detections in wells the following counties because either no additional wells were available for sampling or the reported residues were not found during follow up sampling conducted by DPR: Fresno 2, Kern 1, Kings 1, San Bernardino 1, Tulare 7.
ethylene dibromide (EDB) NR fumigant insecticide nematicide	29 counties 1607 wells	Fresno, 5 Kern, 4 Los Angeles, 1 Merced, 1 Riverside, 3 Tulare, 1	0.01 - 0.11	DHS & USEPA MCL 0.05	Not registered for use since 1/87. Referred to SWRCB.
glyphosate, isopropylamine salt AR herbicide	22 counties 709 wells	Santa Barbara, 1	20	DHS & USEPA MCL 700	CUI by DPR.
hexazinone AR herbicide	31 counties 616 wells	Inperial, 1 San Joaquin, 1 Solano, 1 Tulare, 4	0.051 - 0.55	USEPA IRIS RfD 230	Detection of residues in 1 well in San Joaquin County is CUI by DPR. No further action was taken on detections in 1 well each in Imperial and Solano counties because either no additional wells were available for sampling or the reported residues were not found during follow up sampling conducted by DPR. Detections in 4 wells in Tulare Co. were determined to be due to a possible point source contamination from the Teapot Dome Landfill.

Table I-7 continued

Compound Detected Registration Status Type of Compound	Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (ppb)[a]	Comments
merphos (tribuphos) NR cotton defoliant	4 counties 7 wells	Merced, 1	1	USEPA IRIS RfD 0.21	NR since 2/88. Referred to SWRCB.
naled AR insecticide (nematicide)	4 counties 37 wells	Merced, 1	5	none	No naled residues were detected during follow up sampling onducted by DPR. Removed from the PDRP.
naphthalene NR insecticide fumigant	34 counties 1336 wells	Merced, 2	2 - 66	USEPA IRIS RfD 28	NR for agricultural use. Refered to SWRCB.
ortho-dichlorobenzene NR herbicide insecticide soil fumigant	35 counties 1344 wells	Santa Cruz, 1	0.8 - 1.6	DHS & USEPA MCL 600	Not registered for use since 1/85. Referred to SWRCB
prometon AR herbicide	32 counties 668 wells	Colusa, 1 Contra Costa, 2 Fresno, 1 Kings, 1 Los Angeles, 3 Solano, 1 Tulare, 2	0.05 - 0.55	USEPA IRIS RfD 110	Source of residues in the number of wells in the following counties was determined by DPR to be due to non-point source legal agricultural use: Fresno 1, Los Angeles 3, Tulare 2. Detections that are CUI by DPR are: Colusa 1, Contra Costa 2. No further action was taken on detections in wells the following counties because either no additional wells were available for sampling or the reported residues were not found during follow up sampling conducted by DPR: Kings 1, Solano 1.

Table I-7 continued

Compound Detected Registration Status Type of Compound	Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (ppb)[a]	Comments
propoxur AR insecticide	20 counties 228 wells	Solano, 1	4	USEPA IRIS RfD 2.8	No propoxur residues were detected in the original or 5 other wells during follow up sampling conducted by DPR. Removed from the PDRP.
simazine AR herbicide	42 counties 2203 wells	Contra Costa, 1 Fresno, 53 Los Angeles, 3 Merced, 3 Orange, 4 Riverside, 3 San Bernardino, 3 Tehama, 2 Tulare, 86 Yolo, 1	0.05 - 1	DHS & USEPA MCL 4.0	Source of residues in the number of wells in the following counties was determined by DPR to be due to non-point source legal agricultural use: Fresno 3, Los Angeles 2, Orange 1, Riverside 3, San Bernardino 1, Tehama 1, Tulare 67, Yolo 1. Detections that are CUI by DPR: Contra Costa 1, Fresno 41, Los Angeles 1, Tulare 13. No further action was taken on detections in wells in the following counties because either no additional wells were available for sampling or the reported residues were not found during follow up sampling conducted by DPR: Fresno 1, Merced 3, Orange 3, San Bernardino 2, Tehama 1, Tulare 6.
tetrachlorvinphos AR insecticide	5 counties 42 wells	Merced, 1	1	none	No tetrachlorvinphos residues were found in follow up sampling conducted by DPR. Removed frm PDRP.
TPA (2,3,5,6-tetrachloro-terephthalic acid) breakdown of chlorthal dimethyl	2 counties 178 wells	Fresno, 3	0.1 - 6.88	Dacthal USEPA IRIS RfD 3500	2 wells verified, 1 well unverified. At the levels detected in ground water, TPA does not pose a threat to public heatlh and TPA will not be submitted into the PDRP.
xylene NR solvent	35 counties 1390 wells	Los Angeles, 1 Riverside, 1 San Diego, 1 San Luis Obispo, 1 San Mateo, 1 Santa Cruz, 1	0.5 - 669	DHS MCL 1750	There are no pesticides currently registered in California that contain xylene as an active ingredient. Referred to SWRCB.

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

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ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM

The Environmental Monitoring and Pest Management Branch's Environmental Hazards Assessment Program (EHAP) performs the lead role for implementing DPR's environmental protection programs. EHAP personnel design and conduct field studies of air, soil, surface, and ground water to determine the environmental fate of pesticides and conduct monitoring surveys to determine the presence of pesticide residues in ground water. All sampling results reported to DPR with positive pesticide detections are reviewed and either referred to the SWRCB or further investigated by DPR. DPR uses results of these investigations to take actions to prevent pesticide contamination of ground water.

STATE MANAGEMENT PLAN FOR PESTICIDES

The U.S. EPA issued a plan titled *Pesticides and Ground Water Strategy* (U.S. EPA 1991), which outlines its strategy requiring states to prepare State Management Plans (SMPs):

> *"In the event the U.S. 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 U.S. EPA. U.S. 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)

With funding from U.S. EPA, DPR, in coordination with other agencies such as the SWRCB and CDHS, prepared a draft of a generic SMP titled *State of California Management Plan for Pesticides and Ground Water Protection (Generic)* (Stoddard, 1993). In addition, U.S. EPA published and distributed the final federal guidance document in 1994 for preparing generic and chemical-specific SMPs that U.S. EPA is planning to require under future federal regulations.

MANAGEMENT AGENCY AGREEMENT BETWEEN DPR AND SWRCB

In 1991, DPR and the SWRCB signed a memorandum of understanding (MOU) which established principles of agreement regarding activities of both agencies, identified primary areas of responsibility and authority between the agencies, and provided methods necessary to assure ongoing coordination of activities at both the State and local levels. A memorandum providing interim guidance for implementation of the MOU was issued jointly by the Director of DPR and the Executive Director of SWRCB. Both documents are shown in Appendix A.

The federal Clean Water Act identifies a management agency agreement (MAA) as a formal method to coordinate water quality issues among government agencies. An MAA is generally more detailed than an MOU and includes implementation plans. Representatives from DPR and SWRCB formed a workgroup to develop an MAA and implementation plan (California Pesticide Management Plan for Water Quality, or 'pesticide management plan'), which are intended to replace the existing MOU as the functional agreement between DPR and SWRCB in early 1996.

The MAA details the following:

1. Ensures that all pesticides registered in California are used in a manner that protects water quality and the beneficial uses of water while providing effective, environmentally sound pest management.
2. Identifies the roles of both agencies regarding water quality protection and pesticide regulation.
3. Coordinates authorities to solve water quality problems relating to pesticide use by promoting development and use of preventive practices through voluntary, and when necessary, regulatory efforts.
4. Promotes interagency sharing of information relating to the study of pesticides and regulatory efforts.

The pesticide management plan will implement the MAA by describing a comprehensive program for protection of surface and ground water quality. It encompasses the development and use of preventive activities and practices, ranging from voluntary to regulatory, to protect the beneficial uses of the State's waters from the potentially harmful effects of pesticides.

GROUND WATER PROTECTION TRAINING

Ground water protection training for licensed pest control advisors (PCAs) is part of a comprehensive program designed to protect ground water from contamination due to the legal agricultural use of pesticides. Pesticide management zones (PMZs) have been established where the detection of pesticides listed in section (a) of the Groundwater Protection List (FAC section 13145(d), 6800 3CCR) in ground water has been determined to be due to non-point source, legal agricultural use. A PMZ is approximately a one square mile area that has been determined to be vulnerable to ground water pollution. A ground water protection advisory (GWPA) written by a licensed PCA who has attended DPR-sponsored ground water protection training within the last two years must be submitted before a permit can be issued by the county agricultural commissioner for application of a regulated pesticide for crop uses in its PMZ. The GWPA contains specific information for applying a regulated pesticide in a PMZ so as to reduce the potential for movement of the chemical into ground water.

DPR has conducted ground water protection training annually since 1989. The primary objective of the training is to enable PCAs to write site-specific advisories on the appropriate use of certain pesticides to avoid ground water contamination. Information is provided on the extent of pesticide residues in ground water, the sources of pesticide residues, the pathways by which contamination can occur, the factors which influence migration of pesticides to ground water, and measures which can be taken to decrease such movement. These measures include reducing use of leaching pesticides; using proper storage, mixing, loading, rinsing and disposal procedures; and wellhead protection. Since the movement of pesticides to ground water is caused primarily by the dissolution of pesticide residues in water with subsequent movement to ground water aquifers, training places special emphasis on managing irrigation to reduce deep percolation. In February, 1995, three-hour training sessions were held in Visalia, Fresno, Sacramento, and San Bernardino. A guest speaker from the U.S. Department of Agriculture Natural Resources Conservation Service presented information on resource planning to minimize leaching and runoff.

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

Under the provisions of the Pesticide Detection Response Process (PDRP), EHAP responds to all reports of positive detections of pesticides in ground water, from its own sampling program or from well sampling conducted by other state, federal, and local agencies or

non-government entities. EHAP determines if the reported detection could have resulted from a currently registered pesticide, and if the chemical's presence in ground water is due to 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 that are not currently registered for use, pesticides registered for other than agricultural, outdoor industrial, or outdoor institutional uses, and detections of pesticides in ground water which are determined not to be the result of legal agricultural use, are referred to the SWRCB for appropriate action. The SWRCB and nine RWQCBs are responsible for protecting the beneficial uses of water in California and for controlling all discharges of waste into waters of the State.

In order for a detection of a pesticide in ground water to be verified, FAC section 13149(d) of the PCPA requires that the detection of a pesticide or its breakdown products must be by an analytical method approved by DPR and must be verified, within 30 days, by a second analytical method or second analytical laboratory approved by the Department. DPR set criteria (Bierman, 1989; see Appendix E) for meeting these requirements. Verified detections which are determined to be present as the result of legal agricultural use are subject to regulatory action by the Director of DPR. Reported detections not verified in follow-up sampling are removed from the PDRP. When residues of a compound in a registered producted are detected and verified in ground water for the first time, and determined by the Director of DPR to result from legal agricultural use, a special review is begun pursuant to FAC section 13150. The purpose of the review is to determine whether continued registration, sale, and use of the compound will be allowed. A subcommittee of the PREC holds a hearing, evaluates information, and makes recommendations to the Director of DPR who then makes a determination regarding continued use of the compound in California.

As part of the PDRP, EHAP investigates, evaluates, and mitigates detections of pesticides in ground water. The investigation phase includes further inquiry into reported detections and an attempt to verify the original detection. Verification involves conducting a well sampling (four-section) survey where field personnel sample wells in the same section and/or the 3 most adjacent sections to the original detections. Also, a land use survey is conducted in those sections to determine whether there are agricultural and non-agricultural sites where the pesticide could have been applied. It is also determined whether any detections could be due to legal agricultural use or are due to a possible point source contamination.

After well sampling and land use survey results are obtained, the data are evaluated and a determination is made. If the original detection is unverified, it is removed from the PDRP. Verified detections determined to be due to a possible point source are referred to the SWRCB. Verified detections are determined to be due to legal agricultural use if all the following criteria are met:

1. The residue detected (active ingredient, breakdown product, or any other specified ingredient) is from a pesticide that is registered for agricultural use in California.

2. The application of a pesticide in the vicinity of the detection was reasonably likely.

3. A point source was not a likely cause.

4. A non-agricultural use of the pesticide was not a likely source.

5. A non-pesticide source was not a likely cause.

6. The pesticide should be present in another adjacent section or verified within a second site within a ½ mile radius of original determination.

Verified detections determined to be due to legal, agricultural use trigger the process specified in section 13149(b) of the PCPA.

ACTIONS TAKEN BY DPR ON PESTICIDE DETECTIONS

A total of 27 pesticide active ingredients and breakdown products were detected in well water and reported by DPR or by other agencies from July 1, 1994 through June 30, 1995.

EHAP did not conduct investigations for 9 of the 27 detected chemicals because they are no longer registered for use in California (1,2-D, coumaphos, DBCP, EDB, merphos, demeton, *ortho*-dichlorobenzene, xylene) or are not currently registered for agricultural use in California (naphthalene). Those detections were referred to the SWRCB.

EHAP conducted monitoring studies for chemicals that are currently registered for agricultural use in California. These studies are described below in two groups. First, are chemicals that have previously been reviewed through the PDRP and by a PREC subcommittee. Second, are chemicals that may have previously been reported and monitored for, but were removed from the PDRP and have not been reviewed by a PREC subcommittee. For each study, reported detections may not have been verified because (1) residues were not detected in follow-up sampling or (2) the original positive well could not be resampled and no other wells were available for sampling in a four-section area near the well. A more detailed description of each study is given in Appendix C.

Monitoring for Pesticides Previously Reviewed Through the PDRP and by a PREC subcommittee

EHAP completed 31 well monitoring surveys for aldicarb, aldicarb sulfoxide, atrazine, diruon, simazine, prometon, and bentazon in a total of 14 counties (Table II-1). In 10 of studies, no pesticide residues were detected. In 21 studies, verified detections were made, either of the initiating chemical or of a different chemical.

Table II-1. Monitoring studies conducted by the Department of Pesticide Regulation for reported detections of chemicals that have previously been reviewed through the Pesticide Detection Response Process and by the Pesticide Registration and Evaluation Committee.

County	Initiating Chemical(s)	Verified Detection(s)	Study Number
Fresno/Kings	diuron	none	340
Orange	simazine	none	314, 343
San Bernardino	atrazine	none	344
Glenn	simazine	none	345
Kern	diuron	none	349
Los Angeles	simazine	none	350
Ventura	bentazon	none	375
Tehama	bentazon	none	376
Merced	aldicarb sulfoxide, simazine	none	378
Orange	atrazine, simazine	simazine	346
Orange	atrazine, simazine	atrazine, simazine	347
Los Angeles	simazine	simazine, prometon	348
Kern	prometon	diuron	351
Fresno/Kings	diuron	diuron	352
San Bernardino	simazine	atrazine, diruon, simazine	353
Riverside	simazine	bromacil, diuron, simazine, DIPA	354
Fresno	simazine	bromacil, diuron, simazine	356
Kings	prometon	prometon, diuron	357
Fresno	simazine	atrazine, prometon, simazine	358
San Bernardino	simazine	simazine	359
Tulare	simazine	simazine, diuron, bromacil	360
Tulare	simazine	diuron, simazine	361
Fresno	simazine	bromacil, diuron, simazine	362
Stanislaus	prometon	bromacil, prometon	363
Tulare	simazine, diuron	simazine, bromacil	364
Tulare	diuron	diuron	365
Merced	atrazine	diuron	370
Tehama	simazine, diuron	simazine	381
Contra Costa	aldicarb sulfoxide	atrazine, bromacil, prometon, simazine	382
Solano	aldicarb	atrazine, hexazinone, prometon, DEA	383

Monitoring for Pesticides Not Previously Reviewed by a PREC subcommittee

Studies were conducted in 6 counties for 8 active ingredients or breakdown products that have not been reviewed through a PREC subcommittee: 2,4-D, carbaryl, carbon disulfide, naled, tetrachlorvinphos, thiram, hexazinone, and propoxur. None of the compounds were detected in follow-up sampling and all were removed from the PDRP. Verified detections were made of other chemicals in 3 studies (Table II-2). Studies 378 and 383 were conducted both for pesticides that have and have not been previously reviewed through by a PREC subcommittee, and appear in both Tables II-1 and II-2.

Table II-2. Monitoring studies conducted by the Department of Pesticide Regulation for reported detections of chemicals that have not previously been reviewed by a subcommittee of the Pesticide Registration and Evaluation Committee.

County	Initiating Chemical(s)	Verified Detection(s)	Study Number
Ventura	carbaryl	none	375
Santa Clara	2,4-D	none	377
Merced	naled, tetrachlorvinphos, aldicarb sulfoxide	none	378
San Luis Obispo	carbon disulfide	none	379
Colusa	thiram	prometon	355
Tulare	hexazinone	atrazine, bromacil, diuron, hexazinone, simazine	373
Solano	carbaryl, propoxur	atrazine, hexazinone, prometon, DEA	383

ADJACENT SECTION MONITORING

EHAP samples wells located in sections of land adjacent to PMZs to determine whether ground water in those sections is vulnerable to contamination by pestides. The sampling results and information gathered during land use surveys are used to determine whether an adjacent section should be declared a PMZ.

From July 1, 1994 to June 30, 1995, EHAP sampled wells in 2 of 5 previously unmonitored sections adjacent to PMZs in San Bernardino County, 9 of 10 sections in San Joaquin County, 77 of 106 sections in Tulare County, none of the 10 sections in Ventura County, and 6 of 7 sections in Yolo County. The unsampled sections were examined but no wells could be located, wells were not operating, or permission to sample could not be obtained from well owners.

In the 4 counties sampled, verified detections were made in 71 of 165 wells (43%) in 52 of 94 sections (55%). Diuron was detected in the greatest number of wells (55), followed by simazine (52), bromacil (30), atrazine (4), hexazinone (2), and prometon (2). Two or more chemicals were verified in 49 wells (30%). One well in Tulare County had verified detections of 5 chemicals.

As a result of adjacent section monitoring, 62 new sections were recommended as PMZs. The verified detections of hexazinone in Tulare County initiated a separate monitoring study, which was completed by EHAP. The hexazinone residues were determined not to be due to legal agricultural use.

During the adjacent section monitoring study, 4 wells were sampled that did not meet the requirements of the sampling protocol. In Tulare County, 1 well was sampled in a section that is a PMZ, and 2 wells were sampled in a section that was not adjacent to a PMZ. One well in Yolo County was not adjacent to a PMZ, but was sampled at the request of the county agricultural commissioner. No pesticide residues were detected in these wells.

The sampling and results for adjacent section monitoring are presented below by county, wells, and sections (Table II-3).

Table II-3. Number of wells and sections with verified detections pursuant to Food and Agriculture Code section 13149(d), by county, during well surveys conducted by the Department of Pesticide Regulation in sections adjacent to Pesticide Management Zones (PMZs). Results are for sampling conducted during July 1, 1994 through June 30, 1995.

	WELLS									SECTIONS								
	Verified Detections							Total		Verified Detections						Total		
County (a)	Atrazine	Bromacil	Diuron	Prometon	Simazine	Hexazinone	2 or more chemicals	Sampled	Verified	Atrazine	Bromacil	Diuron	Prometon	Simazine	Hexazinone	Sampled	Verified	Recommend PMZ
San Bernardino	0	0	1	0	1	0	1	3	1	0	0	1	0	1	0	2	1	1
San Joaquin	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	9	0	0
Tulare	4	30	54	2	50	2	48	134	69	4	24	42	2	37	2	77	50	59
Yolo	0	0	0	0	1	0	0	11	1	0	0	0	0	1	0	6	1	2
Total	4	30	55	2	52	2	49	165	71	4	24	43	2	39	2	94	52	62

(a) No wells were sampled in 10 sections adjacent to PMZs in Ventura County.
Either no wells were located, wells were not operating, or permission to sample could not be obtained from well owners.

AGRICULTURAL USE DETERMINATIONS

As a result of well monitoring and land use surveys conducted from July 1, 1994 through June 30, 1995, and investigations completed by DPR for monitoring studies conducted before July 1, 1994, a total of 122 wells in 9 counties were determined to contain pesticide residues as a result of non-point source, legal agricultural use (see Table II-4). These determinations were based either on evidence obtained from well sampling or on a preponderance of evidence including historical land use and proximity to sections that are proposed or adopted PMZs.

DPR recommended a total of 92 new PMZs as a result of the determinations. The new PMZs, by county, are shown in Table II-5. These were the first PMZs recommended for prometon in Fresno and Los Angeles counties, for diuron in Merced County, and for diuron and simazine in Tehama County. Recommended PMZs must be adopted in regulation before they are subject to regulatory controls.

Table II-4. Number of wells with detections of pesticide active ingredients contained in products registered for use as of June 30, 1995, or breakdown products, that were determined, pursuant to Food and Agricultural Code section 13149, to be present in ground water as the result of non-point source, legal agricultural use. Results are given by county for investigations completed by the Department of Pesticide Regulation from July 1, 1994 through June 30, 1995. Detections due to such use were made for a total of 6 chemicals in 122 wells in 9 counties.

County	Atrazine	Bromacil	Diuron	Prometon	Simazine	Deethyl-atrazine	Total wells
Fresno	1	6	6	1	9	1	12
Los Angeles				3	2		3
Merced			2				2
Orange	4				3		4
Riverside		2	2		3		3
San Bernardino			1		1		1
Tehama					1		1
Tulare	6	39	75	2	68		95
Yolo					1		1
Total wells	11	47	86	6	88	1	122

Table II-5. Number of sections recommended as Pesticide Management Zones by the Department of Pesticide Regulation from July 1, 1994 through June 30, 1995.

County	Chemical(s)	Sections
Fresno	atrazine, prometon	1
	diuron	1
	simazine	1
	bromacil, diruon, simazine	4
Los Angeles	simazine, prometon	1
Merced	diuron	1
	atrazine, diuron	1
Orange	atrazine	1
	atrazine, simazine	2
Riverside	atrazine, bromacil, diuron, simazine	2
San Bernardino	diuron, simazine	1
Tehama	diuron, simazine	1
Tulare	bromacil	6
	diuron	15
	simazine	4
	atrazine, bromacil	1
	bromacil, diuron	2
	bromacil, simazine	1
	diuron, simazine	19
	simazine, prometon	1
	atrazine, diuron, simazine	1
	bromacil, diuron, simazine	21
	diuron, simazine, prometon	1
	atrazine, bromacil, diuron, simazine	3
Ventura	atrazine, bromacil, simazine	4
Yolo	simazine	1
	atrazine, simazine	1
Total	Atrazine 17, Bromacil 44, Diuron 73, Simazine 69, Prometon 4	92

Proposed Removal of Previously Adopted PMZs

DPR determined that several PMZs were adopted based on confirmed, but unverified detections. A special study (367) was conducted to verify the presence of these pesticides. As a result of this study, 3 previously adopted PMZs have been recommended for removal. They are one atrazine PMZ in Stanislaus County, one bromacil PMZ in Tehama County, and one bromacil PMZ in Tulare County. The removal of these PMZs will leave no atrazine PMZs in Stanislaus County, and no bromacil PMZs in Tehama County.

BENTAZON MONITORING

Historically, approximately 98% of all bentazon used in California was for postemergence weed control in rice fields. In 1989, confirmed detections of bentazon were made in 64 wells in 10 counties where rice was a major crop. As a result of those detections, DPR suspended the registration of bentazon until a full review could be conducted through the PDRP. The review resulted in DPR adopting regulations in January 1992 which added bentazon to section 6800(a) of the Groundwater Protection List (GWPL), and established use modifications that prohibited the use of bentazon (1) in Del Norte and Humboldt counties, (2) in the production of rice, (3) before April 1 or after July 31, and (4) in fields where irrigation applied through December 31 of the application year would not be by sprinklers (Title 3 CCR 6486.6). In the PDRP findings, DPR's Director stated that the Department would continue to monitor for the presence of bentazon in ground water in areas where it was applied after the establishment of the use modifications.

In May of 1995, EHAP sampled a total of nine wells in sections of Monterey, San Joaquin, San Mateo, Santa Barbara, and Santa Clara counties where bentazon had been applied. The bentazon used in these counties accounted for 70% of the 550 pounds of bentazon use reported in the 1993 Annual Pesticide Use Report for dry bean and pea production and 54% of all bentazon used in 19 counties. These sections were not near rice growing areas with historical uses of bentazon. The samples taken from these wells were also analyzed for atrazine, simazine, prometon, prometryn, bromacil, diuron, cyanazine, hexazinone, and metribuzin. No residues of bentazon or other herbicides were detected in any of the samples.

COMPLIANCE MONITORING

Regulations to prevent further ground water contamination in PMZs include prohibiting certain uses of chemicals in sublist (a) of the GWPL within their PMZs. Agricultural, outdoor industrial, and outdoor institutional use of atrazine or prometon within their respective PMZs is prohibited. Non-crop and rights-of-way use of bromacil, diuron, or simazine is prohibited within their PMZs. To ensure compliance with those regulations, EHAP 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" (CDFA/EHAP, 1989).

From July 1, 1994 through June 30, 1995, compliance monitoring was conducted for atrazine, bromacil, diuron, and simazine. 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 (SEQ). As a standard practice, soil samples that contained more than 1,000 ppb (1 part per million [ppm]) of triazine herbicide as measured by ELISA, were analyzed by a gas chromatographic method (GC) to determine the actual concentration of the regulated triazine(s) (Goh, *et al*, 1993). Analyses of samples collected from bromacil or diuron PMZs were performed using standard GC methods. For any soil sample containing a mimimum of 2 ppm of bromacil or 3 ppm of atrazine, diuron, 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 crop or 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.

The number of PMZs selected for monitoring each herbicide is listed by county in Table II-6. A total of 17 PMZs were monitored.

Table II-6. Location and occurrence of herbicide residues in soil samples collected in Pesticide Management Zones (PMZs) selected by the Department of Pesticide Regulation for compliance monitoring from July 1, 1994 through June 30, 1995.

		PESTICIDE MANAGEMENT ZONES		
Chemical	**County**	**Monitored [a]**	**With Verified Residues**	**Concentration Range (ppb) [b]**
Atrazine	Glenn	4	1	110-210 [c]
Bromacil	Tulare	5	1	130-5600
Diuron	Tulare	8	5	50-980
Simazine	Glenn	1	0	
	Merced	1	1	20-290[c]
	Stanislaus	2	2	20-290[c]
	Tulare	10	7	20-3870[c]

(a) A total of 17 PMZs were monitored: Glenn (4), Merced (1), Stanislaus (2), Tulare (10).
(b) ppb= parts per billion on a dry soil weight basis.
(c) Soil sampled for atrazine and simazine was analyzed using enzyme linked immunosorbent assay (ELISA) which does not differentiate between various triazine herbicides. Results are reported as simazine equivalents.

Triazine residues (SEQ) ranging in concentration from 110 to 210 parts per billion (ppb) were detected in the atrazine PMZs that were monitored in Glenn County. Ten of 14 simazine PMZs contained 20 to 3,870 ppb SEQ. Two samples from two PMZs in Tulare County contained SEQ greater than 1,000 ppb: 3,870 ppb (<50 ppb simazine) and 1,400 ppb (1,340 ppb simazine). Follow-up analysis by GC and back calculations indicated that the residues were not from recent applications.

Residues of diuron ranging from 50 to 980 ppb were detected in five of eight diuron PMZs in Tulare County. The results did not indicate that a recent application had been made.

Bromacil residues ranging from 130 to 5,600 ppb were detected in one of five bromacil PMZs in Tulare County. Two of five samples from one PMZ contained 3,970 ppb and 5,600 ppb, respectively. The mean concentration for the five samples collected at that site indicated that the bromacil residues could have resulted from a recent application. These findings have been

reported to DPR's Pesticide Use Enforcement Branch and the Tulare County Agricultural Commissioner for further investigation.

GROUNDWATER PROTECTION LIST MONITORING

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

Chemicals on the GWPL are prioritized for various factors to determine in which order and to what extent the pesticides should be monitored in California. Chemicals in the first priority for monitoring are pesticide active ingredients that have been detected in ground water due to non-point sources in other states or those given a high priority for risk assessment on the list of pesticide active ingredients created for implementing the Birth Defect Prevention Act (SB950). EHAP samples between 25 and 40 wells for first priority pesticides. DPR selects second priority pesticides based on physiochemical factors and the amount of active ingredient sold per year. EHAP samples 15 to 25 wells for the pesticides given second priority. The remaining pesticides are third priority, and 10 to 15 wells are sampled.

DPR placed and prioritized 48 pesticide active ingredients on the GWPL. The first priority group consists of 24 pesticides. A total of 73 wells in 17 counties were sampled for three pesticides from the first priority group from July 1, 1994 through June 30, 1995. Between 19 and 29 wells were sampled for each pesticide. Sampling results, by county and pesticide, are presented in Table II-7. None of the chemicals from sublist (b) of the GWPL were detected in any of the wells. However, verified detections were made of pesticides on sublist (a): atrazine in 1 well in San Joaquin County; diuron in 2 wells in Kern County and

1 well in Tulare County; and bromacil in 1 well each in Butte, Kern, San Joaquin and Tulare counties. These detections are currently under investigation by EHAP.

The wells sampled from July 1, 1994 through July 1, 1995 together with wells sampled in previous years have satisfied the GWPL sampling requirements for the pesticides azinphos-methyl, diazinon, and fonofos. None of these pesticides were detected in ground water.

Table II-7. Number of wells sampled, by county, for pesticide active ingredients placed on the Groundwater Protection List (Title 3, California Code of Regulations, section 6800(b)). Results are for sampling conducted by the Department of Pesticide Regulation from July 1, 1994 through June 30, 1995.

County	Azinphos-methyl	Diazinon	Fonofos
Butte	2	2	
Fresno	3		
Imperial		5	
Kern	4	2	
Lake	4		
Madera	1		
Merced	2		
Monterey		4	2
Sacramento	2		6
San Benito			4
San Joaquin	3		3
Santa Barbara			2
Stanislaus	5		
Sutter		3	
Tulare	3	3	
Ventura			4
Yolo			4
Total	29	19	25

SUMMARY

From July 1, 1994 through June 30, 1995, EHAP sampled 615 wells in 30 counties. The samples were analyzed for a total of 44 pesticide active ingredients and breakdown products.

Verified detections were made in 213 wells throughout 17 counties of 9 compounds: atrazine, bromacil, diuron, hexazinone, prometon, simazine, TPA, deethyl-atrazine, and deisopropyl-atrazine.

DPR determined that residues of atrazine, bromacil, diuron, prometon, simazine, and deethyl-atrazine had reached ground water as the result of legal, agricultural use in a total of 122 wells in 9 counties: Fresno, Los Angeles, Merced, Orange, Riverside, San Bernardino, Tehama, Tulare, and Yolo. Simazine was most frequently detected (88 wells), followed by diuron (86), bromacil (47), atrazine (11), prometon (6), and deethyl-atrazine (1). Two or more compounds were detected in 75 of the 122 wells.

A total of 92 sections were recommended as PMZs: 75 in Tulare County, 7 in Fresno County, 4 in Ventura County, 3 in Orange County, 2 each in Merced, Riverside, and Yolo counties, and 1 each in Los Angeles, San Bernardino, and Tehama counties.

Three previously adopted PMZs have been recommended for removal. They are 1 atrazine PMZ in Stanislaus County, and 1 bromacil PMZ Tehama County, and 1 bromacil PMZ in Tulare County.

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

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

INTRODUCTION

The PCPA requires the Department to include in the annual report an analysis of the factors that contribute to the movement of pesticides to ground water.

FACTORS CONTRIBUTING TO THE MOVEMENT OF PESTICIDES TO GROUND WATER

Factors which determine the probability of an agricultural use pesticide reaching ground water include the chemical's physiochemical properties, pesticide formulation and site of application, soil type, climate, and irrigation practices.

Pesticides may reach ground water by leaching or direct streaming. Leaching is the process by which pesticide residues are dissolved or suspended in water and are carried through the soil matrix as it recharges a ground water aquifer. Direct streaming is the movement of a pesticide to ground water through conduits. A natural conduit to ground water includes structures such as sink holes, macropores, insect and animal burrows, root channels, karst formations (limestone basins or cavities), and deep cracks in clay soils. Man-made conduits to ground water include poorly constructed or damaged well seals or casings, agricultural drainage wells (dry wells), and improperly abandoned water, oil, or natural gas wells. Surface water runoff is the off-site movement of water. This occurs when the amount of water entering the area (rain or irrigation) is greater than the amount of water that can penetrate the soil or be moved into plants. Pesticide residues in runoff can reach ground water through direct streaming.

Ground water contamination may arise from point or non-point sources. Point source contamination occurs when the pesticide comes from a defined (usually small) area such as from spills (improper handling, storage, disposal), direct injection into ground water during mixing or chemigation, or direct movement of surface water containing residues through natural or man-made conduits. Non-point source contamination occurs when pesticides reach ground water from a large area, typically as a result of movement of pesticide after an agricultural application.

Many of the factors contributing to pesticide movement to ground water have been addressed in research conducted by EHAP. A summary of those studies is presented here.

Using Multiple Factors To Identify Areas Vulnerable to Ground Water Contamination by Pesticides

For the past several years, EHAP scientists have been developing an approach that integrates climatic, soil, and geographic data in analyses of their combined influence on the movement of pesticides to ground water. This research was discussed in previous reports (Maes, *et al.*, 1992 and Maes, *et al.*, 1993). During the past year, EHAP scientists conducted well monitoring studies and field investigations as they continued to examine this new method of identifying areas in California that are vulnerable to ground water pollution by the legal agricultural use of pesticides. Specifically, research was aimed at gaining confidence in a statistical classification method using groups produced by the principal components analysis classification algorithm (study 0369, Appendix C). The monitoring results from this study are presented in sections I and II. This method may provide a basis for development of regional agricultural management practices and regulatory options to reduce ground water contamination by pesticides (Troiano and Nordmark., 1995).

Physicochemical Properties

The physicochemical properties which the PCPA requires of registrants are: water solubility, vapor pressure, octanol-water partition coefficient, soil adsorption coefficient (tendency of a compound to adhere to soil particles), Henry's Law constant (tendency of a dilute solute to escape from water), and dissipation studies, including hydrolysis, photolysis, aerobic and anaerobic soil metabolism, and field dissipation under California or similar environmental use conditions (section 13143(a)). These properties are used in models of pesticide transport through soils (Rao, *et al.* 1985). Cohen *et al.* (1984) estimated values of the properties to act as indicators of leaching potential. In addition, FAC section 13144(a) requires DPR to set specific numerical values (SNVs) for some of these properties that are used to identify pesticides with the potential to leach to ground water. DPR has updated the established SNVs described by Wilkerson and Kim (1986) in three reports entitled *Setting Revised Specific Numerical Values* (Johnson, 1988, 1989 and 1991).

Site of Application and Formulation

Herbicides found in ground water as a result of non-point source contamination 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 sunlight enhances degradation and (2) concentrations that reach the soil are low enough to allow for abiotic and biotic degradation before leaching. It is important to note that some degradation products may be as toxic as the parent compound.

The formulation in which a pesticide is applied, such as wettable powders, granulars, or emulsifiable concentrates, does not seem to affect the leaching potential of the pesticide. There has been some research on the use of slow-release formulations as a method to prevent pesticide movement through the soil. However, this is not yet a proven method for mitigating leaching potential.

Soil Type and Climate

Soil type can be an important factor in determining the likelihood of a pesticide to leach to ground water in a given area. Under dry conditions, certain clay soils, known as vertisols, develop large, deep cracks that may reach from 3 to 7 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. In this case, soil management practices may be the best approach to controlling pesticide movement.

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 database 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.

The interactions between soil type and climate is exemplified by the detection of aldicarb residues in well water in Del Norte County (Lee, 1983). Because soils in that area are high in organic matter, they would be expected to retard pesticide movement. However, total

annual rainfall may exceed 6.67 feet, with as much as 4.2 feet occurring during the fall and winter months from November to March. Aldicarb was normally 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 as little as 10 feet below the soil surface, in spite of the high soil organic matter.

The effect of winter rain on movement of pesticides in the central San Joaquin Valley was investigated in the Fresno area (Troiano and Garretson, 1988). Because soils there are sandy, the area might be expected to be vulnerable to pesticide leaching from winter rainfall. However, winter rainfall averages 10 inches in the San Joaquin Valley compared to 4.2 feet on the North Coast. For the study, an inorganic ion tracer was detected at about 5.5 feet deep in the soil, with some detected down to 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 0.5 feet of soil, with some residues detected down to 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, soil type and 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. These studies also demonstrate that agricultural management practices to reduce the chance of pesticides reaching ground water must be developed on a regional basis.

Irrigation Practices

Although many pre-emergent 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 in order to move the pesticide from the surface into the soil matrix. If heavy rainfall or irrigation follows application, there is a greater risk that residues could be moved offsite with excess runoff water.

An irrigation study was conducted by EHAP to compare the effect of low, medium and high amounts of percolating water applied by drip, sprinkler, flood, and furrow irrigation on leaching of atrazine (Troiano, *et al.*, 1990). 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 what is 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 subsequent 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 may help define the requirements needed for each irrigation method to prevent leaching.

One aspect of pesticide use critical to leaching may be the timing of pesticide application in relation to irrigation applications. A theory of soil adsorption 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 (Di Toro, 1985). 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 (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 intended zone of herbicidal activity. This could also result 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 to determine if leaching of herbicides was reduced by lengthening the time between application of an herbicide and initiation of irrigation treatments (Troiano *et al.*, 1993). Bromacil and simazine were broadcast onto the soil and immediately incorporated with a 0.50-inch sprinkler application of water. Irrigation treatments were started at 1, 7 or 14 days after the application and incorporation of the pesticide. For each individual chemical, lengthening the time between herbicide application and initiation of irrigation did not affect depth of leaching. However, results differed between herbicides. Bromacil moved deeper than simazine, probably because of its different 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).

Runoff water is commonly produced in surface irrigation systems such as furrow, basin-flooding and border types of irrigation which can be very inefficient. Excess water is often removed by drainage into dry wells. 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.

A DPR study was conducted to measure the concentrations of herbicides in water sampled near dry well drainage structures (Braun and Hawkins, 1991). Excess standing water occurred at the edge of fields as a result of either winter rainfall or runoff from irrigation. Herbicides were detected in rain runoff and in water collected after irrigation events. Further study is needed to determine the effect of application and soil incorporation on mitigating the presence of residues found in surface water moving off treated fields to dry wells.

Knowledge about the factors that contribute to pesticide movement to ground water allows for the development of regional and chemical specific agricultural management practices that will prevent agricultural use pesticides from reaching ground water. These practices are formally discussed during PCA training and the information is also available informally through other sources.

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APPENDICES

APPENDIX A

THE PESTICIDE CONTAMINATION PREVENTION ACT (PCPA)

and

MEMORANDUM OF UNDERSTANDING
BETWEEN THE STATE WATER RESOURCES CONTROL BOARD
AND THE CALIFORNIA DEPARTMENT OF PESTICIDE REGULATION

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 of 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.

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 make 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 registration 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 purposed of this article, the following definitions apply:

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

(b) "Groundwater protecting 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 of 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 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 in 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 are 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 data 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, 1896, 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 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 States 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 prevent the registrant from submitting valid, complete, and adequate information with 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 exits.

(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 Governmental 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 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 of 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 states.

(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 and 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 of 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 and 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) of (3), he or she shall determine whether the adverse health effects of the economic poison are carcinogenic, mutagenic, teratogenic, or neurotoxic.

11351. 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 monitoring 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 make 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.

MEMORANDUM OF UNDERSTANDING
BETWEEN THE
STATE WATER RESOURCES CONTROL BOARD
AND THE
CALIFORNIA DEPARTMENT OF PESTICIDE REGULATION
FOR THE PROTECTION OF
WATER QUALITY (SURFACE AND GROUND WATER)
FROM POTENTIALLY ADVERSE
EFFECTS OF PESTICIDES

BACKGROUND

The State Water Resources Control Board (SWRCB) and the California Department of Pesticide Regulation (CDPR) have responsibilities relating to the protection of water quality from the potentially adverse effects of pesticides. Both agencies believe that the State will benefit by a unified and cooperative program to address water quality problems related to the use of pesticides.

The purpose of this Memorandum of Understanding (MOU) between the SWRCB and CDPR is to ensure that pesticides registered in California are used in a manner that protects water quality and the beneficial uses of water while recognizing the need for pest control.

The Food and Agricultural Code, as amended by the 1991 Governor's Reorganization Plan No. 1, charges CDPR with the responsibility of ensuring the orderly regulation of pesticides while protecting the quality of the total environment (including water quality) and the health, and safety of the public.

SCOPE

This MOU is intended to assure that the respective authorities of the SWRCB and CDPR, relative to the protection of water quality and beneficial uses from impairment by the use of pesticides, will be exercised in a coordinated and cohesive manner designed to eliminate overlap of activities, duplication of effort, and inconsistency of action. To that end, this MOU establishes principles of agreement regarding activities of the signatory agencies, identifies primary areas of responsibility and authority between these agencies, and provides methods and mechanisms necessary to assure ongoing coordination of activities relative to such purposes. This MOU also describes how the agencies will work cooperatively to achieve the goals of the respective agencies.

STATUTORY AUTHORITIES

The Porter-Cologne Water Quality Control Act establishes a comprehensive water quality control program for California. The Federal Clean Water Act adds additional water quality control provisions to be implemented nationwide. The SWRCB and the nine California Regional Water Quality Control Boards (CRWQCB) are responsible for protecting the beneficial uses of water in California and for controlling all discharges of waste into waters of the State. The SWRCB sets overall State policy, adopts or approves all water quality control plans, and hears petitions to review CRWQCB decisions. The CRWQCBs have primary responsibility for permitting, inspection, and enforcement actions. The CRWQCBs implement and enforce the policies adopted by the SWRCB.

CDPR is the lead agency for pesticide regulation in California. California law requires CDPR to register and regulate the use of pesticides and protect public health and safety by providing for environmentally sound pest management.

The Pesticide Contamination Prevention Act of 1985 (Article 15, Chapter 2, Division 7 of the Food and Agricultural Code) authorizes CDPR to:

1. Collect and analyze environmental fate data on all pesticides registered for agricultural use in California to determine ground water data gaps and identify and monitor potential ground water contaminants;

2. Review any pesticide or related chemical found in ground water or in soil under certain conditions to determine if that chemical pollutes or threatens to pollute ground water as a result of legal agricultural use and take appropriate corrective action when necessary; and

3. Compile and maintain a statewide database of wells sampled for pesticide active ingredients and to make an annual report on that inventory and any corrective actions taken by CDPR and/or the SWRCB.

The Pesticide Contamination Prevention Act (Act) also prescribes a cooperative working relationship between CDPR, as the lead agency, and the SWRCB for the purpose of protecting ground water from pesticide pollution as a result of agricultural uses. A subcommittee of CDPR's Pesticide Registration and Evaluation Committee (PREC) is established by the Act for this purpose.

The local administration of CDPR's pesticide regulatory program is the responsibility of the County Agricultural Commissioners (Commissioners), with coordination, supervision, and training provided by CDPR. The Commissioners enforce pesticide laws and regulations and evaluate permit requests for the use of restricted pesticides. In addition, the Commissioners monitor and inspect pesticide handling and use operations, investigate suspected pesticide misuse, and take enforcement action against violators.

PRINCIPLES OF AGREEMENT

The SWRCB and CDPR agree that the use of certain pesticides may degrade water quality and threaten beneficial uses. To protect the State's water, it is necessary to prevent water pollution by pesticides by establishing water quality objectives and by implementing control measures for those pesticides which have a potential to unreasonably affect beneficial uses.

In order to provide for better protection of water quality and beneficial uses for the people of California, the SWRCB and CDPR mutually agree to:

1. Promote both technical and policy consultations concerning pesticide water quality issues through formal channels, such as standing interagency committees and SWRCB workshops and meetings, as well as through informal staff exchanges of information. The SWRCB and CRWQCBs and CDPR will consult during the early stages of planning any investigation related to pesticides and water quality. The agencies will provide technical assistance to each other upon request.

2. Implement a pesticide detection notification system to ensure mutual awareness of pesticide finds in the waters of the State. Results of pesticide monitoring will be provided in an expeditious manner. Results of pesticide monitoring related to ground water will be provided in compliance with "Minimum Reporting Requirements for Well Sampling" approved by the SWRCB, California Department of Food and Agriculture, and California Department of Health Services in July 1986. Reporting requirements and procedures for data referrals relative to surface water will be described in an implementation document.

3. Collect, exchange, and disseminate information on (a) the use of pesticides, (b) impacts on the quality of the State's waters from such uses, and (c) any efforts to mitigate those impacts.

4. Share information on pesticide formulations and environmental fate and toxicity of active ingredients, inert ingredients, and break-down products. Procedures to protect proprietary information will be described in an implementation document.

5. Consult each other in developing or revising water quality objectives for pesticides and in developing or revising regulations which may impact water quality.

6. Participate in the development of State policies, guidelines, and management plans relative to pesticide use and water quality control.

7. Promote the development and implementation of Best Management Practices (BMPs) whenever necessary to protect the beneficial uses of the waters of the State from the potentially adverse effects of the use of certain pesticides. CDPR's plans to implement BMPs, as furnished to the SWRCB and/or CRWQCBs, should (a) describe the nature of the actions which are necessary to achieve the objectives, including recommendations for appropriate actions by any entity, public or private; (b) set a time schedule for actions to be taken; and (c) describe the points of application and the monitoring to be undertaken to determine compliance with the water quality objectives.

8. Implement BMPs initially upon voluntary compliance to be followed by regulatory-based encouragement of BMPs as circumstances dictate. Mandatory compliance will be based, whenever possible, on CDPR's implementation of regulations and/or pesticide use permit requirements. However, the SWRCB and CRWQCBs retain ultimate responsibility for compliance with water quality objectives. This responsibility may be implemented through the SWRCB and CRWQCBs' Basin Planning Programs or other appropriate regulatory measures consistent with applicable authorities and the provisions of the Nonpoint Source Management Plan approved by the SWRCB in November 1988.

9. Develop an implementation plan to (a) provide uniform guidance and direction to the CRWQCBs and to the Commissioners regarding the implementation of this MOU, (b) describe in detail procedures to implement specific sections of this MOU, and (c) make specific the respective roles of units within the signatory agencies.

DISPUTE AND CONFLICT RESOLUTION

It is the desire of both agencies to establish a speedy, efficient, and informal method for the resolution of interagency conflicts. Conflicts between the SWRCB and CRWQCBs, CDPR, and the Commissioners which cannot otherwise be informally resolved will be referred to the Executive Director of the SWRCB and the Director of CDPR. Conflicts which cannot be resolved at this level will be elevated to the Secretary of the California Environmental Protection Agency.

To assist the Executive Director of the SWRCB and the Director of CDPR in resolving conflicts, two staff persons will be appointed by the Chairman of the SWRCB and the Director of CDPR representing the interests of the SWRCB and CRWQCBs and CDPR and Commissioners, respectively.

This MOU shall become effective upon the date of final signature and shall continue in effect until modified by the mutual written consent of both parties or until terminated by either party upon a thirty (30) day advance written notice to the other party.

STATE WATER RESOURCES CONTROL BOARD

W. Don Maughan

W. Don Maughan, Chairman

Dec. 23, 1991
Date

CALIFORNIA DEPARTMENT OF PESTICIDE REGULATION

James W Wells

James W. Wells, Interim Director

Dec. 23, 1991
Date

State of California

Memorandum

To : EM & PM Program Supervisors and Managers
Environmental Monitoring and Pest Management

Date : February 26, 1993

Place : Sacramento

Phone: 4-1141

From : Department of Pesticide Regulation John S. Sanders, Acting Chief
Environmental Monitoring and Pest Management

Subject : Implementing the MOU with the State Water Board

Attached for your information is a copy of a joint memo issued by Director Jim Wells and State Water Board Executive Director Walt Petit as interim guidance for implementing the principles of agreement in our memorandum of understanding (MOU). Please familiarize yourself with both the MOU and this guidance memo. If you have any questions concerning consultation with the State and Regional Water Boards or how the MOU might affect your projects, please see Steven Monk or me. The same suggestion applies if you or your staff encounter any issues with the Boards which are not consistent with the MOU or this guidance.

I would also like to take this opportunity to institute a specific process of consultation regarding interim guidance III. (c)(3) for notice of field monitoring activities. Starting immediately, a copy of all approved study protocols will be sent to both the State and appropriate Regional Water Board. The State Water Board copy will go to the attention of Jack Hodges, the interim MOU coordinator, at the address indicated in the attached memo. To expedite your mailing to the Regional Board within whose boundaries the study is to be conducted, I am also attaching a list of designated contacts and a list of mailing addresses for each Regional Board Office.

With your assistance, the MOU will become a workable reality. Thank you.

Attachments

cc: Steven Monk

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SUBNAME Sanders

Executive Office 93-3

January 4, 1993

TO: ALL SWRCB DIVISION CHIEFS
ALL DPR BRANCH CHIEFS
ALL REGIONAL BOARD EXECUTIVE OFFICERS
ALL COUNTY AGRICULTURAL COMMISSIONERS

SUBJECT: IMPLEMENTING THE PESTICIDES-WATER QUALITY MEMORANDUM OF UNDERSTANDING (MOU)

The Department of Pesticide Regulation (DPR) and the State Water Resources Control Board (SWRCB) executed a Memorandum of Understanding (MOU) on December 23, 1991, to ensure that pesticides registered in California are used in a manner that protects water quality and the beneficial uses of water while recognizing the need for pest control. The MOU established principles of agreement regarding activities of both agencies, identifies primary areas of responsibility and authority between these agencies, and provides methods and mechanisms necessary to assure ongoing coordination of activities at both the State and local levels.

In order to provide for better protection of water quality and beneficial uses for the people of California, the SWRCB and DPR mutually agreed, in part, to develop an implementation plan to (1) provide uniform guidance and direction to the Regional Water Quality Control Boards (RWQCBs) and to the County Agricultural Commissioners (CACs) regarding the implementation of this MOU, (2) describe in detail procedures to implement specific sections of this MOU, and (3) make specific the respective roles of units within both agencies.

Despite our mutual best efforts, the implementation document has not been completed. We remain committed to making the drafting of an implementation plan and/or a water quality management plan a high priority activity leading to an eventual Management Agency Agreement.

However, it has come to our attention that, in the absence of a completed implementation document, many staff at the State and local levels of both agencies remain unaware of the MOU and its principles of agreement and/or are unsure of its implications for their respective assignments and projects. In fact, the CACs were informed that "the MOU places no immediate requirements on county staff or programs" until an implementation document has been developed.

In January, 1992, such instructions made sense, but today we cannot afford to delay any longer the integration of the MOU and its principles of agreement into policy development and program implementation. We have long ago agreed to exercise our respective authorities "in a coordinated and cohesive manner designed to eliminate overlap of activities, duplication of effort, and inconsistency of action." While coordination is occurring, efforts could be improved. Therefore, we have mutually agreed to provide the following interim guidance for implementation of our MOU.

I. Appointment of Staff Persons for Dispute Resolution

The MOU declares, and we reaffirm, that it is the mutual intent of both agencies to resolve any interagency conflicts in "a speedy, efficient, and informal" way. However, in the event that conflict resolution between any parties to this agreement (SWRCB, RWQCBs, DPR, or CACs) cannot be reached informally, the dispute will be referred to the SWRCB Executive Director and DPR Director.

The MOU specifies that "two staff persons will be appointed" by each agency to "assist the Executive Director of the SWRCB and the Director of DPR in resolving conflicts." Jesse M. Diaz, Chief of the Division of Water Quality, and Jack Hodges, Chief of the Nonpoint Source Agriculture Unit, will be appointed by Eliseo M. Samaniego, Acting Chairman, to these roles on behalf of the SWRCB. Ronald J. Oshima, Assistant Director for the Division of Enforcement, Environmental Monitoring, and Data Management, and Steven C. Monk, Regulatory Coordinator, will be appointed by James W. Wells, Director, to represent DPR in these roles.

II. Designation of State-Level Interim MOU Coordinators

To facilitate the integration of the MOU principles of agreement into the mainstream of policy development and program implementation at both the State and local levels, we hereby designate two State-level interim MOU coordinators. Jack Hodges and Steven Monk will serve their respective agencies in this role. The MOU Coordinators will be the key point of contact on <u>all</u> matters related to the implementation of the MOU. In that capacity, Jack and Steven should be added to any appropriate State and local "interested parties" mailing lists. The MOU Coordinators will be a source of information, will facilitate interagency contacts, and generally promote the MOU principles of agreement. Jack and Steven can be reached as follows:

Jack Hodges, Chief
Nonpoint Source Agriculture Unit
Division Of Water Quality
STATE WATER RESOURCES CONTROL BOARD
901 P Street, P.O. Box 100
Sacramento, California 95801-0100
(916) 657-0682 or 8-437-0682
FAX (916) 657-2388

Steven C. Monk,
Regulatory Coordinator
DEPARTMENT OF
PESTICIDE REGULATION
Environmental Monitoring
1220 N Street, P.O. Box 942871
Sacramento, California 94271-0001
(916) 654-1141 or 8-464-1141
FAX (916) 654-0539

III. Implementation of Interim Staff Guidance

It is not our intent to disrupt the ongoing activities of either state or local programs. On the other hand, we fully intend that the process of integration and coordination begin in earnest. Therefore, we are providing the following interim guidelines for implementation:

(a) Appropriate staff should be informed of the existence of the MOU and provided access to a reference copy.

(b) It is our intent that interagency staff communication take place at all levels in a frequent and meaningful manner. Staff should be encouraged to seek and provide technical assistance, and to explore the opportunities for joint projects. In addition, we propose that an interagency staff briefing be convened at least quarterly to highlight existing and proposed projects of mutual interest. On a routine basis, Jesse Diaz, Ron Oshima, and the MOU Coordinators will coordinate these briefings and ensure that appropriate staff are invited to discuss items of mutual interest. An executive summary of each quarterly briefing will be sent to the CACs, RWQCBs, and appropriate State staff.

(c) To facilitate consultation "during the early stages of planning", staff should be informed to, at least, contact the MOU Coordinators in any of the following situations <u>when related to pesticides and water quality</u>:

(1) <u>Prior</u> to the issuance of any public notice of either: regulations; or workshops, hearings, or public meetings where policies or projects of mutual interest will be discussed or adopted.

(2) <u>Prior</u> to the release of any pertinent reports.

(3) <u>Prior</u> to finalizing the study design or contract workplan for any field monitoring or other investigations of mutual interest.

(4) <u>Prior</u> to proposing legislation, budget change proposals, or grant workplans which impact mutual program interests.

(5) <u>Prior</u> to setting or revising any water quality objectives or other standards.

(6) <u>During</u> the development of policies, guidelines, and management plans for federal and/or State projects.

(d) To "implement a pesticide detection notification system", staff should be informed to, at least, contact the MOU Coordinators <u>as soon as</u> any pesticide detections are confirmed in violation of any water quality objective or other known standard. In the case of surface water detections which do not violate an objective or standard, monitoring results should be made available within a reasonable period after the study is completed.

All ground water sampling results, both positive and negative, must be reported in a timely manner to DPR pursuant to the Pesticide Contamination Prevention Act of 1985. Minimum reporting requirements for ground water sampling were established by DPR, SWRCB, and the Department of Health Services in 1986. To obtain a copy of the minimum reporting requirements or to report sampling results, please contact:

Candace Maes
Associate Environmental Research Scientist
Environmental Monitoring and Pest Management Branch
Department of Pesticide Regulation
1220 N Street, P.O. Box 942871
Sacramento, California 94271-0001
(916) 654-1141 or 8-461-1441
FAX (916) 654-0539

(e) While recognizing that the SWRCB and RWQCBs retain ultimate responsibility for compliance with water quality objectives, staff should ensure that programs and workplans are consistent with and support DPR's responsibility to develop and implement voluntary and regulatory-based "best management practices" to control the potentially adverse impacts of pesticide use on water quality.

Finally, we would encourage staff to operate under the following maxim --when in doubt, consult. A reason for designating the MOU Coordinators is to encourage staff to presume that consultation promotes efficient and effective discharge of our respective roles and responsibilities.

Thank you all for your assistance in giving substance and value to the MOU and our principles of agreement.

DEPARTMENT OF PESTICIDE REGULATION

James W. Wells

James W. Wells, Director

Jan. 5, 1993
Date

STATE WATER RESOURCES CONTROL BOARD

Walter G Pettit

Walter G. Pettit, Executive Director

Jan 19, 1993
Date

cc: Jesse M. Diaz, Water Quality Division Chief
Ronald J. Oshima, Assistant Director
Jack Hodges
Steven Monk

APPENDIX B

GLOSSARY OF TERMS USED IN THE 1995 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. Soils high in clay or organic content may tend to adsorb pesticides.

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 Agricultural 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.*

Cal/EPA - California Environmental Protection Agency. Comprised of the Department of Pesticide Regulation, the Department of Toxic Substances Control, the Integrated Waste Management Board, the Water Resources Control Board, the Air Resources Board, and the Office of Environmental Health Hazard Assessment.

CCR (3CCR) - California Code of Regulations. Title 3, California Code of Regulations (3CCR). California Code of Regulations contains enforceable regulations that provide the specific means for implementation of laws. Title 3 CCR contains regulations pertaining to Food and Agriculture.

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 database.

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

database record – Each chemical analysis of a well water sample for a pesticide residue or related chemical constitutes one record in the database. Each record may contain up to 148 columns of data.

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

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.

emulsifiable concentrate – A concentrated pesticide formulation containing organic solvent and emulsifier to aid 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).

FAC - Food and Agricultural Code. The laws pertaining to Food and Agriculture. Specific regulations for implementation of law are in the California Code of Regulations (see definition).

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 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 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 soil pests.

ground water – Water beneath the surface of the ground, whether or not flowing through known and definite channels.

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.

Groundwater Protection List (GWPL) – A list, required by the 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. Sublist (b) contains pesticide active ingredients whose physicochemical properties exceed or are less than the specific numerical values (see definition) and that are labeled for soil application under certain conditions. 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. Water containing pesticides at or below the lifetime 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 is 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 kill insects.

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 pestidices carried by water, either in the dissolved or suspended state, through the soil matrix as it recharges a ground water aquifer.

legal, agricultural use – The application of a pesticide, according to label 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 in either an adjacent section or within ½ mile radius of the original, verified detection; (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 Level (MCL) – 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. Primary MCLs are take into consideration both health-based criteria and technologic and economic factors relating to the ability to achieve and monitor these concentrations in drinking water supply systems.

Maximum Contaminant Level goals (MCL goals) – MCL goals are promulgated by the USEPA and are 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 by a living organism (bacteria, 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 reliably quantify. 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 – Any artificial excavation by any method for the purpose of monitoring fluctuations in ground water levels, quality of underground waters, or the concentration of contaminants in underground waters.

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 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 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 Groundwater 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 database 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 groundwater, 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 its PMZ is subject to certain ground water protection restrictions and requirements.

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 properties – 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.

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 (one square mile) identified by DPR as sensitive to ground water pollution by specific pesticides, not yet adopted into regulation in section 6802 (3CCR).

record – See *database 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 (one square mile) equal to 1/36 of a township. (See *well numbering system.*)

selective pesticide – A pesticide that kills specific pest species, 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 compound such as 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 identifying pesticides with the potential to pollute 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 database. 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 class of chemical compounds 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, prometon, 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 physical 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 (and pressures).

water solubility - The property of a substance to dissolve in water.

water well - any artificial excavation constructed by any method for the purpose of extracting water from, or injecting water into, the underground.

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 meridian 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 powder formulation that, on addition to water, forms a suspension.

APPENDIX C

SUMMARY OF STUDIES
INCLUDED IN THE 1995 UPDATE
TO THE WELL INVENTORY DATABASE REPORT

The following summarizes the well sampling surveys that were added to the well inventory database during the period July 1, 1994 - June 30, 1995. The study number assigned by DPR is shown to the left.

I. CALIFORNIA DEPARTMENT OF HEALTH SERVICES (Sanitary Engineering Branch)

0023 Sampled for numerous chemicals in 40 counties: Alameda, Butte, Calaveras, Colusa, Contra Costa, El Dorado, Fresno, Humbolt, Inyo, Kern, Kings, Lake, Los Angeles, Madera, Marin, Mariposa, Mendocino, Merced, Monterey, Napa, Orange, Placer, Riverside, Sacramento, San Bernardino, San Diego, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Solano, Sonoma, Stanislaus, Sutter, Tulare, Tuolumne, Yolo, Yuba counties; January 1993 - December 1994; 2,713 wells sampled.

II. CALIFORNIA DEPARTMENT OF WATER RESOURCES

0374 Sampled for numerous chemicals in Del Norte and Siskiyou counties; June 1994 - September 1994; 34 wells sampled.

III. DEPARTMENT OF PESTICIDE REGULATION (Environmental Hazards Assessment Program)
Analyses were performed for the listed chemicals.
Bold indicates the chemical(s) for which the study was initiated.
Underline indicates a verified detection of the chemical was made.

0332 Atrazine, bromacil, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, simazine, **thiram**; Colusa County; April 1994; 4 wells sampled.

0340 Atrazine, bromacil, cyanazine, **diuron**, hexazinone, metribuzin, prometon, prometryn, simazine; Fresno and Kings counties; August 1994; 4 wells sampled.

0341 Atrazine, bromacil, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Orange County; July 1994; 1 well sampled.

0342 **Atrazine**, bromacil, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Riverside County; July 1994; 4 wells sampled.

0343 Atrazine, bromacil, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Orange County; July 1994; 5 wells sampled.

0344 **Atrazine**, bromacil, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; San Bernardino County; August 1994; 5 wells sampled.

0345 Atrazine, bromacil, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Glenn County; July 1994; 4 wells sampled.

0346 **Atrazine**, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Orange County; July 1994; 2 wells sampled.

0347 **Atrazine**, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Orange County; July 1994; 4 wells sampled.

0348 Atrazine, bromacil, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Los Angeles County; July 1994; 3 wells sampled.

0349 Atrazine, bromacil, cyanazine, **diuron**, hexazinone, metribuzin, prometon, prometryn, simazine; Kern County; August 1994; 3 wells sampled.

0350 Atrazine, bromacil, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Los Angeles; July 1994; 4 wells sampled.

0351 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, **prometon**, prometryn, simazine; Kern County; July - August 1994; 2 wells sampled.

0352 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, **diuron**, hexazinone, metribuzin, prometon, prometryn, simazine; Fresno and Kings counties; August 1994; 4 wells sampled.

0353 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; San Bernardino; August 1994; 1 well sampled.

0354 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Riverside County; July 1994; 4 wells sampled.

0355 Atrazine, bromacil, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, simazine, **thiram**; Colusa County; April 1994; 4 wells sampled.

0356 Atrazine, bromacil, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Fresno County; July 1994; 5 wells sampled.

0357 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, **prometon**, prometryn, simazine; Kings County; August and December 1994; 5 wells sampled.

0358 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Fresno County; July 1994; 5 wells sampled.

0359 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; San Bernardino County; July 1994; 5 wells sampled.

0360 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Tulare County; August 1994; 5 wells sampled.

0361 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Tulare County; August 1994; 5 wells sampled.

0362 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Fresno County; August 1994; 4 wells sampled.

0363 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, **prometon**, prometryn, simazine; Stanislaus County; August 1994; 4 wells sampled.

0364 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, **diuron**, hexazinone, metribuzin, prometon, prometryn, **simazine**; Tulare County; August 1994; 4 wells sampled.

0365 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, **diuron**, hexazinone, metribuzin, prometon, prometryn, simazine; Tulare County; August 1994; 4 wells sampled.

0367 Atrazine, bromacil, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; Fresno, Stanislaus, Tehama, Tulare counties; July - December 1994; 11 wells sampled. Special study to complete monitoring for several previously conducted well monitoring studies.

0368 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; San Bernardino, San Joaquin, Tulare, Yolo counties; January 1994 - September 1995; 165 wells sampled. Additionally, 1 well in Yolo County was sampled at the request of the County Agricultural Commissioner and 3 wells in Tulare County were sampled. Adjacent Section Monitoring.

0369 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, chlorthal-dimethyl, MTP; Fresno and Tulare counties; April - June 1994; 178 wells sampled. Study to gain confidence in soil cluster analysis modeling.

0370 **Atrazine**, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; Merced County; July and October, 1995; 4 wells sampled.

0371 Atrazine, azinphos-methyl, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diazinon, diuron, fonofos, hexazinone, metribuzin, prometon, prometryn, simazine; Butte, Fresno, Imperial, Kern, Lake, Madera, Merced, Monterey, Sacramento, San Benito, San Joaquin, Santa Barbara, Stanislaus, Sutter, Tulare, Ventura, Yolo counties; April - December 1994; 73 wells sampled. Ground Water Protection List Monitoring.

0373 3-hydroxycarbofuran, aldicarb, aldicarb sulfone, aldicarb sulfoxide, atrazine, azinphos-methyl, bromacil, carbaryl, carbofuran, chlorpyrifos, cyanazine, DDVP, deethyl-atrazine, deisopropyl-atrazine, diazinon, dimethoate, diuron, ethoprop, ethyl parathion, fonofos, **hexazinone**, malathion, methidathion, methiocarb, methiocarb sulfone, methiocarb sulfoxide, methomyl, methyl parathion, metribuzin, oxamyl, phosalone, phosmet, prometon, prometryn, simazine; Tulare County;
March - December 1995; 25 wells sampled.

0375 Atrazine, **bentazon**, bromacil, **carbaryl**, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; Ventura County; February 1995;
6 wells sampled.

0376 Atrazine, **bentazon**, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; Tehama County; February 1995; 6 wells sampled.

0377 Atrazine, bromacil, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, simazine, **2,4-D**; Santa Clara County; February 1995; 6 wells sampled.

0378 Aldicarb, aldicarb sulfone, **aldicarb sulfoxide**, atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; tetrachlorvinphos, DDVP; Merced County; March 1995; 6 wells sampled.
Sampling conducted for this study also satisfied the sampling requirements for 5 additional detections reported to DPR. They were detections of **aldicarb sulfoxide, tetrachlorvinphos, naled**, and two detections of **simazine**. The associate file names are Z284, Z297 and Z298.

0379 Atrazine, bromacil, **carbon disulfide**, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; San Luis Obispo County; March 1995; 6 wells sampled.

0381 Atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, **diuron**, hexazinone, metribuzin, prometon, prometryn, **simazine**; Tehama County; April 1995; 4 wells sampled.

0382 Aldicarb, aldicarb sulfone, **aldicarb sulfoxide**, atrazine, bromacil, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, simazine, Contra Costa County; March 1995; 6 wells sampled.

0383 **Aldicarb**, aldicarb sulfone, aldicarb sulfoxide, atrazine, bromacil, **carbaryl**, cyanazine, deethyl-atrazine, deisopropyl-atrazine, diuron, hexazinone, metribuzin, prometon, prometryn, **propoxur**, simazine; Solano County; March 1995; 6 wells sampled.

0384 Atrazine, bentazon, bromacil, cyanazine, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; Monterey, San Joaquin, San Mateo, Santa Barbara, Santa Clara counties; May 1995;
9 wells sampled. Bentazon monitoring.

Well sampling studies were not conducted for the following detections because no additional wells were available for sampling. No further action will be taken on these detections. No study number was assigned; the associated file name is given.

Z244 Diuron and simazine in Stanislaus County

Z278 Prometon in Colusa County.

APPENDIX D

RESULTS BY COUNTY AND PESTICIDE

Appendix D, Part 1. Counties without a detection of any pesticide or breakdown product.
Value represents total wells analyzed for a compound. Most wells analyzed for multiple compounds.

Pesticide or Breakdown Product	Alameda	Calaveras	El Dorado	Glenn	Humboldt	Inyo	Lake	Marin	Mariposa	Mendocino	Napa	Placer	Plumas	Sacramento	San Benito	Siskiyou	Sonoma	Sutter	Tuolumne	Yuba
1,1,2,2-tetrachloroethane	13		5			1	1	1	10	6	1			2			34	1	10	9
1,2,4-trichlorobenzene	13					1	1	1	10	6	1						34	1	10	8
1,2-dichloropropane	13		5			1	1	1	10	6	1			2		18	34	1	10	9
1,3-dichloropropene (1,3-D)	13					1	1	1	10	6	1					18	31	1	10	8
2,3,7,8-tcdd (dioxin)	5																			
2,4,5-T																			1	1
2,4,6-trichlorophenol																				
2,4-D	10	1			1				11	4		3		2			18		22	2
2,4-dinitrophenol																				
3-hydroxycarbofuran	6																		25	
4(2,4-DB), dimet																				
acenapthene																				
acephate																18				
alachlor	10				1				18							18			25	1
aldicarb	10															18			25	
aldicarb sulfone	7																		25	
aldicarb sulfoxide	7																		25	
aldrin	7								10					21		18			25	1
ametryne																				1
aminocarb																18				
atraton																18				1
atrazine	10	1		4		6	7		18	3				45	4	18	19	3	23	1
azinphos-ethyl																18				1
azinphos-methyl							4							2						
barban																18				
benefin																				
benomyl																18				
bentazon, sodium salt	10								11							18	1		22	2
bhc (other than gamma isomer)	6																			
bromacil	10			4		6	4		18					8	4		1	3	22	1
butachlor	7					6			18								1		17	1
butylate																				1
captafol																18				
captan																18				
carbaryl	7													4		18			25	
carbofuran	10						2			1				3		18	1		25	
carbon disulfide																				
carbophenothion																				
chloramben																				1
chlordane	10				1				8	2				5		18	18		25	1
chlorobenzilate																				
chloroneb																				
chloropicrin																18				
chlorothalonil	10								10					1		18	1		17	1
chlorpropham																18				
chlorpyrifos																				1
chlorthal-dimethyl																				1
coumaphos																18				1
cyanazine				4			4							8	4			3		
cycloate																				1
dalapon	7								11	2							1			2
DBCP	10		2			6										18	1	2		
DCPA acid metabolites																				
DDD	6																			
DDE	11																			
DDT	6																			

Appendix D, Part 1. Counties without a detection of any pesticide or breakdown product (continued).

Pesticide or Breakdown Product	Alameda	Calaveras	El Dorado	Glenn	Humboldt	Inyo	Lake	Marin	Mariposa	Mendocino	Napa	Placer	Plumas	Sacramento	San Benito	Siskiyou	Sonoma	Sutter	Tuolumne	Yuba
DDVP																18				1
deethyl-atrazine																				
deisopropyl-atrazine																				
demeton	2								6							18			1	1
diazinon	10					6			18					2		18	1	3	22	1
dicamba	7								11					1					16	2
dichlorprop, butox																				
dicofol																				
dieldrin	7								11					16		18			24	1
dimethoate	10					6			18					1		18	1		22	
dinoseb	7								11								1		16	2
diphenamid																18				1
diquat dibromide	20																			
disulfoton	2								6							18			1	1
diuron	3			4			4		4					9	1	18	1	3		
DMPA																				
endosulfan	6															18				
endosulfan II																18				
endosulfan sulfate	6															18				
endothall	7															18				
endrin	10				1				10	2		3		17		18	17		25	1
endrin aldehyde	6															18				
EPN																				
EPTC																				1
ethion																18				
ethoprop																18				
ethyl parathion																18				1
ethylene dibromide	10		2			6			2							18	8			
fenamiphos																18				1
fensulfothion																18				1
fenthion																18				
fenuron																18				
fluometuron																18				
fonofos														6	1					
glyphosate, isopropylamine salt	23																4			
heptachlor	10				1				10					8		18	18		25	1
heptachlor epoxide	10				1				10	2				21		18	18		25	1
hexachlorobenzene	17								10	2							1		16	1
hexazinone				4			4							8	4			3		1
lindane (gamma-bhc)	10				1				10	2		3		19		18	18		25	1
linuron																18				
malathion						5										18				
maneb																18				
MCPA, dimethylamine salt																				
MCPP																				
merphos																				1
metam-sodium																18				
methidathion																				
methiocarb																18			6	
methiocarb sulfone																				
methiocarb sulfoxide																				
methomyl	7													2		18			25	
methoxychlor	10				1				10	2		3		10			18		25	1
methyl bromide	13					1	1	1	10	6	1			2			31	1	10	8
methyl parathion																18				
metolachlor	7					6			18					2			1		17	1

Appendix D, Part 1. Counties without a detection of any pesticide or breakdown product (continued).

Pesticide or Breakdown Product	Alameda	Calaveras	El Dorado	Glenn	Humboldt	Inyo	Lake	Marin	Mariposa	Mendocino	Napa	Placer	Plumas	Sacramento	San Benito	Siskiyou	Sonoma	Sutter	Tuolumne	Yuba
metribuzin	7			4		5	4		6					8	4			3	1	1
mevinphos																18				1
mexacarbate																18				
molinate	10	1				6			18					2			1		23	
monuron																18				
monuron-tca																18				
MTP																				
naled																18				1
naphthalene	13					5	1	1	10	6	1						31	1	10	8
napropamide																				1
neburon																18				
nitrofen																				
ortho-dichlorobenzene	15					1	1	1	10	6	1			2			31	1	10	8
oxamyl	7													1		18			25	
paraquat bis(methylsulfate)																				
paraquat dichloride																18				
parathion																18				1
PCNB																				
pendimethalin																				
permethrin																				
permethrin, other related																				
phorate																18				1
phosalone																				
phosmet																				
picloram	7								11								1			2
prometon				4			4							8	4	18		3		
prometryn	10			4		6	4		18					8	4	18	1	3	6	
propachlor	7								18								1			
propazine						5										18				1
propham																18				
propoxur																18				
prothiofos																18				
ronnel																18				1
secbumeton																18				
siduron																18				
silvex	10	1			1				11	4		3					17		22	2
simazine	10	1		4		6	7		18	1				44	4	18	19	3	23	1
simetryn																18				1
sulprofos																18				
swep																18				
tebuthiuron																				1
terbuthylazine																18				
terbutryn																18				1
tetrachlorvinphos																18				1
tetradifon																				
thiobencarb	10													2			1		23	
thiram																				
toxaphene	10				1				10	2		3		15		18	18		25	1
TPA																				
triadimefon																				1
trichloronate																18				
trifluralin																				
vernolate																				1
xylene	13		5			6	1	1	10	6	1						31	1	10	9
ziram																18				

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product. Number of verified (V) or unverified (U) detections, and the total number of wells sampled for each pesticide or breakdown product.

	Butte			Colusa			Contra Costa			Del Norte			Fresno			Imperial		
Pesticide or Breakdown Product	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total
1,1,2,2-tetrachloroethane			12						5						173			
1,2,4-trichlorobenzene			12						5						173			
1,2-dichloropropane (1,2-D)			12						5		1	16		2	173			
1,3-dichloropropene (1,3-D)			12						5			16			173			
2,3,7,8-tcdd (dioxin)															1			
2,4,5-t									1						4			
2,4,6-trichlorophenol																		
2,4-D									6						249			
2,4-dinitrophenol																		
3-hydroxycarbofuran									5						60			
4(2,4-DB), dimethylamine salt																		
acenapthene																		
acephate												16						
alachlor						3			6			16			246			
aldicarb									8			16			251			
aldicarb sulfone									8						251			
aldicarb sulfoxide								1	8						251			
aldrin									5			16			62			
ametryne																		
aminocarb												15						
atraton												16						
atrazine			4			11	1		8			16	2	1	415			5
azinphos-ethyl																		
azinphos-methyl			2									16			3			
barban												16						
benefin																		
benomyl												16						
bentazon, sodium salt									6			16			64			
bhc (other than gamma isomer)																		
bromacil	1		4			11	1		8				19	1	224			5
butachlor									5						54			
butylate																		
captafol												16						
captan												16						
carbaryl									5			16			60			
carbofuran									5			16			251			
carbon disulfide																		
carbophenothion																		
chloramben																		
chlordane									6			16			249			
chlorobenzilate																		
chloroneb																		
chloropicrin												16						
chlorothalonil									5			16			54			
chlorpropham												16						
chlorpyrifos																		
chlorthal-dimethyl												4			183			
coumaphos												16						
cyanazine			4			8			6			1			169			5
cycloate																		
dalapon									5						246			
dbcp									5			16		112	309			
dcpa acid metabolites												12						
ddd																		
dde																		
ddt																		
ddvp												16						

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

	Butte			Colusa			Contra Costa			Del Norte			Fresno			Imperial		
Pesticide or Breakdown Product	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total
deethyl-atrazine								2	2				43	3	155			
deisopropyl-atrazine								1	2					14	154			
demeton												16			5			
diazinon			2			3			5			16			55			5
dicamba									5						64			
dichlorprop, butoxyethanol ester																		
dicofol																		
dieldrin									5			16			57			
dimethoate						3			5			16			55			
dinoseb									5						246			
diphenamid												16						
diquat dibromide									5						244			
disulfoton												16			5			
diuron			4			8			7			16	32	2	174			5
dmpa																		
endosulfan												16						
endosulfan II												16						
endosulfan sulfate												15						
endothall									5			15			244			
endrin									6			15			249			
endrin aldehyde												16						
epn																		
eptc																		
ethion												16						
ethoprop												16						
ethyl parathion												16						
ethylene dibromide									5			16		5	305			
fenamiphos												16						
fensulfothion												16						
fenthion												16						
fenuron												16						
fluometuron												15						
fonofos																		
glyphosate, isopropylamine salt									5						212			
heptachlor									6			16			249			
heptachlor epoxide									6			16			249			
hexachlorobenzene									5						248			
hexazinone			4			8			6						169		1	5
lindane (gamma-bhc)									6			16			249			
linuron												16						
malathion												16						
maneb												15						
mcpa, dimethylamine salt																		
mcpp																		
merphos																		
metam-sodium												15						
methamidophos																		
methidathion																		
methiocarb									1			16			4			
methiocarb sulfone																		
methiocarb sulfoxide																		
methomyl									5			16			60			
methoxychlor									6						249			
methyl bromide			12						5						173			
methyl parathion												16						
metolachlor						8			5						53			
metribuzin			4			8			8						176			5
mevinphos												16			1			

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

	Butte			Colusa			Contra Costa			Del Norte			Fresno			Imperial		
Pesticide or Breakdown Product	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total
mexacarbate												15						
molinate						3			5						61			
monuron												16						
monuron-tca												16						
mtp (monomethyl 2,3,5,6-tetrac															147			
naled												16						
naphthalene			12						5						173			
napropamide																		
neburon												16						
nitrofen																		
ortho-dichlorobenzene			12						5					1	173			
oxamyl									5			16			251			
paraquat bis(methylsulfate)																		
paraquat dichloride												16						
parathion												16						
pcnb																		
pendimethalin																		
permethrin																		
permethrin, other related																		
phorate												16						
phosalone																		
phosmet																		
picloram									5						246			
prometon			4	1		8	1	1	6			16	1		170			5
prometryn			4			11			8			16			224			5
propachlor									5						56			
propazine												15						
propham												16						
propoxur									1			16			4			
prothiofos												16						
ronnel												16						
secbumeton												16						
siduron												16						
silvex									6						246			
simazine			4			11	1		8			16	48	5	409			5
simeton																		
simetryn												16			1			
sulprofos												16						
swep												16						
tebuthiuron																		
terbuthylazine												16						
terbutryn												16			1			
tetrachlorvinphos												16						
tetradifon																		
thiobencarb						3			5						54			
thiram						7												
toxaphene									6			16			243			
tpa (2,3,5,6-tetrachlorotereph													2	1	147			
triadimefon																		
trichloronate												16						
trifluralin																		
vernolate																		
xylene			12						5						173			
ziram												15						
total number wells sampled			16			11			10			16			486			5

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

	Kern			Kings			Los Angeles			Madera			Merced			Monterey		
Pesticide or Breakdown Product	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total
1,1,2,2-tetrachloroethane			79			4			248			4			8			14
1,2,4-trichlorobenzene			46			4			231			4			8			14
1,2-dichloropropane (1,2-D)		2	81			4			248			4			8			14
1,3-dichloropropene (1,3-D)			47			4			236			3			8			14
2,3,7,8-tcdd (dioxin)									24						4			
2,4,5-t			9			2						10			25			1
2,4,6-trichlorophenol																		
2,4-D			69			2			140			10			26			32
2,4-dinitrophenol																		
3-hydroxycarbofuran			36			2			79			10			26			32
4(2,4-DB), dimethylamine salt						2						9						
acenapthene															4			
acephate																		
alachlor			63			4			349			13			26			32
aldicarb			47			2			81			10			28			33
aldicarb sulfone			36			2			50			10			28			32
aldicarb sulfoxide			36			2			50			10		4	28			32
aldrin			37			2			76			13			22			33
ametryne															4			
aminocarb																		
atraton															4			
atrazine			75			13			388			5		1	34		1	39
azinphos-ethyl																		
azinphos-methyl			4									1			4			
barban																		
benefin			2												15			
benomyl																		
bentazon, sodium salt			72			2			108			10			26			8
bhc (other than gamma isomer)			2												19			1
bromacil	1		48			13			80			6			34			10
butachlor			18			4			93			5			22			31
butylate															4			
captafol																		
captan			2												15			
carbaryl			36			2			89			10			26			33
carbofuran			64			2			118			10			26			33
carbon disulfide																		
carbophenothion			2												15			
chloramben															4			
chlordane			66			2			137			13			26			33
chlorobenzilate															4			
chloroneb															4			
chloropicrin																		
chlorothalonil			33			2			42			5			6			1
chlorpropham															4			
chlorpyrifos															2			
chlorthal-dimethyl															6			1
coumaphos														1	2			
cyanazine			11			9			7			1			12			7
cycloate															4			
dalapon			67			2			134			10			26			32
dbcp		19	85			3		8	167		1	10		9	19			36
dcpa acid metabolites																		
ddd			2												19			1
dde			2												19			1
ddt			2												19			1
ddvp															6			

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

Pesticide or Breakdown Product	Kern			Kings			Los Angeles			Madera			Merced			Monterey		
	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total
deethyl-atrazine			1			2									1			
deisopropyl-atrazine			1			2									1			
demeton			9											1	17			
diazinon			43			4			69			5			26			7
dicamba			24						72						26			32
dichlorprop, butoxyethanol ester						2						8						1
dicofol			2												15			
dieldrin			37			2			76			13			22			33
dimethoate			37			4			58			5			20			3
dinoseb			53			2			130			10			26			32
diphenamid															4			
diquat dibromide			54			4			88			10			24			29
disulfoton			9												19			
diuron	3		26	1		9			55			1	2		13			7
dmpa			2												13			
endosulfan			2												19			1
endosulfan II																		1
endosulfan sulfate			2												19			
endothall			52			4			59			10			25			29
endrin			66			2			141			13			26			33
endrin aldehyde			2												19			1
epn																		
eptc															4			
ethion																		
ethoprop																		
ethyl parathion															1			
ethylene dibromide		4	85			3		1	172			10		1	18			36
fenamiphos															4			
fensulfothion															2			
fenthion															1			
fenuron																		
fluometuron																		
fonofos																		2
glyphosate, isopropylamine salt			32						109			1			6			36
heptachlor			66			2			137			13			26			32
heptachlor epoxide			66			2			137			13			26			32
hexachlorobenzene			47			2			132			13			7			32
hexazinone			11			9			7			1			12			7
lindane (gamma-bhc)			66			2			141			13			26			33
linuron																		
malathion																		
maneb																		
mcpa, dimethylamine salt																		1
mcpp																		1
merphos														1	4			
metam-sodium																		
methamidophos																		
methidathion																		
methiocarb			14			2						10			20			1
methiocarb sulfone																		
methiocarb sulfoxide																		
methomyl			36			2			79			10			26			32
methoxychlor			66			2			141			13			26			33
methyl bromide			80			4			248			3			8			14
methyl parathion															2			
metolachlor			18			4			93			5			7			31
metribuzin			24			11			27			3			27			7
mevinphos															17			

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

	Kern			Kings			Los Angeles			Madera			Merced			Monterey		
Pesticide or Breakdown Product	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total
mexacarbate																		
molinate			53			4			353			4			24			4
monuron																		
monuron-tca																		
mtp (monomethyl 2,3,5,6-tetrac																		
naled														1	2			
naphthalene			44			4			247			3		2	8			15
napropamide															4			
neburon																		
nitrofen			2												15			
ortho-dichlorobenzene			80			4			248			3			8			14
oxamyl			55			2			105			10			26			33
paraquat bis(methylsulfate)			12			2						10			16			
paraquat dichloride			12			2						10			16			
parathion															1			
pcnb			2												15			
pendimethalin			2															
permethrin															4			
permethrin, other related															4			
phorate															2			
phosalone																		
phosmet																		
picloram			66			2			135			10			26			32
prometon			11		1	9	2	1	7			1			27			7
prometryn			48			13			67			6			34			10
propachlor			18			2			93			5			7			32
propazine															4			
propham																		
propoxur			13			2						10			20			1
prothiofos																		
ronnel															2			
secbumeton																		
siduron																		
silvex			69			2			139			10			26			32
simazine			74			13	2	1	387			5		3	34			39
simeton																		
simetryn															19			
sulprofos																		
swep																		
tebuthiuron															4			
terbuthylazine																		
terbutryn															19			
tetrachlorvinphos														1	6			
tetradifon																		
thiobencarb			53			4			353			4			9			4
thiram																		
toxaphene			66			2			139			13			26			33
tpa (2,3,5,6-tetrachlorotereph																		
triadimefon															4			
trichloronate																		
trifluralin															4			
vernolate															4			
xylene			79			4		1	278			3			8			14
ziram																		
total number wells sampled			169			16			569			16			45			57

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

	Orange			Riverside			San Bernardino			San Diego			San Joaquin			San Luis Obispo		
Pesticide or Breakdown Product	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total
1,1,2,2-tetrachloroethane			219			35			105			22			45			34
1,2,4-trichlorobenzene			219			35			104			22			41			34
1,2-dichloropropane (1,2-D)			219		3	37			105			22		1	45			34
1,3-dichloropropene (1,3-D)			219			35			104			22			41			34
2,3,7,8-tcdd (dioxin)									69			16						1
2,4,5-t									2						1			
2,4,6-trichlorophenol									2									
2,4-D			73			37			147			16			12			26
2,4-dinitrophenol									2									
3-hydroxycarbofuran			67			30			49			17			11			4
4(2,4-DB), dimethylamine salt																		
acenapthene			194						2									
acephate																		
alachlor			203			68			183			16			23			21
aldicarb			67			30			50			17			11			4
aldicarb sulfone			67			30			48			17			11			4
aldicarb sulfoxide			67			30			48			17			11			4
aldrin			197			29			32			16			11			15
ametryne																		
aminocarb																		
atraton																		
atrazine	4		200			74	1		196			17	1		47			29
azinphos-ethyl																		
azinphos-methyl															3			
barban																		
benefin																		
benomyl																		
bentazon, sodium salt			73			37			146						12			26
bhc (other than gamma isomer)			196						2									
bromacil		1	195	2		75			62			17	1		47			16
butachlor			1			58			33			17			22			2
butylate																		
captafol																		
captan																		
carbaryl			67			30			49			17			11			27
carbofuran			73			30			132			18			11			28
carbon disulfide																		6
carbophenothion																		
chloramben																		
chlordane			203			37			156			16			12			29
chlorobenzilate																		
chloroneb																		
chloropicrin																		
chlorothalonil			197			37			49			17			11			20
chlorpropham																		
chlorpyrifos																		
chlorthal-dimethyl																		
coumaphos																		
cyanazine			12			8			14						24			6
cycloate																		
dalapon			72			11			106						7			26
dbcp			225		9	98		47	276			16		26	56			22
dcpa acid metabolites																		
ddd			196						2									
dde			196						2									
ddt			196						2									
ddvp																		

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

	Orange			Riverside			San Bernardino			San Diego			San Joaquin			San Luis Obispo		
Pesticide or Breakdown Product	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total
deethyl-atrazine			5			2		1	2					1	1			
deisopropyl-atrazine			5	2	1	3		2	2						1			
demeton																		
diazinon			193			67			49			17			23			22
dicamba			9			28			31						11			4
dichlorprop, butoxyethanol ester																		
dicofol																		
dieldrin			197			29			32			16			11			15
dimethoate			193			67			49			17			22			17
dinoseb			72			29			136			16			11			29
diphenamid																		
diquat dibromide			1			2			21			17			10			26
disulfoton																		
diuron			23	2		66	2		96						24			35
dmpa																		
endosulfan			196						2									
endosulfan II																		
endosulfan sulfate			196						2									
endothall			2			1			17			17			10			4
endrin			203			37			156			16			12			27
endrin aldehyde			197						2									
epn																		
eptc																		
ethion																		
ethoprop																		
ethyl parathion			192															
ethylene dibromide			225		3	102			246			16			30			22
fenamiphos																		
fensulfothion																		
fenthion																		
fenuron																		
fluometuron																		
fonofos															3			
glyphosate, isopropylamine salt			71			22			44			17			3			12
heptachlor			203			37			156			16			12			29
heptachlor epoxide			203			37			156			16			12			29
hexachlorobenzene			201			29			135						11			25
hexazinone			12			8			14					1	24			6
lindane (gamma-bhc)			203			37			156			16			12			27
linuron																		
malathion			192															
maneb																		
mcpa, dimethylamine salt																		
mcpp																		
merphos																		
metam-sodium																		
methamidophos																		
methidathion																		
methiocarb			66						10			17			1			2
methiocarb sulfone																		
methiocarb sulfoxide																		
methomyl			67			29			49			17			11			26
methoxychlor			203			37			156			16			12			27
methyl bromide			219			35			104			22			41			34
methyl parathion			192															
metolachlor			1			58			33			17			23			2
metribuzin			12			11			35						25			6
mevinphos																		

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

	Orange			Riverside			San Bernardino			San Diego			San Joaquin			San Luis Obispo		
Pesticide or Breakdown Product	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total
mexacarbate																		
molinate			198			67			183			17			23			22
monuron																		
monuron-tca																		
mtp (monomethyl 2,3,5,6-tetrac																		
naled																		
naphthalene			220			44			104			18			41			34
napropamide																		
neburon																		
nitrofen																		
ortho-dichlorobenzene			219			35			104			22			41			34
oxamyl			72			29			128			17			11			33
paraquat bis(methylsulfate)												17						
paraquat dichloride												17						
parathion			192															
pcnb																		
pendimethalin																		
permethrin																		
permethrin, other related																		
phorate																		
phosalone																		
phosmet																		
picloram			72			29			134						11			29
prometon			12			8			14						24			6
prometryn			195						62			17			47			25
propachlor			17			29			32			17			11			4
propazine																		
propham																		
propoxur			66						10			17			1			2
prothiofos																		
ronnel																		
secbumeton																		
siduron																		
silvex			73			37			147			16			12			26
simazine	4		200	3		75	3		198			17			47			29
simeton																		
simetryn																		
sulprofos																		
swep																		
tebuthiuron																		
terbuthylazine																		
terbutryn																		
tetrachlorvinphos																		
tetradifon																		
thiobencarb			198			67			182			17			23			22
thiram																		
toxaphene			203			37			156			16			12			27
tpa (2,3,5,6-tetrachlorotereph																		
triadimefon																		
trichloronate																		
trifluralin																		
vernolate																		
xylene			219		1	36			105		1	22			45		1	35
ziram																		
total number wells sampled			233			132			303			23			102			49

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

	San Mateo			Santa Barbara			Santa Clara			Santa Cruz			Solano			Stanislaus		
Pesticide or Breakdown Product	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total
1,1,2,2-tetrachloroethane			10			7			63			22			5			70
1,2,4-trichlorobenzene			10			7			63			22			5			69
1,2-dichloropropane (1,2-D)		1	11			7			63			22			5			70
1,3-dichloropropene (1,3-D)			10			7			63			22			5			69
2,3,7,8-tcdd (dioxin)						1			19						5			
2,4,5-t						1			20						3			9
2,4,6-trichlorophenol																		
2,4-D			6			18		1	58			2			10			56
2,4-dinitrophenol																		
3-hydroxycarbofuran						4			11						10			47
4(2,4-DB), dimethylamine salt									20									7
acenapthene									1									
acephate																		
alachlor			6			18			29			2			10			56
aldicarb			6			4			23					1	14			45
aldicarb sulfone			6			4			23						14			45
aldicarb sulfoxide			6			4			23						14			45
aldrin						15			28			2			10			67
ametryne						1												
aminocarb															1			
atraton																		
atrazine			8			24						2	1	1	14			68
azinphos-ethyl																		
azinphos-methyl																		5
barban															1			
benefin																		
benomyl																		
bentazon, sodium salt			8			21			54			2			10			56
bhc (other than gamma isomer)						1												
bromacil			8			20			27			2			13	1		67
butachlor						4			17			2			10			52
butylate																		
captafol																		
captan																		
carbaryl						12			19			2		1	14			45
carbofuran			5			16			24						10			46
carbon disulfide																		
carbophenothion			1															
chloramben						1									3			
chlordane			6			24			28			2			10			70
chlorobenzilate						1												
chloroneb						1												
chloropicrin																		
chlorothalonil						9			2						7			18
chlorpropham						1									1			
chlorpyrifos																		
chlorthal-dimethyl						1						1			3			
coumaphos																		
cyanazine			2			6			7						6			12
cycloate						1												
dalapon			6			17			50			2			10			53
dbcp			11			21			21			2			10		40	89
dcpa acid metabolites																		
ddd						1												
dde			5			1			2						6			
ddt						1												
ddvp						1												

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

	San Mateo			Santa Barbara			Santa Clara			Santa Cruz			Solano			Stanislaus		
Pesticide or Breakdown Product	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total
deethyl-atrazine														1	1			1
deisopropyl-atrazine															1			1
demeton																		2
diazinon			6			18			21			2			10			54
dicamba						1			49			2			10			8
dichlorprop, butoxyethanol ester									20									
dicofol																		
dieldrin						15			26			2			10			67
dimethoate			6			11			17			2			7			52
dinoseb			6			17			50			2			10			53
diphenamid						1												
diquat dibromide			6			10			43						10			3
disulfoton						1												2
diuron			2			21			12						8			14
dmpa																		
endosulfan						1												
endosulfan II																		
endosulfan sulfate						1												
endothall			6			1			30						7			3
endrin			6			20			29			2			10			70
endrin aldehyde						1												
epn																		
eptc						1												
ethion																		
ethoprop																		
ethyl parathion																		
ethylene dibromide			11			21			21			2			100			77
fenamiphos						1												
fensulfothion																		
fenthion																		
fenuron															1			
fluometuron															1			
fonofos						2												
glyphosate, isopropylamine salt					1	11			21			2			7			3
heptachlor			6			24			29			2			10			70
heptachlor epoxide			6			24			29			2			10			70
hexachlorobenzene			5			17			22			2			16			65
hexazinone			2			7			7				1		6			12
lindane (gamma-bhc)						19			22			2			10			70
linuron															1			
malathion																		
maneb																		
mcpa, dimethylamine salt																		
mcpp																		
merphos						1												
metam-sodium																		
methamidophos																		
methidathion																		
methiocarb						1			1						9			1
methiocarb sulfone																		
methiocarb sulfoxide																		
methomyl						12			18						10			47
methoxychlor			6			20			29			2			10			70
methyl bromide			10			7			63			22			5			70
methyl parathion																		
metolachlor						3			17			2			10			51
metribuzin			2			7			14			2			14			59
mevinphos						1												2

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

Pesticide or Breakdown Product	San Mateo			Santa Barbara			Santa Clara			Santa Cruz			Solano			Stanislaus		
	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total	V	U	Total
mexacarbate															1			
molinate						20			14			2			10			56
monuron															1			
monuron-tca																		
mtp (monomethyl 2,3,5,6-tetrac																		
naled																		
naphthalene			16			4			73		1	24			5			69
napropamide						1						1						
neburon															1			
nitrofen																		
ortho-dichlorobenzene			10			7			63		1	22			5			69
oxamyl			6			14			23						10			47
paraquat bis(methylsulfate)			6			1									8			
paraquat dichloride			6			1									8			
parathion																		
pcnb																		
pendimethalin																		
permethrin						1												
permethrin, other related						1												
phorate																		
phosalone																		
phosmet																		
picloram			6			18			50			2			10			53
prometon			2			7			7				1		6			14
prometryn			8			20			27			2			13			67
propachlor						1			19			2			10			48
propazine						1												
propham															1			
propoxur						1			8					1	13			
prothiofos																		
ronnel																		
secbumeton																		
siduron															1			
silvex			6			17			53			2			10			56
simazine			8			27			28			2			14			68
simeton																		
simetryn						1												2
sulprofos																		
swep															1			
tebuthiuron						1												
terbuthylazine																		
terbutryn						1												2
tetrachlorvinphos						1												
tetradifon																		
thiobencarb						18			14			2			10			54
thiram																		
toxaphene			6			19			28			2			10			70
tpa (2,3,5,6-tetrachlorotereph																		
triadimefon						1												
trichloronate																		
trifluralin						1												
vernolate						1												
xylene		1	11			7			63		1	22			5			70
ziram																		
total number wells sampled			34			30			106			24			20			123

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

	Tehama			Tulare			Ventura			Yolo		
Pesticide or Breakdown Product	V	U	Total	V	U	Total	V	U	Total	V	U	Total
1,1,2,2-tetrachloroethane						46			33			
1,2,4-trichlorobenzene						46			33			
1,2-dichloropropane (1,2-D)						46			33			
1,3-dichloropropene (1,3-D)						46			33			
2,3,7,8-tcdd (dioxin)									3			
2,4,5-t						2			9			
2,4,6-trichlorophenol												
2,4-D						40			28			
2,4-dinitrophenol												
3-hydroxycarbofuran						29			24			
4(2,4-DB), dimethylamine salt									3			
acenapthene												
acephate												
alachlor						39			32			
aldicarb						40			24			
aldicarb sulfone						40			22			
aldicarb sulfoxide						40			22			
aldrin						28			31			
ametryne									1			
aminocarb												
atraton									1			
atrazine	2		12	7	5	255			43		1	16
azinphos-ethyl									1			
azinphos-methyl						6						
barban												
benefin						1						
benomyl												
bentazon, sodium salt			6			40		1	30			
bhc (other than gamma isomer)						1						
bromacil			12	45		248			38			16
butachlor						28			27			
butylate												
captafol												
captan						1						
carbaryl						29		1	28			
carbofuran						40			36			
carbon disulfide												
carbophenothion						1						
chloramben												
chlordane						39			37			
chlorobenzilate												
chloroneb												
chloropicrin												
chlorothalonil						30			19			
chlorpropham									1			
chlorpyrifos						3			1			
chlorthal-dimethyl						31						
coumaphos												
cyanazine			12			216			11			16
cycloate												
dalapon						16			26			
dbcp					33	96			33			
dcpa acid metabolites												
ddd						1						
dde						1						
ddt						1						
ddvp						3			1			

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

	Tehama			Tulare			Ventura			Yolo		
Pesticide or Breakdown Product	V	U	Total	V	U	Total	V	U	Total	V	U	Total
deethyl-atrazine			1	2	2	112						
deisopropyl-atrazine			1	15	60	113						
demeton						1			1			
diazinon						38			30			
dicamba						28			14			
dichlorprop, butoxyethanol ester									3			
dicofol						1						
dieldrin						28			30			
dimethoate						26			29			
dinoseb						39			26			
diphenamid												
diquat dibromide						40			27			
disulfoton						1			1			
diuron			12	84	6	218			32			16
dmpa						1						
endosulfan						1						
endosulfan II												
endosulfan sulfate						1						
endothall						40			6			
endrin						39			32			
endrin aldehyde						1						
epn									1			
eptc									1			
ethion									1			
ethoprop						3						
ethyl parathion						3			1			
ethylene dibromide					1	95			33			
fenamiphos									1			
fensulfothion												
fenthion												
fenuron												
fluometuron												
fonofos						3			1			4
glyphosate, isopropylamine salt						52			16			
heptachlor						39			37			
heptachlor epoxide						39			37			
hexachlorobenzene						38			30			
hexazinone			12	4	1	216			11			16
lindane (gamma-bhc)						39			32			
linuron												
malathion						3			1			
maneb												
mcpa, dimethylamine salt												
mcpp												
merphos									1			
metam-sodium												
methamidophos												
methidathion						3						
methiocarb						5			18			
methiocarb sulfone						3						
methiocarb sulfoxide						3						
methomyl						29			23			
methoxychlor						39			32			
methyl bromide						46			33			
methyl parathion						3			1			
metolachlor						27			27			
metribuzin			12			219			29			16
mevinphos						1			1			

Appendix D, Part 2. Counties with a detection of any pesticide or breakdown product (continued).

	Tehama			Tulare			Ventura			Yolo		
Pesticide or Breakdown Product	V	U	Total	V	U	Total	V	U	Total	V	U	Total
mexacarbate												
molinate						36			32			
monuron												
monuron-tca												
mtp (monomethyl 2,3,5,6-tetrac						31						
naled												
naphthalene						47			39			
napropamide									1			
neburon												
nitrofen						1						
ortho-dichlorobenzene						46			33			
oxamyl						33			26			
paraquat bis(methylsulfate)						1			16			
paraquat dichloride						1			16			
parathion						3			1			
pcnb						1						
pendimethalin												
permethrin												
permethrin, other related												
phorate									1			
phosalone						3						
phosmet						3						
picloram						38			26			
prometon			12	2		217			11			16
prometryn			12			248			36			16
propachlor						27			27			
propazine									1			
propham												
propoxur						2			17			
prothiofos												
ronnel												
secbumeton									1			
siduron												
silvex						40			28			
simazine	1	1	12	79	7	254			44	1		16
simeton												
simetryn						1			1			
sulprofos												
swep												
tebuthiuron												
terbuthylazine												
terbutryn						1			1			
tetrachlorvinphos												
tetradifon									1			
thiobencarb						31			32			
thiram												
toxaphene						39			32			
tpa (2,3,5,6-tetrachlorotereph						31						
triadimefon									1			
trichloronate												
trifluralin												
vernolate									1			
xylene						47			33			
ziram												
total number wells sampled			12			368			54			16

APPENDIX E

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	***non-specific***	***specific***
specific	detection & separation	detection
non-specific	detection	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 a 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 is not required. A qualitative method cannot be used as a second method when the first method is qualitative.

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.

APPENDIX F

MATERIALS AND METHODS USED FOR COLLECTION, PREPARATION, AND ENTRY OF DATA INTO THE DATABASE

and

FORMAT OF DATABASE RECORDS

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 database. DPR has notified appropriate agencies of this law and requested them to submit required information on a DPR reporting form (Figure C-1), 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 database:

1. 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 well was identified by at least township/range/section according to the U.S. Geological Survey's Public Lands Survey Coordinate system;
5. Data had not previously been entered into the database.

Agencies supplied well sampling data as published reports, raw laboratory results, or retrievals of information on magnetic media from their databases. Published reports were examined to determine if the data met the above criteria. For 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 magnetic media.

The PCPA also requires DPR, the SWRCB, and CDHS to jointly establish minimum requirements for well sampling that will ensure precise and accurate results. 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 insure 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 database. The format used for records in the database is explained beginning on page *97.

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 Database

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 database 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.

Before being added to the permanent well inventory database, 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 database 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 database. 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 database. Each well must have a unique well number and address. When a discrepancy is found, the new record is flagged as an error.

Records identified by the verification programs as having an error were examined and edited as necessary. The data were then entered into the permanent well inventory database.

Figure F-1. Sample reporting form

State of California
Environmental Protection Agency
Department of Pesticide Regulation
1020 N Street
Sacramento, CA 95814-5624
(916) 324-4190
FAX (916) 324-4088

SAMPLE REPORTING FORM:
Well Sampling Results

1) California State Well Number:

Township	Range	Section	Tract	Sequence	Base Meridian

2) County of Sample: _____

3) Well Site Location Name: _____

4) Well Location Address: _____

5) Well Type:

- ☐ Large System
- ☐ Small System
- ☐ Private-Domestic
- ☐ Non-Community
- ☐ Irrigation
- ☐ Irrigation & Domestic
- ☐ Community
- ☐ Other: _____

6) Chemical Analysis Results (per well):

Chemical Name/ Screen **	Sample Date (Mo/Day/Yr)	Sample Type Initial Confirmation or Split	Analysis Results (ppb)		Analyzing Lab	Analysis Date (Mon/Day/Yr)
			Concentration	MDL		

** (If more than six chemicals were analyzed for each well, attach additional pages to appropriate well sheet).

Other Reporting Information (if available).

1) Well construction information:
Well depth (ft.) _____ Year well drilled _____

	Top	Bottom
Top/bottom perforation depths (ft.)		
Dept of standing water in well (ft.)		

Well log located (yes/no) _____

2) Method of analysis: _____

3) Reason for sampling the well: _____

4) Source of contamination-suspected ☐ confirmed ☐ Describe: _____

FORMAT OF RECORDS IN THE WELL INVENTORY DATABASE

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 database. The maximum record length is 148 characters.

An example of the well inventory database format showing the data fields and column numbers, is shown in Figure C-2. A key to the codes used in the well inventory database 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.

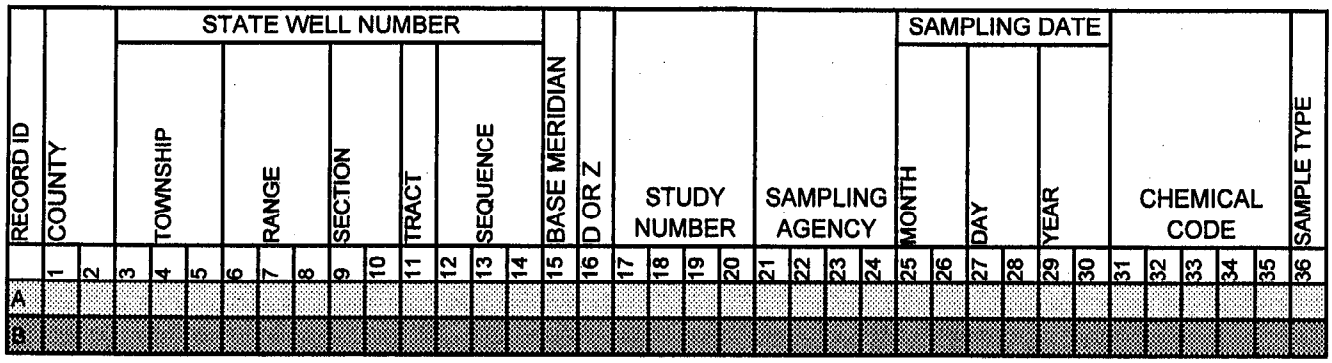
Column Number	Explanation of Database Record Fields
1-2	County code: a minimum reporting requirement. This code is consistent with DPR Pesticide Use Report format.
3-14	State well number (township/range/section/tract/sequence number): a minimum reporting requirement. The state well number is based on 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 (cols. 3-5) are oriented from north to south and are six miles long. Range lines (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 (cols. 9-10), numbered consecutively from 1 to 36. Each section is again divided into 16 individual 40-acre tracts (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. If information is not available from DWR, an in-house, tract and sequence is assigned.
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 specifying DWR state well number or in house number assigned by DPR.
17-20	Study number: numbers were assigned consecutively as studies were obtained.
21-24	Sampling agency code: a minimum reporting requirement.
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." The precise sampling date is recorded for most studies.

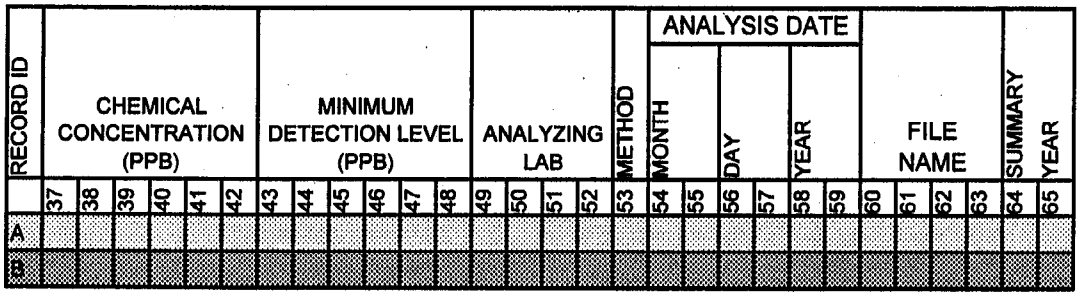
Column Number	Explanation of Database Record Fields
31-35	Chemical code: a minimum reporting requirement. Each chemical is assigned a five-digit alpha-numeric code which corresponds to the chemical codes used in the Pesticide Use Reporting System maintained by the Information Systems Branch of DPR. Codes 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 is endosulfan, B0259 is endosulfan sulfate. Pesticides that have not been registered for use in California are assigned sequential numbers preceded by the letter "U"; e.g., U0012 is 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 initial detection and confirmation 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 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: in house file designation.
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 –.

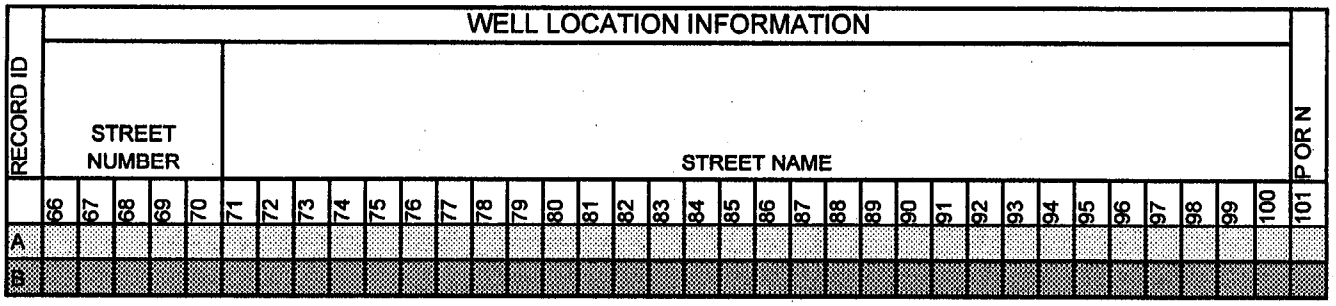
Column Number	Explanation of Database Record Fields
102-105	Well depth (in feet), as recorded on the well log.
106-108	Depth to top of perforation (in feet), as recorded on the well log.
109-112	Depth to bottom of perforation (in feet), as recorded on the well log; often corresponds to depth of completed 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, etc.
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.
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.

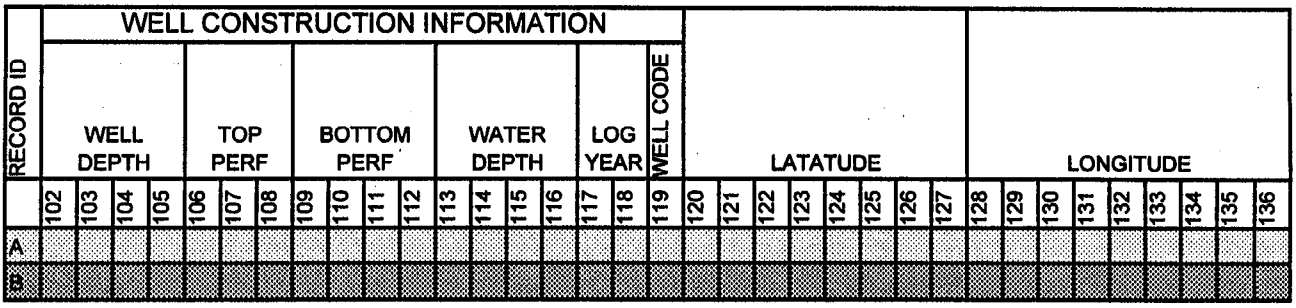
These 136 columns make up the data record. An additional 3 fields, using 12 columns, are used for in-house information and database indexing.

Figure F-2. Format of records in the well inventory data base









SECTION IV

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

PESTICIDE CONTAMINATION PREVENTION ACT
ANNUAL REPORT TO THE LEGISLATURE

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

A. SWRCB staff participated in the following activities:

1. Development of the Inland Surface Waters Plan and Enclosed Bays and Estuaries Plan. Staff participated in the Watershed Task Force which developed recommendations regarding watershed management. Pesticide-related issues were frequently addressed when (1) describing one of the primary purposes of watershed management as the control of nonpoint sources, (2) blending Management Agency Agreements (MAAs) with watershed management, (3) blending grass roots and regulatory approaches to watershed management, (4) describing a voluntary approach to allocating responsibility, in contrast to the Total Maximum Daily Load (TMDL) approach, and (5) explaining the relationship between watershed management and the Nonpoint Source Management Plan's three-tiered approach.

2. Development of recommendations by the Nonpoint Source Program's Technical Advisory Committees. The committees relevant to pesticide issues included Pesticides Management, Irrigated Agriculture, and Urban Runoff. Topics covered included the watershed management approach, education and technical assistance, information clearinghouse, interagency coordination, and financial assistance. Summarization of these recommendations and subsequent improvements in the program are currently under development.

3. Implementation of the Watershed Management Initiative. Pursuant to the Strategic Plan, staff has begun to mold many of the above pesticide related issues into a program for implementing watershed management.

4. Regular attendence at meetings sponsored by the Department of Pesticide Regulation (DPR), including the interagency Pesticide Advisory Committee (PAC), Pesticide Registration and Evaluation Committee (PREC), Pest Management Advisory Committee, the Interagency Coordinating Committee for Agricultural Regulatory Programs, and the Pesticide Bag Burning Work Group.

5. Discussions with U.S. Geological Survey scientists on studies dealing with pesticides and water quality.

6. In cooperation with DPR staff continued development of a schedule and outline for establishing the MAA that will further coordinate pesticide and water quality management activities and uphold the provisions of the Memorandum of Understanding (MOU) between the two agencies.

7. Participation in the workshop on pesticide contamination of ground water in California sponsored by the Environmental Health Policy Program of the University of California, Berkeley.

8. Submittal of a workplan to U.S. Environmental Protection Agency (U.S. EPA) pursuant to Section 106 of the Clean Water Act (CWA) for Federal Fiscal Year (FFY) 1995 funding for pesticides and ground water-related work.

9. Review on an ongoing basis of DPR Notices of "Materials Entering Evaluation" and advice to DPR on potential water quality impacts of pesticide registration and use decisions.

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

11. Co-sponsorship of the 20th Biennial Ground Water Conference.

B. RWQCB: Information on actions to prevent economic poisons from migrating to the ground waters of the State by each of the nine RWQCBs is listed in Tables 1 through 10.

Table IV-1. Actions taken by the Regional Water Quality Control Board, North Coast Region, (Region 1), In 1995.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Del Norte	Smith River Plains	Aldicarb, 1,2-D	Ongoing monitoring program.
Humboldt	U.S. Forest Service Nursery McKinleyville	Dithiocarbamate	USFS monitoring with RWQCB support.
	Blue Lake Forest Products	Pentachlorophenol, Tetrachlorophenol, Copper 8-Quinolinolate	State Superfund Site with ongoing assessment.
	Carlotta Lumber Company	Pentachlorophenol, Tetrachlorophenol	Ongoing contamination assessment and cleanup.
	Beaver Lumber Company, Arcata	Pentachlorophenol, Tetrachlorophenol	Contamination cleanup.
	Sun Valley Bulb Farms	Chlorothalonil, Dithiocarbamate, Oxamyl	Ongoing monitoring and assessment to prevent discharges to surface water and ground water is under RWQCB direction.
Mendocino	Marcel Peterson	Chlordane	Remediation underway; new well.
Siskiyou	Mount Heron	Strychnine	Source removal.
	Hi-Ridge Lumber Company	Pentachlorophenol, Tetrachlorophenol	Ongoing contamination assessment and cleanup.
	Pine Mountain Lumber Company	Pentachlorophenol, Tetrachlorophenol	Ongoing contamination assessment and cleanup.
Trinity	Stone Forest Industries, Burnt Ranch	Pentachlorophenol, Tetrachlorophenol	Ongoing contamination assessment.

Table IV-2. Actions Taken by the Regional Water Quality Control Board, San Francisco Bay Region (Region 2), In 1995.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Alameda	Parker & Amchem	2,4-D	Soil removal in September 1988 (work completed). Ground water monitoring ongoing. RWQCB Order. No. 91-079 specifies schedules for investigations and cleanup.
	Jones-Hamilton	Pentachlorophenol	RWQCB Order No. 89-110 specified time schedule for investigation/cleanup. Ground water cleanup underway.
	Port of Oakland (Embarcadero Cove)	Chlordane, Pentachlorophenol, DDT, Endosulfan, Chlordane, 2,3,7,8-TCDD, DDD	Department of Toxic Substances Control (DTSC) has lead and has approved a Remedial Action Plan including continuous ground water monitoring.
	Lincoln Properties (Orsetti Site)	DDE, 2,4-D	Alameda County Water District is the lead agency. Ground water cleanup underway.
	Peerless Southern Pacific Railroad	Pentachlorophenol	City of Berkeley Health Department has lead. Additional soil and ground water investigations required.
	FMC, Newark	EDB	RWQCB Order No. 89-055 specified time schedule for investigation and cleanup. Ground water cleanup underway.
	3830 Old Santa Rita Road, Pleasanton	Dicamba, Dichloroprop, 2,4-D, 2,4,5-T	Pesticide found in grab water samples. One monitoring well installed onsite. Alameda County Department of Environmental Health lead on this site. Site closed October 1990.
Contra Costa	Chevron	Endrin, Lindane, Dieldrin, DDT, Arsenic	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	U.S. Environmental Protection Agency (U.S. EPA) lead on-site cleanup. Workplan for dredging of affected sediments pending.
	FMC, Richmond	DDT, DDD, DDE, Dieldrin, Chlordane, Tedion, Endosulfan, Ethion, Carbophenothion, Heptachlor	DHS lead onsite cleanup. Cleanup completed. Monitor to assure remaining pollutants do not migrate.
Marin	Former Sonoma Mosquito Abatement District, San Rafael	5 monitoring wells on-site (U.S. EPA Method 8080). MW-1 detected DDD, DDE, DDT, and Dieldrin; MW-2 detected DDD, DDE, DDT; MW-3 detected DDD, DDE; DDT; MW-4 detected DDD; and MW-5 detected DDD and DDT.	DTSC or San Rafael Flood District is lead agency. Some soil removal has already taken place (approximately 3000 yd^3). MWs destroyed. DTSC asking for permanent multilayer clay cap and remediation or encapsulation of remaining soil plus a deed restriction. No response from Mosquito Abatement District to DTSC's request. DTSC not actively involved for several years due to funding issues.

Table IV-3. Actions Taken By the Regional Water Quality Control Board, Central Coast Region (Region 3), In 1995.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Monterey	Monterey SoilService, King City	EDB, 1,2-D, DDT, DBCP, Toxaphene	Remediation.
	NH_3 Service Company, Salinas	1,2-D	Remediation underway.
	WFS-Salinas	Dinoseb	Interim remediation.
	Castlerock Estates	Toxaphene, beta-BHC, delta- BHC, 4,4'-DDE, 4,4'-DDT, 4,4-DDE, 4,4-DDT, 4,4-DDD	Correct practices at pesticide applicator facility.
Santa Barbara	J.R. Simplot Inc., Guadalupe	Benzene, Toluene, Xylenes	Remediation underway.
Santa Clara	Castle-Veg-Tech, Morgan Hill	Toxaphene, Endrin, Lindane, Endosulfan	Remedial design.
Santa Cruz	PUREGRO, Watsonville	1,2-D	Remedial.
	WFS-Greengro, Watsonville	1,2-D, Endosulfan	Remedial design.
	WFS, Watsonville	DDT, DDD, Toxaphene	Remedial design.

Table IV-4. Actions Taken by the Regional Water Quality Control Board, Los Angeles Region (Region 4), In 1995.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Los Angeles	Dominquez Park Landfill, Redondo Beach	Bis (2-ethylhexyl) phthalate	Additional ground water monitoring was required. (No data received as of August 16, 1995.)
	Bixby Village Sanitary Landfill (City Dump Salvage No. 1), Long Beach	Aldrin, Beta-BHC, Alpha-BHC, Bis (2-ethlhexyl) phthalate, Delta-BHC, 4,4'-DDE, 4,4'-DDT, 1,4-Dichlorobenzene, Dieldrin, 2,4-Dinitrophenol, Endosulfan I, Endrin, Endrin aldehyde, Lindane, Heptachlor	Monitoring has not adequately demonstrated that the subject disposal site is not the source of pollutants and listed pesticides detected in ground water monitoring wells downgradient of the disposal site. Two additional semiannual sampling events must be performed for U.S. EPA Method 625. A workplan must be submitted to the RWQCB. Final report will be submitted by December 31, 1995. (No additional monitoring data received as of August 15, 1995.)
	Market Place Sanitary Landfill (City Dump Salvage No. 2), Long Beach	Alpha-BHC, Bis (2-ethylhexyl) phthalate, Delta-BHC, 4,4'-DDE, 4,4'-DDT, Endosulfan I, Lindane, Heptachlor	Monitoring has not adequately demonstrated that the subject disposal site is not the source of pollutants and listed pesticides detected in ground water monitoring wells downgradient of the disposal site. Two additional semiannual sampling events must be performed for U.S.EPA Method 625. A workplan must be submitted to the RWQCB. No additional monitoring data received as of August 15, 1995. Final report will be submitted by December 31, 1995.
	Studebaker-Loynes Sanitary Landfill (City Dump Salvage No. 3), Long Beach	Alpha-BHC, Bis (2-ethylhexyl) phthalate, 4,4'-DDD, 4,4'-DDE, Di-n-octyl-phthalate, Endosulfan I, Endosulfan II, Endrin, Lindane, Heptachlor	Monitoring has not adequately demonstrated that the subject disposal site is not the source of pollutants and listed pesticides detected in ground water monitoring wells downgradient of the disposal site. Two additional semiannual sampling events must be performed for U.S. EPA Method 625. A workplan must be submitted to the RWQCB. Final report will be submitted by December 31, 1995. (No additional monitoring data received as of August 15, 1995.)

Table IV-4 continued.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Los Angeles	Peter Pitchess Honor Rancho Landfill, Castaic Junction	Bis (2-ethylhexyl) phthalate	It appears that the subject landfills may have affected ground water in the vicinity with pesticide and other compounds. Two additional semiannual Solid Waste Assessment Test (SWAT) monitoring events were required. A workplan was also required. Received two additional SWAT monitoring events, with no defections.
	Royal Boulevard Land Reclamation Site, Torrance	Lindane, 1,3-Dichloropropene	The responsible party is monitoring ground water pursuant to their closure requirements. Semiannual data received, under review.
	Port Disposal Landfill, Wilmington	Bis (2-ethylhexyl) phthalate, Di-n-Octyl-phthalate	Chemical compounds were detected in excess of the regulatory levels, and the site was directed to submit a workplan to assess the nature and extent of the releases and to develop a corrective action program. (No data received as of August 16, 1995.)
	Port Disposal Banning Pit and Macco Pit, Wilmington	Bis (2-ethylhexyl) phthalate, Napthalene, Di-n-Butyl phathalate, 2-Methyl-naphthalene	Chemical compounds were detected in excess of the regulatory levels, and the site was directed to submit a workplan to assess the nature and extent of the releases and to develop a corrective action program. Received four more quarters of data as of August 16, 1995. Data under review.
	City of Compton Landfill	Di(2-ethylhexyl) phthalate (DEHP), Di-n-Octyl-phthalate	Two semiannual ground water monitoring events were required. (No data received as of August 16, 1995.)

Table IV-5. Actions Taken By The Regional Water Quality Control Board, Central Valley Region (Region 5 Sacramento), In 1995.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Colusa	Moore Aviation	Atrazine, 2,4,5-TP, 2,4-D, 2,4-Dichlorophenol, 4-Nitrophenol	Ground water remediation ongoing. Soils bioremediation appears to be nearing completion.
Merced	Merced Municipal Airport	1,2 Dichlorobenzene, 1,2 Dichloroethane, 1,2 Dichlorothane (cis), 1,2 Dichlorothane (trans), 1,3 Dichloropropane (cis), Alachlor, Benzene, Captan, Carbophenothion (trithion), Chloroform, DDT (total), Dicofol (Kethane), Dieldrin, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin aldehyde, Endrin ketone, Ethylbenzene, Heptachlor epoxide, Methoxychlor, Tetrachloroethylene (PCE), Toluene, Toxaphene, TPH-diesel, TPH-gasoline, Trichloroethylene (TCE), Vinyl chloride, Xylenes	Cleanup levels and remedial options being determined. Adjacent fire training area being assessed.
	J.R. Simplot, Winton	1,2-DCP, Dieldrin, Benefin, 1,2,3-TCP, DBCM, DBCP, Endrin, Alachlor	Cleanup and Abatement Order issued. Off-site monitoring wells installed.
	BAC Pritchard	Chromium, Arsenic, Copper	RWQCB Lead Agency. Ground water extraction and treatment system in pilot study period. Plume spreading due to ground water flow direction change. Working on enhancing reinjection with infiltration gallery.
Sacramento	Sacramento Army Depot	Diazinon, Dursban	Assessment report requested. Federal Superfund work in progress. Cleanup of pesticides completed.
	Natomas Field	Alachlor, Dicofol, DDE, DDT, Toxaphene, Gama-BHC, Dieldrin	Cleanup and Abatement Order required.
	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. For the last 4-5 years, no pesticides found in ground water.

Table IV-5 continued.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Sacramento	Bureau of Land Management, Fitzerald Ranch	Toxaphene	Buried empty pesticide containers found on land purchased by Bureau of Land Management. Soil excavated, ground water in pit contains toxaphene. Monitoring wells to be installed in 1995.
San Joaquin	Occidental Chemical	EDB, DBCP, Sulfolane, others suspected, but never detected.	Site remediation occurring pursuant to stipulation and judgement approving settlement (1981).
	Defense Depot, Tracy	Dieldrin, Simazine	Assessment ongoing as part of the site-wide remedial investigations. Draft Remedial Information Report complete.
	Sharpe Army Depot, Stockton	Bromacil	Assessment ongoing.
	Marley Cooling	Arsenic, Copper, Chromium	Ground water cleanup underway.
	U.S. Navy Communication Station	DDD, DDE	Assessment ongoing. Soil removal actions have occurred and more are planned. Ground water assessment to begin in 1996.
	Triple "E" Produce	Chloroform	Bioremediation began September 1993 and is ongoing. However, concentrations have increased in downgradient well, so ground water extraction and treatment is now proposed.
	Pure Gro/Brea Agricultural Service, Stockton	1,2-DCP, Chloroform, Dibromochloromethane	Soil and ground water investigation ongoing. Off-site plume definition underway.
	Former Oxychem/Simplot/ PureGro	DBCP, 1,2-DCP, 1,1-DCE, 1,2-DCA, Chlorobenzene, 1,1,2-TCA, Mevinphos, Fensulfothion, Dinoseb, Dicamba, 2,4,5-T, Atrazine, Monuron, Carbaryl, Carbofuran, Propham, Diuron, Propoxur	Site assessment ongoing.
	Cal Farm Supply	b-BHC, Dieldrin, Prometon, Simazine, Atrazine, 2,4,5-TP, Dinoseb	Soils cleaned up. Ground water investigation continues.
Solano	Wickes Forest Industries	Chromium (Cr^{3+} and Cr^{6+}), Arsenic, Copper	Ground water cleanup ongoing.
Stanislaus	Chemurgic Agricultural Chemicals	BHC, DDT	Ongoing monitoring. Revised Cleanup and Abatement Order issued in late 1993. Area with elevated BHC concentrations discovered in 1994. Considering soil excavation and ground water extraction and treatment.
	Geer Road Landfill	1,1-DCA, 1,1,1-TCA, TCE, Chloridazon, Freons	Ground water cleanup underway.

Table IV-5 continued.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Stanislaus	Rhone-Poulenc (formerly Union Carbide) Test Plots	Aldicarb	Monitoring has ended and wells were abandoned under the oversight of Stanislaus County Department of Environmental Resources. Site was closed in the spring of 1995.
	Shell Agricultural Research Facility	Bladex, Atrazine, Chloroform, Planavin, 1,1-DCE, DBCP, Nitrate	Additional ground water investigation ongoing.
	Valley Wood	Copper, Chromium, Arsenic	Out-of-court settlement. Federal Superfund site. Interim cleanup in progress.
Sutter	Bowles Flying Service	2,4-D, Bolero, Diuron, Metalaxyl, Ordram, Simazine	Assessment ongoing. Toxic Pits Cleanup Act (TPCA) site. Cease and Desist Order issued. U.S. EPA looking at this site.
Yolo	Frontier Fertilizer Company, Davis	EDB, DCP, DBCP, Carbon tetrachloride	DTSC installed interim ground water treatment system. U.S EPA expanded the system and is conducting an investigation to determine extent of plume.
	U.C. Davis	Chlorpyrifos, Dicamba, Atrazine, Aldrin, Simazine, Dieldrin, Endrin, DDT	Cleanup and Abatement Order issued. Additional assessment ongoing.
	J.R. Simplot, Courtland	EDB, 2,4-DB, Dicofol, Dicamba, 2,4,5-TP, Carbophenthion, DDT, Dieldrin, Dinoseb, Picloram	Cleanup and Abatement Order issued. Must complete final assessment before beginning remediation.

Table IV-6. Actions Taken By The Regional Water Quality Control Board, Central Valley Region (Region 5 Fresno), In 1995.

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.
	Occidental Chemical/J.R. Simplot	Dieldrin	Monitoring of ground water continues.
	FMC Corporation	Aldrin, Dieldrin, DDT, DDD, DDE, Heptachlor, Lindane, Toxaphene, Ethyl Parathion, Malathion, Ethion, Endosulfan, Dimethoate, Furadan, Dinitrocresol, Dinoseb (DNBP)	State Superfund site. Remedial investigation/feasibility study in progress. Interim ground water removal process began December 1994.
	Britz, Inc., Five Points	Toxaphene, DDT, DNBP	State Superfund site. Remedial investigation and health assessment report submitted. Soil and ground water remediation feasibility study also submitted. Additional contamination assessment ongoing.
	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.
	Coalinga Airport	DDT, Chlorpyrifos, DEF, Ethion, Disyston	Contamination assessment needed.
	Union Carbide Test Plot	Aldicarb	Additional contamination assessment needed.
	Spain Air	Ethion, DEF, Parathion, Trithion, Dinoseb, Paraquat, DDE, DDT, Endosulfan II	Assessment needed.
Kern	Brown & Bryant, Inc., Arvin	1,2-D, 1,3-D, DBCP, Dinoseb, EDB	Federal Superfund site. U.S. EPA has prepared Remedial Information Feasibility Study Report.
	Puregro Company, Bakersfield	DBCP	State Superfund site. Further assessment conducted. The waste discharge requirements for closure of a former dry well were issued March 1994.
	Guimarra Vineyard	DBCP	Contamination assessment and pond closure plan needed. (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 in 1993. TPCA site. Hydrogeological Assessment Report completed in 1993. Work in progress to determine extent of ground water degradation. Impoundment is covered.

Table IV-6 continued.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Kern	Wasco Airport	Aldrin, Lindane, Endrin, Chlordane, Methoxychlor, DDT, DDD, DDE, Thimet, Malathion, Methyl Parathion, Paraoxon, Disyston, Omite, Paraquat	Site closed with Chapter 15 cap in 1993. Waste Discharge Requirements also adopted in 1993.
	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 County Wells	DBCP, 1,2-D, EDB	Pesticides detected in 57 wells (AB 1803 sampling). No assessment underway.
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 two wells (AB 1803 sampling). No assessment underway.
	Western Farm Service, Inc.	Dinoseb, DBCP, Dieldrin	Assessment ongoing. Impoundment closed. Developing closure plan for soils.
	Madera Municipal Airport	DDT, DDE, Toxaphene, Dicofol, Endrin	Soil and ground water investigation underway.
Kings	Lemoore N.A.S.	Unspecified	Investigation ongoing.
	Blair Field	2,4-D, Dicofol, Diazinon, Propargite	Assessment needed.
	Blair Aviation	Trifluralin, Mevinphos, Phorate	Contamination assessment needed.
	Lakeland Dusters	DDT, Toxaphene	Contaminated soils excavated and stockpiled on site. Remediation underway.
Tulare	Mefford Field, City of Tulare	p,p'-DDT, p,p'-DDE, 2,4,5-TCP, 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	DHS Remedial Action Order issued January 1984. Cleanup ongoing.
	Tulare County Wells	1,2-D	Detected in wells through AB 1803 sampling. No assessment 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 IV-7. Actions Taken By The Regional Water Quality Control Board, Lahontan Region (Region 6), In 1995.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Inyo	Haiwee Reservoir	Copper sulfate	Potential for ground water contamination will be evaluated.

Table IV-8. Actions Taken By the Regional Water Quality Control Board, Colorado River Basin Region (Region 7), In 1995.

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.
	Stoker Company	Endosulfan I & II, Dinoseb, 2,4-DB	Land treatment facility undergoing closure.
	Ross Flying Service	4,4'-DDD, 4,4'-DDE 4,4'-DDT, Dieldrin	Closure of surface impoundment.
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. U.S. EPA has lead in cleanup.
	Foster Gardner, Inc., Coachella Facility	1,2-Dichloroethane, 1,2-D, Ethylene Dibromide	Cleanup and Abatement Order issued October 1991 by RWQCB. Imminent and Substantial Endangerment Order issued by DTSC on August 21, 1992.
	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	Undergoing cleanup.

Table IV-9. Actions Taken By The Regional Water Quality Control Board, Santa Ana Region (Region 8), In 1995.

There are currently 100 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 RWQCB. With the exception of this, all detections on this list are from domestic and agricultural production wells. Ninety eight of these wells contain dibromochloropropane (DBCP), four contain simazine, and one contains 1,2-dichloropropene (three 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 80 of the 97 wells containing DBCP are drinking water wells.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Orange	Great Lakes Chemical Corporation (formerly Great Western Savings), Irvine	1,2-D, EDB, 1,2-DCA	A new National Pollutant Discharge Elimination System (NPDES) permit was issued July 7, 1995. Ground water extraction and treatment continuing.
Riverside	Sunnymead Mutual Water Company (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 City Water District (Wells 2 & 3, mun.)	DBCP, Simazine	Water purveyor has closed these wells and is now purchasing water from City of 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, DBCP	Well is being used. Trace of DBCP was detected in March 1991 sampling.
	City of Riverside (Russell "B")	Simazine DBCP	Water is being blended with other supply wells in the area.

Table IV-9 continued.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Riverside	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 water is being blended with water from other supply wells; blended water is sampled on a bi-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 (3 wells, emergency, Downtown Riverside)	DBCP	No mitigation measures in effect. These three 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 Trichloroethylene and Perchloroethylene 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	Well is out of service.
	Home Gardens School (mun.)	DBCP	Well was abandoned about four 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 seven years ago. A second well on the property with traces of DBCP is being used for irrigation only.
San Bernardino	Gage System Wells (13 wells, mun.)	DBCP	The City of Riverside operates the Gage System which consists of 15 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 installed three deep wells in the area to increase blending capacity. New wells are in operation.
	Bunker Hill Basin: Crafton/Redlands area (36 wells)	DBCP	The City of Redlands started construction of a 6,000 gpm granular activated carbon (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 SWRCB ($2.8 million) and bond money through the State Expenditure Plan ($1.9 million) which is managed by DTSC. The system has been on line since May 1993.

Table IV-9 continued.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
San Bernardino	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.
	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 Metropolitan Water District (MWD).
	Monte Vista CWD (3 wells, mun.)	DBCP	All three wells are on standby status. Water is being purchased from MWD.
	City of Upland (14 wells)	DBCP	Ten 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. The City also purchases treated water from the City of San Bernardino.

Table IV-10. Actions Taken By The Regional Water Quality Control Board, San Diego Region (Region 9), In 1995.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
San Diego	City of Oceanside Water Utility District (Well No. 12-11S/ 4W-18L1 S)	1,2-DCP (1,2-Dicloropropane)	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 State's DHS.
	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. Trace levels still exist in ground water. No further monitoring required. (RWQCB lead)
	San Pasqual Valley Union School (three wells)	Ethylene dibromide	Three drinking water wells impacted with Ethylene dibromide above MCL. City of San Diego monitored the wells until last year, wells were washed out by flood in 1993.