

# **SAMPLING FOR PESTICIDE RESIDUES IN CALIFORNIA WELL WATER**

## **1993 Update Well Inventory Data Base**

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

Pursuant to the  
Pesticide Contamination Prevention Act



California Environmental Protection Agency  
**DEPARTMENT OF PESTICIDE REGULATION**

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**California Environmental Protection Agency**  
**DEPARTMENT OF PESTICIDE REGULATION**

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by

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## EXECUTIVE SUMMARY

### PURPOSE:

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

### BACKGROUND:

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

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

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

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

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

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

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

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

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

1. *Only data submitted to DPR between July 1, 1992 and June 30, 1993 are included and discussed in this report;*
2. *Data included in this report are not the results of a single study. Rather, they are the result of 46 studies, designed and conducted by eight agencies for varying purposes using different sampling and analytical methods;*
3. *Pesticide residue detections in the well inventory do not represent a complete survey of ground water contamination in the state. The detected compounds are limited to only those for which the sample was specifically analyzed. Therefore, the data indicate which pesticides are present in California well water among those pesticides for which analyses were carried out, but not among all pesticides used statewide;*
4. *Sampling by agencies other than DPR is not necessarily related to suspected agricultural non-point sources of contamination. Consequently, it should not be assumed that the reported results are an indication of which pesticides are more or less likely to leach to ground water as a result of non point-source agricultural use.*

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

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

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

## **METHODS:**

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

- 1. Sampling results were for the analyses of agricultural-use pesticides (see Glossary) or their breakdown products;*
- 2. Samples were taken from a well, i.e., from ground water, not surface water or soil;*
- 3. Samples were obtained from an untreated and unfiltered system;*
- 4. Location of each sampled well was identified by at least township/range/section according to the U.S. Geological Survey Public Lands Survey Coordinate system;*
- 5. Data had not been entered into the data base previously.*

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

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

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

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

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

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

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

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

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

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



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

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

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

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

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

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

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

A. SWRCB staff participated in the following activities:

1. Regularly attended meetings sponsored by DPR, including the interagency Pesticide Advisory Committee, Pesticide Registration and Evaluation Committee, State Environmental Hazards Assessment Committee, and the Interagency Coordinating Committee for Agricultural Regulatory Programs (ICCARP). The ICCARP, formed in 1993, will initially focus on identifying all regulatory programs for state and federal lands that impact the rice industry.
2. Conferred with U.S. Geological Survey scientists to discuss studies dealing with pesticides and water quality.
3. Initiated the development, in cooperation with DPR staff, of a schedule for establishing the Management Agency Agreement that will further coordinate pesticide and water quality management activities and uphold the provisions of the Memorandum of Understanding (MOU) between the two agencies.
4. Reviewed and commented on DPR's proposed amendments to regulations placing pesticides on the Ground Water Protection List and describing PMZs.

5. Prepared text summarizing the State and Regional Water Boards' responsibilities for two drafts of the State Ground Water Protection Plan for Pesticides being developed by DPR.
6. Submitted a workplan to U.S. Environmental Protection Agency pursuant to Section 106 of the Clean Water Act for Federal Fiscal Year 1994 funding for pesticides and ground water-related work.
7. Reviewed on an ongoing basis, DPR Notices of "Materials Entering Evaluation" and will advise DPR on potential water quality impacts of pesticide registration and use decisions.
8. Worked on adapting the Pesticide Use Retrieval System database queries of 1990 and 1991 pesticide usage in select watersheds within the State.

**B. RWQCBs:**

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