

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

**1992 Well Inventory
Data Base,
Cumulative Report 1986-1992**

Seventh 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**

Pete Wilson
Governor

James M. Strock
Secretary for Environmental Protection

James W. Wells
Director
Department of Pesticide Regulation

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by

DPR Portion: C. Miller Maes, M. Pepple, J. Troiano, D. Weaver, W. Kimaru

SWRCB Portion: Staff

California Environmental Protection Agency
Department of Pesticide Regulation
Environmental Monitoring and Pest Management Branch
Environmental Hazards Assessment Program
1220 N Street, Sacramento, California 95814

EXECUTIVE SUMMARY

PURPOSE:

The Pesticide Contamination Prevention Act (PCPA, see Appendix A, p. 90), requires that the Director of the Department of Pesticide Regulation (DPR) within the California Environmental Protection Agency maintain a statewide data base of wells sampled for pesticide active ingredients and that all agencies 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, including actions taken by the Regional Boards, to prevent pesticides from moving to ground water; and (3) factors contributing to the movement of pesticides to ground water.

BACKGROUND:

Prior to 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. Since then, well sampling programs have been conducted throughout California by numerous agencies and private firms.

The well inventory data base was developed by DPR (then a division of the California Department of Food and Agriculture) in 1983, prior to the enactment of the PCPA in 1986. 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, sampling results of both point sources (where the contaminant flows in a fairly distinct plume from an identifiable source) and non-point sources are now included in the data base.

This, the 1992 report, is the first cumulative report on the entire contents of the data base since the 1986 report (Brown, et al., 1986). A numerical summary of data contained in the data base by report year is in Table 1. A glossary of terms used in this report is in Appendix B (p. 103).

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

1. Only data submitted to DPR between November 1, 1983 and June 30, 1992 are included and discussed in the report. The results of monitoring surveys were not always submitted as they were completed. Some results were submitted up to eight years later.
2. Data included in this report are not the results of a single study. Rather, they are the result of 251 separate monitoring surveys, designed and conducted by 35 government agencies and three private firms from 1971 through 1992 for varying purposes;
3. Pesticide residue detections in the well inventory do not represent a complete survey of ground water contamination in the state. The detected compounds are limited to only those for which the sample was specifically analyzed. Some areas of the state have never been sampled; a few areas have been sampled many times. 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 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 for the results of ground water monitoring for pesticides, only California centralizes monitoring results from all sampling agencies into a single collection point on an ongoing basis.

Table 1. Numerical Summary of Records Contained in the Well Inventory Data Base, by Year of Report.

CATEGORY	REPORT YEAR							TOTAL
	1986	1987	1988	1989	1990	1991	1992	
Total Analyses	71,093	5,163	39,972	8,157	30,058	24,881	81,369	260,693
Positive Analyses (a)	5,091	1,133	527	674	837	700	3,497	12,459
Confirmed Analyses (b)	498	983	336	627	715	580	876	4,615
Wells Sampled	8,987	574	3,074	752	2,784	1,557	4,741	17,713 (c)
Wells Reported with Detections	2,404	257	283	209	234	206	756	3,697 (c)
Wells with Confirmed Detections	166	180	115	181	163	146	143	957 (c)
Counties Sampled	53	20	41	33	53	30	52	58 (c)
Counties with Wells	23	14	17	22	26	19	28	44 (c)
Reported with Detections								
Counties with Wells Having Confirmed Detections	18	12	14	20	15	16	17	36 (c)
Pesticides and Related Compounds Sampled For	160	79	167	96	191	186	125	273 (c)
Pesticides and Related Compounds Reported Detected	16	15	25	15	27	20	40	68 (c)
Pesticides and Related Compounds with Confirmed Detections	10	14	10	14	14	12	15	35 (c)
Pesticides and Related Compounds Detected in Ground Water as the Result of Legal, Agricultural Use(d)	9	8	1	7	6	7	5	12 (c)

(a) Confirmed and unconfirmed detections are included in the positive analyses.

(b) Positive sampling results are designated as confirmed if a specific compound was detected in at least two discrete samples taken from the same well during a single monitoring survey.

(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, for agricultural use as defined in Food and Agricultural Code Section 11408.

Sampling results contained in the well inventory data base can be used in 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 Act requires that the Director maintain a statewide data base of wells sampled for pesticide active ingredients. All sampling results reported to DPR were appraised 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 had to be identified by at least township/range/section according to the U.S. Geological Survey Public Lands Survey Coordinate system;
5. Data must not have been entered into the data base previously.

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

MAJOR FINDINGS, 1986-1992:

The results of 260,693 analyses of well water samples are included in the well inventory data base and are summarized and discussed in this report. The samples were taken during 251 separate ground water monitoring surveys submitted to DPR between November 1, 1983 and June 30, 1992. The surveys

were conducted by 35 government agencies and three private firms from 1971 through 1992. Overall, samples were taken from a total of 17,713 wells in all 58 counties and analyzed for one or more of 273 pesticide active ingredients and breakdown products.

The detection of 68 pesticides and related compounds in California well waters have been reported to DPR. Detections of 35 of the compounds in ground water were reported confirmed (i.e., the compound was detected in two discrete samples taken from a single well during the time period of a single monitoring survey). Pesticide residues were reported detected in 3,697 wells in 44 counties, and reported confirmed in a total of 957 wells in 36 counties. Compounds with confirmed detections were: alachlor; aldicarb; aldicarb sulfone; aldicarb sulfoxide; atrazine; bentazon; bromacil; carbon disulfide; chlorothalonil; chlorthal-dimethyl; 1,2-dichloropropane (1,2-D); 2,4-dichlorophenoxyacetic acid (2,4-D); 1,2-dibromo-3-chloropropane (DBCP); dichloro diphenyl trichloroethane (DDT); DDE (a breakdown product of DDT); diazinon; diuron; ethylene dibromide (EDB); endrin; molinate; molinate sulfoxide; monuron; naphthalene; ortho-dichlorobenzene; prometon; simazine; 2,4,5-trichlorophenoxyacetic acid (2,4,5-T); tebuthiuron; 1,1,2,2-tetrachloroethane; thiobencarb; toxaphene; 2,3,5,6-tetrachloroterephthalic acid (TPA, a breakdown product of chlorthal-dimethyl); 1,2,4-trichlorobenzene; trifluralin; and xylene.

Included in the 68 compounds reported detected were first-time detections of 14 compounds that were reported to DPR after the 1991 report was published: dicamba, 2,4-DP, ethylene dichloride, heptachlor and its breakdown product heptachlor epoxide, methoxychlor, methyl trithion, naphthalene, prometryn, propazine, 1,1,2,2-tetrachloroethane, tetrachloroethylene, thiobencarb, and 1,2,4-trichlorobenzene. Eight of these compounds are no longer registered for use in California and one is no longer registered for agricultural use; those detections have been reported to the SWRCB. Detections of the remaining five compounds are currently under investigation by DPR.

Also included in the 68 compounds reported detected are 22 other compounds, previously detected in other areas of California, that were reported with detections in new counties: alachlor, atrazine, bentazon, bromacil, carbon disulfide, chlorpyrifos, chlorthal-dimethyl, 1,2-D, 2,4-D, DBCP, diazinon, diuron, EDB, endrin, lindane, methyl bromide, ortho-dichlorobenzene,

prometon, silvex, simazine, toxaphene, and xylene. Seven of these compounds are no longer registered for use and have been reported to the SWRCB. Detections of the remaining 15 compounds are currently under investigation by DPR.

As specified by the PCPA, after an active ingredient of a pesticide has been detected in the ground waters of the state and the detection is verified by a second analytical method or a second analytical laboratory, the Director shall determine whether the pesticide reached ground water as a result of agricultural use in accordance with state and federal laws and regulations (i.e., legal, agricultural use).

Agricultural applications are considered by DPR to be the source of residues of 12 compounds detected in ground water: aldicarb sulfone, aldicarb sulfoxide, atrazine, bentazon, bromacil, 1,2-D, DBCP, diuron, EDB, prometon, simazine, and TPA.

Detections due to non-point source, legal agricultural use have been made in a total of 475 wells in 20 counties: Butte, Colusa, Contra Costa, Fresno, Glenn, Humboldt, Kern, Los Angeles, Merced, Orange, Placer, Riverside, Sacramento, Solano, Stanislaus, Sutter, Tehama, Tulare, Yolo, and Yuba.

Overall, simazine has been found most frequently (detected in 296 wells), atrazine and bentazon found in the most counties (10 each), and Tulare County has the largest number of wells (206) with detections resulting from legal, agricultural use.

Of the 12 compounds with detections attributed to agricultural applications, DBCP, EDB, and 1,2-D are no longer registered for use as active ingredients. Use of atrazine, bromacil, diuron, prometon, or 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 sensitive to ground water pollution.) Agricultural, outdoor institutional, and outdoor industrial uses of atrazine and prometon are prohibited within atrazine and prometon PMZs. Agricultural, outdoor institutional, and outdoor industrial uses of bromacil, diuron, and simazine

in non-crop areas and on rights-of-way are prohibited within bromacil, diuron, and simazine PMZs.

Regulations were adopted by DPR that prohibit the use of bentazon for the production of rice, limit bentazon use on other crops to non-irrigated or sprinkler-irrigated sites during April through July only, and prohibit the use of bentazon in Del Norte and Humboldt Counties.

Aldicarb had been used in the production of lily bulbs prior to 1983 in Del Norte County and prior to 1986 in Humboldt County when the use of aldicarb was prohibited in those counties following the detection of aldicarb or its breakdown products in ground water. Aldicarb and its breakdown products, aldicarb sulfone and aldicarb sulfoxide, were detected in Del Norte County. Aldicarb sulfone and aldicarb sulfoxide were detected in Humboldt County. Regulations were adopted by DPR to reduce the maximum rate of aldicarb that may be legally applied in other counties of the state and that prohibit the application of aldicarb from September 1 to March 1 of each year, during the time when rain is most likely, to further reduce the likelihood of aldicarb reaching ground water.

Although DPR's investigation suggests that the chlorthal-dimethyl metabolite TPA reached ground water as a result of agricultural use, TPA will not be regulated under the provisions of the PCPA. Degradation products of pesticides detected in ground water are reviewed through the AB 2021 detection response process when they pose a threat to public health and have migrated to ground water as a result of legal, agricultural use. At the request of DPR, the registrant of chlorthal-dimethyl submitted all available toxicology studies on TPA. After a review of the toxicological data, the Medical Toxicology Branch of DPR concluded that, at the levels detected in ground water, TPA does not pose a threat to public health. Therefore, TPA was not submitted into the AB 2021 detection response process.

SUMMARY, REPORT YEARS 1986-1992:

The well inventory data base contains information on the detection of 68 pesticides and related compounds in California well waters that was reported to DPR between November 1, 1983 and July 1, 1992. The data are from surveys

conducted in 1971 through 1992 by 35 government agencies and three private firms. The presence of 35 of the compounds in ground water was confirmed by a second, positive sample. Agricultural applications are considered by DPR to be the source of detections of 12 compounds in ground water: aldicarb sulfone, aldicarb sulfoxide, atrazine, bentazon, bromacil, 1,2-D, DBCP, diuron, EDB, prometon, simazine, and TPA.

DPR has taken the following actions between January 1, 1986 and June 30, 1992 to prevent pesticide contamination of ground water:

1. Adopted regulations to establish the Groundwater Protection List (GWPL) in Title 3, California Code of Regulations (3CCR) of pesticides that have the potential to pollute ground water. The GWPL is divided into two sublists: 6800(a) and 6800(b) (3CCR);

Pesticides with detections confirmed by approved verification methods in soil or ground water as a result of legal, agricultural use are placed in section 6800(a). Six pesticides are listed in this section: atrazine, bentazon, bromacil, diuron, prometon, and simazine. Pesticides listed in section 6800(b) of the GWPL have been identified as having the potential to leach to ground water because of (1) their physical and chemical properties and (2) language on their label allowing for their application to the soil. A total of 48 chemicals are listed in section 6800(b);

DPR has proposed regulations to add aldicarb to section 6800(a) and three additional pesticides to section 6800(b): chlorothalonil; 2,4-D, alkanolamine salts; and endothall;

2. Completed 118 agricultural use determinations for detections of 33 pesticide active ingredients and breakdown products. Other agricultural use determinations are currently in progress. As a result of the determinations, eight compounds have been identified as having been found in ground water as a result of legal, agricultural use: aldicarb sulfone, aldicarb sulfoxide, atrazine, bentazon, bromacil, diuron, prometon, and simazine. Atrazine, bentazon, bromacil, diuron, prometon, and simazine are listed in section 6800(a) of the GWPL;

Although agricultural applications of DBCP, EDB, and 1,2-D are considered by DPR to be the source of residues of those compounds that have been detected in ground water, they are not listed on the GWPL because they are no longer registered for use as active ingredients in California. Because levels of TPA detected in ground water were determined to not pose a threat to public health, pursuant to Food and Agricultural Code section 13149, TPA was not listed in section 6800(a) of the GWPL;

3. Adopted regulations to establish PMZs for the pesticides atrazine, bromacil, diuron, prometon, and/or simazine in one or more of the following counties: Contra Costa, Fresno, Glenn, Los Angeles, Merced, Orange, Riverside, Stanislaus, Tehama, and Tulare. DPR has

proposed regulations to establish additional PMZs in Kern, Placer, and Solano Counties, and to regulate the use of all 6800(a) compounds in all PMZs;

4. Adopted regulations designating pesticides containing active ingredients listed in section 6800(a) as restricted materials when labeled for agricultural, outdoor industrial, or outdoor institutional use, and requiring a permit for possession or use of such pesticides within a PMZ for that chemical. Permits are issued by county agricultural commissioners for the use of chemicals, at a specific site, that are restricted pesticides. Restricted pesticides, for various reasons, are potentially more hazardous than other pesticides. A groundwater protection advisory, written by a licensed pest control advisor who has completed the Groundwater Protection Training Program approved and administered by DPR, must be submitted to the county agricultural commissioner when applying for a permit to use a pesticide containing a chemical listed in section 6800(a) in a PMZ for that chemical;
5. Proposed regulations that would require a groundwater protection advisory, written by a licensed pest control advisor who has completed the Groundwater Protection Training Program approved and administered by DPR, be submitted to the county agricultural commissioner when applying for a permit to use a pesticide containing a chemical listed in section 6800(a) in any PMZ;
6. Adopted regulations that prohibit the use of the pesticide bentazon on rice, limit bentazon use on other crops to non-irrigated or sprinkler-irrigated sites during April through July only, and prohibit the use of bentazon in Del Norte and Humboldt Counties;
7. Adopted regulations that reduce the maximum rate of the pesticide aldicarb that may be legally applied to certain agricultural and ornamental crops. The regulations also prohibit the application of aldicarb from September 1 to March 1 of each year, during the time when rain is most likely, to further reduce the likelihood of aldicarb reaching ground water. DPR has proposed regulations that would list aldicarb in section 6800(a) as a pesticide that has been detected in ground water;
8. Adopted regulations that would allow chemicals listed in section 6800(a) of the GWPL to be used for research purposes in any area of the state authorized by the Director;
9. Conducted ground water monitoring surveys for pesticides in wells located in sections adjacent to PMZs, and for chemicals placed in section 6800(b) of the GWPL. Chemicals listed in 6800(b) have been identified as having the potential to leach to ground water because of (1) their physical and chemical properties and (2) language on their label allowing for their application to the soil;

Sampled wells for aldicarb residues in areas where aldicarb has been applied for agricultural use. Taken soil samples from a representative number of PMZs in order to determine compliance with regulations prohibiting or modifying use of pesticides within PMZs.

Actions taken by the SWRCB in 1992 to prevent pesticides from entering ground water included:

1. Participated on a regular basis in meetings of DPR's interagency Pesticide Advisory Committee, Pesticide Registration and Evaluation Committee, Pest Management Advisory Committee, and State Environmental Hazard Assessment Committee;
2. Reviewed the U.S. Environmental Protection Agency's (USEPA) July 1992 draft document "Pesticides State Management Plan Guidance for Ground Water Protection" and provided comments to DPR for a joint response to USEPA;
3. Met with U.S. Geological Survey scientists to discuss studies dealing with pesticides and ground water;
4. In cooperation with DPR, developing an Implementation Plan to implement the Memorandum of Understanding regarding pesticides and water quality which was approved by the two agencies;
5. Reviewed DPR's proposed amendments to regulations dealing with the GWPL and PMZs and provided comments to DPR;
6. Submitted a workplan to USEPA for Federal Fiscal Year 1993 funding for pesticides and ground water-related work pursuant to Section 106 of the Clean Water Act;
7. Reviewed DPR's notices of "Materials Entering Evaluation" on an ongoing basis and advised DPR on potential water quality impacts of pesticide registration and use decisions.

Actions taken by the nine Regional Water Quality Control Boards 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.

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 will be used to develop recommendations for pesticide use practices that will prevent ground water contamination by the agricultural use of pesticides.