# SAMPLING FOR PESTICIDE RESIDUES IN CALIFORNIA WELL WATER

*37th Annual Well Sampling Report | 2022 Update*

**California Environmental Protection Agency**
**Department of Pesticide Regulation**
**Environmental Monitoring Branch**
**Groundwater Protection Program**

**WIR37**

**August 2023**

California Department of Pesticide Regulation

## SUMMARY

As required by the Pesticide Contamination Prevention Act (PCPA) under Food and Agricultural Code (FAC) section 13152(e), this report summarizes the results of groundwater sampling in California for pesticide residues by the Department of Pesticide Regulation (DPR) and other agencies that reported their results to DPR. This 2022 annual Well Sampling Report (annual report) includes well sampling data from DPR, the State Water Resources Control Board (SWRCB), and the United States Geological Survey (USGS) for January through December 2021. Some of the USGS data are listed as preliminary and could be subject to change.

The report consists of background information, two main tables, multiple appendices, and a glossary. The background information includes steps DPR takes to implement the PCPA. Table 1 summarizes the well sampling data from all three agencies. Tables 2B–2E provide additional information about the specific pesticides or pesticide degradates with reported detections and identify actions taken by DPR to prevent migration of pesticides to groundwater from nonpoint agricultural sources. State and federal drinking water quality standards or health levels listed for each compound in Tables 2B–2E are defined in Table 2A. Appendix A describes how DPR creates Groundwater Protection Areas (GWPAs) and implements regulations to mitigate the movement of specific pesticides to groundwater. Appendix B explains the core functions of the three agencies contributing groundwater monitoring data for this report. Appendix C describes DPR's Well Inventory Database. Appendix D summarizes the well sampling results by county. [1]

A total of 5,195 wells were sampled for one or more of 196 pesticides or degradates (Table i).[2] Thirty-nine pesticides or degradates were detected; ten of the detected pesticides are not registered for use in California (e.g., detections from legacy pesticide use or non-pesticidal use) (Table 2E). For all three agencies, sampling data for 2021 increased over the previous year as the risks due to the COVID-19 pandemic were reduced and more monitoring was conducted.

[1] Although DPR is required to provide locations of sampled wells, information in the report is summarized by county to protect well owner privacy. DPR can provide additional location information—including township, range, and section—upon request or at: https://www.cdpr.ca.gov/docs/emon/grndwtr/well_inventory_database/index.htm.

[2] Some exceptions to the "agricultural use" status of sampled pesticides apply; some industrial use pesticides and pesticides that are no longer—or never were—registered for use in California are included due to the different monitoring goals of reporting agencies.

## Table i. Summary of well sampling results for the 2022 annual report

| Sampling Data Type | | DPR | SWRCB | USGS | Total[a] | Percent with Detections |
|---|---|---|---|---|---|---|
| | Pesticides & Degradates Sampled[b] | 65 | 110 | 93 | 196 | **19.9%** |
| | Pesticides & Degradates Detected | 16 | 15 | 20 | 39 | |
| | Wells Sampled[c] | 147 | 4,886 | 162 | 5,195 | **9.2%** |
| | Wells with Detections | 60 | 350 | 66 | 476 | |
| | Counties Sampled | 20 | 57 | 22 | 57 | **50.9%** |
| | Counties with Detections | 5 | 24 | 14 | 29 | |

a. "Total" reflects total *unique* values, not a summation of values for all three agencies. For example, of the 58 California counties, some counties are sampled by more than one agency, but some are not sampled at all. For the data collected in 2021, only Del Norte County was not sampled.
b. "Pesticides…Sampled" and "Pesticides…Detected" are the total number of pesticides sampled for or detected in groundwater regardless of the number of sampling events or detections that occurred during the reporting period.
c. "Wells Sampled" and "Wells with Detections" represent the total number of wells sampled or found to have pesticide residues regardless of the number of sampling events or detections that occurred during the reporting period.

## PREFACE

This report fulfills the requirements of the Pesticide Contamination Prevention Act of 1985 (PCPA), Assembly Bill (AB) 2701 of 2004, and Senate Bill 1117 of 2014. The PCPA originally required the Department of Pesticide Regulation (DPR) to submit groundwater sampling results for pesticide residues in an annual written report; AB 2701 amended the PCPA to require DPR to post the information on DPR's website.

## ACKNOWLEDGEMENTS

The authors wish to thank the reviewers whose unique perspectives and experiences helped ensure this report's accuracy and readability. We gratefully acknowledge DPR staff and cooperating federal, state, local, and private agencies for contributing to the database.

DPR's Groundwater Protection Program (GWPP) wishes to acknowledge Craig Nordmark for his contributions to the program and to this project. As a valued member of the GWPP for 30 years, Craig set the standard and expectation for outstanding stewardship of the Well Inventory Database and these annual reports by meticulously and dependably collecting and uploading data, maintaining the database, and reporting pesticide results for California's groundwater wells. He was also one of the GWPP's most dedicated monitoring staff. His influences on this project will be appreciated well beyond his retirement.

## DISCLAIMER

As required by the PCPA, this report describes the active ingredients of registered pesticide products that have been detected in groundwater. DPR provides this information to satisfy legal mandates and provide information to the public. Any discussion of commercially available pesticide products does not constitute an actual or implied endorsement of the products by DPR.

## GENERAL ABBREVIATIONS

| Abbreviation | Terminology |
|---|---|
| CAC | County Agricultural Commissioner |
| CALVUL | California Vulnerability Model |
| 3CCR | Title 3, California Code of Regulations |
| CDPH | California Department of Public Health |
| DDW | Division of Drinking Water |
| DPR | Department of Pesticide Regulation |
| DWEL | Drinking Water Equivalent Level |
| FAC | Food and Agricultural Code |
| GAMA | Groundwater Ambient Monitoring and Assessment Program |
| GWPA | Groundwater Protection Area |
| GWPL | Groundwater Protection List |
| GWPP | Groundwater Protection Program |
| HA | Health Advisory |
| HBSL | Health-Based Screening Level |
| HHBP | Human Health Benchmark for Pesticide |
| HHRL | Human Health Reference Level |
| LLNL | Lawrence Livermore National Laboratory |
| LEACHM | Leaching Estimation and Chemistry Model |
| MCL | Maximum Contaminant Level |
| MCLG | Maximum Contaminant Level Goal |
| nr | Parent pesticide is not currently registered in California |
| OEHHA | Office of Environmental Health Hazard Assessment |
| PCPA | Pesticide Contamination Prevention Act |
| PHC | Public Health Concentration |
| PHG | Public Health Goal |
| PMZ | Pesticide Management Zone |
| ppb | Parts per billion |
| REG | Parent pesticide is currently registered for use in California |
| RL | Reporting Limit |
| RMPP | Restricted Materials Permit Program |
| SNV | Specific Numerical Value |
| SL | Screening Level |
| SWRCB | State Water Resources Control Board |
| USEPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| WIR | Well Inventory Report |

## PESTICIDE ACRONYMS AND ABBREVIATIONS

| Acronym | Pesticide or Degradate |
|---|---|
| 1,2-DCP | 1,2-Dichloropropane |
| 1,3-D | 1,3-Dichloropropene |
| 2,4-D | 2,4-Dichlorophenoxy acetic acid |
| 2,4-DB | 4-(2,4-Dichlorophenoxy) butyric acid |
| 2,4,5-T | 2,4,5-Trichloro-phenoxy acetic acid |
| ACET | Deethyl-simazine or Deisopropyl-atrazine (degradate of atrazine and simazine) |
| BHC | Benzene hexachoride, unspecified isomers |
| DACT | Diaminochlorotriazine (degradate of simazine) |
| DBCP | 1,2-Dibromo-3-chloropropane |
| DCPA | Chlorthal-dimethyl |
| DDD | Dichloro diphenyl dichloro ethane (degradate of DDT) |
| DDE | Dichloro diphenyl dichloro ethylene (degradate of DDT) |
| DDT | Dichloro diphenyl trichloro ethane |
| DDVP | Dichlorvos |
| DEA | Deethyl-atrazine (degradate of atrazine) |
| DSMN | Desmethylnorflurazon (degradate of norflurazon) |
| EPTC | EPTAM or Ethyl N,N-dipropyl thiocarbamate |
| MCPA | 2-Methyl-4-chlorophenoxy acetic acid |
| PCNB | Pentachloronitrobenzene |
| PCP | Pentachlorophenol |
| P-DCB | 1,4-Dichlorobenzene |

## Contents

# BACKGROUND

## Protecting Groundwater from Pesticide Contamination — The PCPA

The California Department of Pesticide Regulation (DPR) began addressing pesticide contamination of groundwater in the early 1980s after the discovery of 1,2-dibromo-3-chloropropane (DBCP) in well water. Subsequent reports of pesticides in groundwater led to the passage of the Pesticide Contamination Prevention Act (PCPA) of 1985,[3] an act designed to prevent pesticide pollution[4] of groundwater by agricultural use[5] pesticides, with emphasis on the protection of public drinking water supplies.

The PCPA of 1985 added Article 15 (sections 13141–13152) to the Food and Agricultural Code (FAC). FAC section 13150 allows the continued sale and use of detected pesticides that were determined to pollute or threaten to pollute groundwater provided certain conditions for use have been met. DPR authorizes use modifications of these pesticides under the Restricted Materials Permit Program (RMPP) (Title 3, California Code of Regulations [3CCR] section 6400 et seq.), implemented by California's County Agricultural Commissioners (CACs). DPR continues to monitor for pesticides and degradates that were determined not to pollute at the levels detected.

The PCPA authorized the establishment of a program that identifies pesticides that have the potential to pollute groundwater.[6] Under this program, DPR is required to conduct groundwater monitoring for pesticides, maintain a database of wells sampled for pesticides, and conduct a formal review to determine if use of detected pesticides can continue as currently allowed, if modified use restrictions are necessary, or if all uses should be prohibited. **Figure 1** shows the major steps of the PCPA that the DPR follows to protect groundwater.

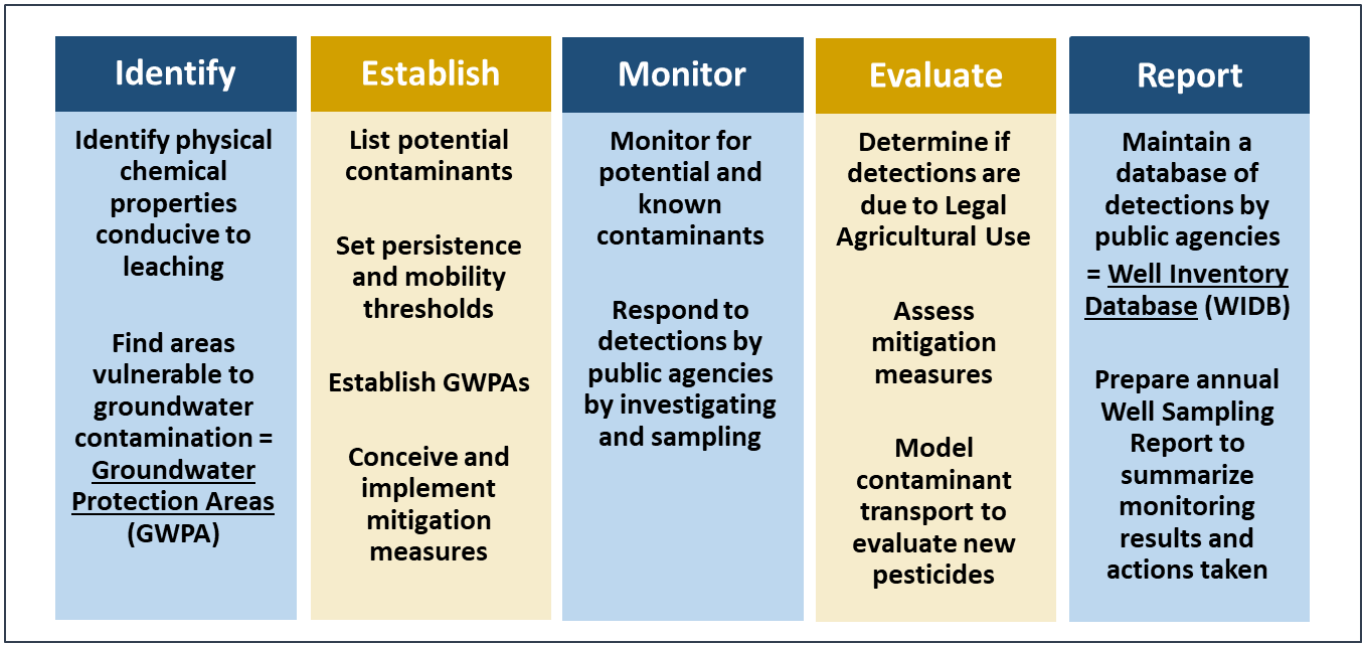
[3] The PCPA added sections 13141-13152 to the FAC. 3CCR sections 6416-6487.5 and 6800-6804 implement these FAC sections.

[4] FAC section 13142 defines "*pollution" as "*the consequence of polluting," and "*pollute*" as "…to introduce a pesticide product into the groundwaters of the state resulting in an active ingredient, other specified ingredient, or a degradation product of a pesticide above a level that does not cause adverse health effects, accounting for an adequate margin of safety."

[5] California's definition of "agricultural use" is broad and includes not only pesticides used in production agriculture, but also those used on turf (e.g., golf courses, cemeteries) and along rights-of-way.

[6] See DPR's Groundwater Protection Program.

**Figure 1. Five major steps to protect groundwater through the Pesticide Contamination Prevention Act (PCPA)**




To implement the PCPA, DPR:

- Obtains physical/chemical/environmental fate data from pesticide registrants to support the registration of agricultural use pesticides; maintains the data in DPR's Pesticide Chemistry Database (see Pesticide Data Index).

- Uses data in the Pesticide Chemistry Database to establish persistence and mobility threshold values called specific numerical values (SNVs)[7] and evaluates the groundwater pollution potential of agricultural use pesticides based (in part) on these values. **NOTE:** Senate Bill (SB) 1117 modified the process for determining pollution potential by requiring DPR to develop a peer-reviewed method[8] (in consultation with a subcommittee of the Director's Pesticide Registration and Evaluation Committee) to determine the potential of a pesticide to pollute groundwater using SNVs. Scientific peer review of this revised method has been completed and regulation development is underway.

[7] SNV threshold values for all parameters are listed in 3CCR section 6804.

[8] Peer review was conducted using the process described in section 57004 of the Health and Safety Code.

- Compiles the Groundwater Protection List (GWPL)[9] that includes agricultural use pesticide active ingredients, other specified ingredients, and degradation products that have the potential to pollute groundwater. Pesticides whose use has been modified following their detection in groundwater are added to 3CCR section 6800(a) of the GWPL.[10]

- Utilizes contaminant transport modeling tools to:
    - Evaluate the contamination potential of pesticides prior to their California registration;
    - Prioritize pesticides for monitoring; and
    - Define Groundwater Protection Areas (GWPAs).[11]

- Monitors for agricultural use pesticides on the GWPL and their degradates to determine if they have migrated to groundwater.

- Evaluates reported pesticide and degradate detections in groundwater, including those reported by other agencies.[12]

- Determines whether the detection of a pesticide in groundwater is the result of legal agricultural use[13] and, if so, conducts a formal review process to determine if the pesticide's use can continue as currently allowed, with modified use restrictions, or if all uses should be prohibited.

- Conducts ongoing groundwater monitoring of pesticides whose continued use has been modified to prevent pollution or that were determined not to pollute at the levels initially detected.

- Continuously reviews new science and data that could impact the validity of a finding that a pesticide has not polluted and does not threaten to pollute groundwater.[14]

---

[9] The GWPL (3CCR section 6800) is divided into two parts. Section 6800(a) includes seven chemicals that have been detected in groundwater and are regulated as groundwater contaminants with the potential to pollute: atrazine, bentazon, bromacil, diuron, norflurazon, prometon, and simazine. Section 6800(b) includes 98 chemicals that have the potential to become groundwater contaminants based on their mobility, persistence, and legal uses. SB 1117 requires DPR to *"…include on the GWPL each active ingredient, other specified ingredient, and degradation product of a pesticide that, when applied, has the potential to pollute groundwater."*

[10] Previously detected pesticides on the GWPL (3CCR section 6800[a]) that require use modifications include atrazine, bentazon, bromacil, diuron, norflurazon, prometon, and simazine.

[11] See Appendix A for more information on GWPAs.

[12] See Appendix B for a list of reporting agencies and a discussion of their role in the PCPA process.

[13] Legal agricultural uses include pesticide applications made in accordance with the registered pesticide label.

[14] Chlorthal-dimethyl (DCPA) degradates, hexazinone, imidacloprid, and metolachlor/S-metolachlor degradates were determined not to have polluted or threatened to pollute groundwater in the state, but continued monitoring of each was recommended (Leahy, 2017; Leahy, 2018; Henderson 2022; Reardon, 2011).

- Resubmits a pesticide to the formal review process or mitigates the threat if new evidence indicates that continued use of a previously reviewed pesticide threatens to pollute groundwater.

In addition, DPR:

- Maintains a database of pesticide detections in groundwater reported to DPR by local, county, state, and federal agencies.[15]

- Prepares an annual Well Sampling Report[16] that summarizes monitoring results and specifies actions taken by DPR in response to detections from nonpoint agricultural sources.

## Identifying Potential Groundwater Contaminants Under the PCPA

DPR developed several evaluation procedures to estimate a pesticide's potential to pollute groundwater. These procedures are described below.

### Using environmental fate data to predict pesticide behavior in the environment

The PCPA required DPR to establish threshold SNVs for six physical/chemical parameters presumed to be correlated to a pesticide's potential to leach to groundwater: water solubility, soil organic carbon coefficient (Koc), hydrolysis half-life, aerobic soil metabolism half-life, anaerobic soil metabolism half-life, and field dissipation half-life. Water solubility and Koc are indicators of mobility within the soil, while hydrolysis half-life, aerobic and anaerobic soil metabolism, and field dissipation are indicators of the persistence of the pesticide in soil.[17] A pesticide is predicted to have the potential to leach to groundwater if it is both mobile and persistent.

DPR developed threshold SNVs by evaluating nationwide groundwater studies and performing a statistical comparison of the physical/chemical attributes of pesticides detected in groundwater as a result of legal agricultural use (called leachers), and pesticides not detected (non-leachers). Analysis showed data for water solubility, hydrolysis half-life, Koc, and anaerobic soil metabolism half-life were significantly different for leachers and non-leachers (Johnson, 1991).[18] However, leacher and non-leacher aerobic soil metabolism data were not significantly different.[19]

---

[15] See Appendix C for more information on the Well Inventory Database.

[16] Annual Well Sampling Reports are located at: https://www.cdpr.ca.gov/docs/emon/grndwtr/wellinv/wirmain.htm.

[17] Although DPR has not established an SNV for field dissipation data, these data are used in modeling procedures to assess the leaching potential of new products proposed for registration.

[18] An evaluation of SNVs for these properties resulted in the identification of 90 percent of the chemicals detected in groundwater due to legal agricultural use.

[19] The PCPA requires DPR to establish an SNV for each physical/chemical parameter, but because soil metabolism half-life appears to be an ineffective predictor of a pesticide's groundwater contamination potential, the SNV for aerobic soil metabolism half-life is set at a value that minimizes its impact in the discrimination procedure.

After establishing threshold SNVs, DPR scientists used the physical/chemical data to characterize a pesticide's behavior in the environment. Pesticides that exceed at least one mobility SNV, one persistence SNV, and are applied under specific conditions are placed on the GWPL and monitored to determine if they have migrated to groundwater as a result of their legal agricultural use.

SB 1117 modified the process for estimating pollution potential by requiring DPR to develop a peer-reviewed SNV-based method in consultation with a subcommittee of the Director's Pesticide Registration and Evaluation Committee. Scientific peer review of this revised method has been completed and regulation development is underway.

### Using computer modeling tools to predict pesticide contamination potential

In addition to evaluating the contamination potential of agricultural use pesticides by comparing SNV values, DPR scientists use two computer models to predict pesticide behavior.[20]

- **LEACHM**, the ***leaching estimation and chemistry model*** (Hutson, 2003), is a pesticide fate and transport modeling tool used to evaluate leaching potential. The model enables DPR scientists to predict a pesticide's movement through the root zone of a leaching-vulnerable soil (Spurlock, 2000) and predict the occurrence and magnitude of well water concentrations based upon mobility and persistence data, label information, climate data, and label-recommended irrigation practices (Troiano and Clayton, 2009). If the pesticide is determined to be a potential groundwater contaminant following the evaluation, the registrant is required to take steps (e.g., amending the product label or committing to a stewardship program) to mitigate the potential threat to groundwater before DPR approves the pesticide for use in California. If mitigation is not possible, California registration is denied.

- **CALVUL**, *the* ***California vulnerability model***, is used to determine sections of land in California that are vulnerable to pesticide contamination based on soil type and depth-to-groundwater (Troiano et al., 2000). If pesticide use on a given section is deemed likely to result in groundwater contamination, the section is designated a GWPA.[21] Currently, only pesticides listed under 3CCR section 6800(a) are regulated within GWPAs.

## Monitoring for Pesticides — Prioritizing the Candidates

DPR ranks pesticides predicted to have the potential to contaminate groundwater to prioritize groundwater monitoring.[22] This ranking enables DPR to focus limited resources on pesticides that

[20] The data used in these models are maintained in DPR's Pesticide Chemistry Database. The database includes pesticide mobility and persistence data submitted by pesticide registrants.

[21] To use a pesticide regulated as a groundwater contaminant in a GWPA, users must obtain a Restricted Materials permit from their CAC. These permits specify the enforceable management practices required for use in each type of GWPA. For more information on GWPAs, see Appendix A.

[22] For more information on pesticide monitoring ranking, see *Selection of Pesticide Active Ingredients for Future Analytical Method Development and Ground Water Monitoring* (Clayton, 2011).

present the greatest contamination risk. DPR assigns the highest priority to California-registered agricultural use pesticides that are:

- On the GWPL;[23]
- Reported as detections in groundwater by public agencies (see Appendix B for a list of reporting agencies);
- Predicted to have a higher likelihood of contaminating groundwater based on computer-simulated transport modeling or based on a review of new science and data that indicate the pesticide could potentially pollute groundwater;
- Used intensively, or whose use is increasing; or
- Injected into the soil by ground-based application equipment, applied by chemigation, or followed by flood or furrow irrigation within 72 hours of application.

DPR also assigns a higher priority to pesticides that:

- Have been detected previously in California; or
- Have no monitoring history in California and have been detected in other states.

## Responding to Pesticide Detections in Groundwater

DPR conducts groundwater monitoring to confirm detections of agricultural use pesticides but does not conduct additional sampling if the detected pesticide is:

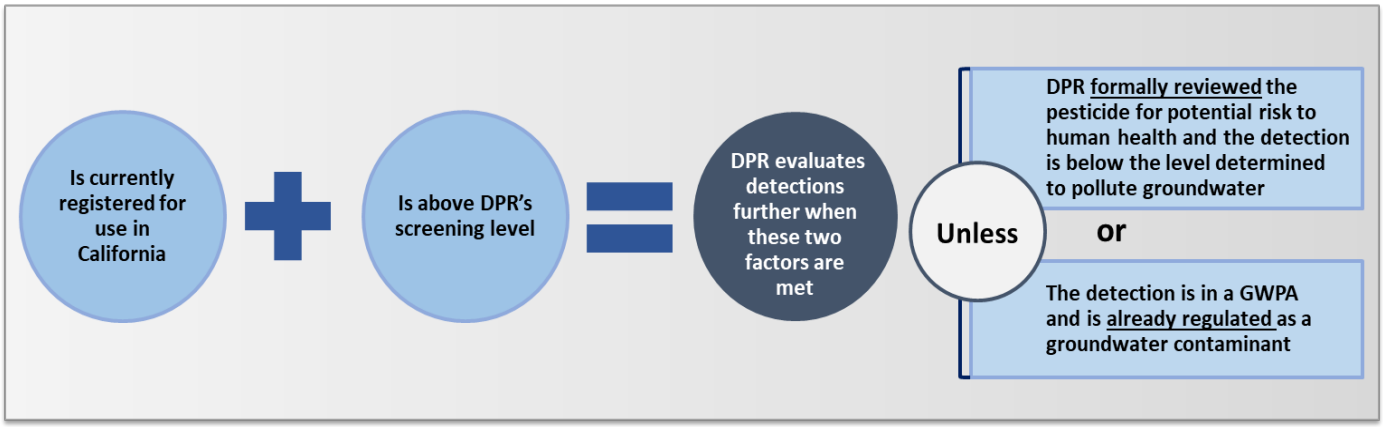
- Not registered for use as a pesticide in California (e.g., detections from legacy pesticide use or from non-pesticidal use);
- Reported in error or is an invalid detection due to unacceptable analytical quality;
- Not detected in follow-up samples taken by the reporting agency;
- Detected at a concentration below DPR's screening level (SL) (i.e., less than 70 percent of DPR's analytical reporting limit; the current SLs are included in Tables 2B-2D;[24]
- Regulated as a groundwater contaminant under 3CCR section 6800(a) and detected in a GWPA where use of the pesticide is regulated;
- Registered for use as a pesticide but also occurs naturally (such as copper); or
- Detected in a private well that DPR does not have permission to sample.

DPR will defer sampling and place a pesticide on a "watch list" if the pesticide was detected at a concentration below DPR's SL, or if DPR has not yet developed an analytical method that meets the requirements necessary to validate the detection. Figure 2 provides a simplified version of DPR's process for deciding when to conduct further evaluation.

[23] DPR samples groundwater for pesticides on the GWPL to 1) determine if pesticides identified as potential contaminants have migrated to groundwater as a result of their legal agricultural use; 2) expand GWPAs if regulated pesticides are detected in new sections; and 3) assess the effectiveness of mitigation measures used in GWPAs.

[24] DPR only responds to detections of pesticides over the SL (Tables 2B-2D) unless the drinking water quality standard (health advisory goal/standard) is lower. DPR's detection response policy is available upon request (Ganapathy, 2022).

**Figure 2. Simplified diagram of DPR's responses to all reported detections of currently registered pesticides or their degradates**




If groundwater detections of an active ingredient or its degradates are determined to originate from a pesticide's legal agricultural use, the findings are subject to a formal review process to determine if the pesticide's use can continue as currently allowed, with modified use restrictions, or if all uses should be prohibited.[25] If DPR determines that use can be modified to the extent that there is a high probability it will not pollute, DPR adds the pesticide to 3CCR section 6800(a) of the GWPL and requires applicators to adopt mitigation measures when applying the pesticide in GWPAs. Detections of agricultural use pesticides (or their degradates or other specified ingredients) that do not trigger the formal review process or are determined not to pollute are placed on a "watch list" and tracked by DPR for changes in detection concentration or frequency.

If a detected pesticide is added to the GWPL and regulated as a groundwater contaminant under 3CCR section 6800(a)—and the well is located within a GWPA—regulation of use under the RMPP constitutes an adequate DPR response to detections, unless concentrations are high enough to indicate existing mitigation measures are insufficient to prevent pollution. If the well is not located in a GWPA, DPR may establish a GWPA that includes the well site if: 1) the well is in a section of land that is adjacent to an existing GWPA, or 2) the pesticide is detected in two or more wells within a four-section area that is not adjacent to an existing GWPA. (For more information on GWPAs, see Appendix A.)

[25] Pesticides that have been subject to the formal review process include aldicarb (1988); atrazine (1986); bentazon (1989); bromacil (1986); chlorthal-dimethyl (DCPA) (2019); diuron (1986); hexazinone (2010); imidacloprid (2021); metolachlor/S-metolachlor (2016); norflurazon (1998); prometon (1986); and simazine (1986). Except for aldicarb, chlorthal-dimethyl (DCPA), hexazinone, imidacloprid, and metolachlor/S-metolachlor, DPR determined that agricultural use of these pesticides could be modified so that there is a high probability their continued use would not pollute groundwater. In 1988, statewide use restrictions were adopted for aldicarb. Chlorthal-dimethyl (DCPA) degradates, imidacloprid, hexazinone, and metolachlor/S-metolachlor degradates were determined not to have polluted or threatened to pollute groundwater in the state but continued monitoring of each was recommended (Leahy, 2017; Leahy, 2018; Henderson, 2022; Reardon, 2011). Another pesticide recently placed in the formal review process was alachlor (2016). The formal review of alachlor was suspended due to the imminent federal cancellation of all alachlor products which was published by USEPA in the Federal Register on 6/30/2016. As of 12/31/2016, all products containing alachlor previously registered for use in California were inactive.

### Areas of non-authorization

State law does not authorize DPR to regulate pesticide use when detections in groundwater result from manufacturing processes, accidental spills/releases, or illegal disposal; DPR refers these detections to SWRCB for further investigation.

## Assessing the Effectiveness of Mitigation Measures

In 1999, DPR established a well monitoring network to evaluate baseline pesticide concentrations to measure the effectiveness of groundwater protection regulations. Currently, DPR's well monitoring network includes about 60 shallow, domestic wells located in runoff and/or leaching GWPAs in Fresno and Tulare counties. Previous DPR analysis suggests that DPR's regulatory actions have resulted in measurable decreases in both detection frequencies and well water concentrations for many regulated pesticides (Davalos, 2021; Garretson, 1999; Troiano et al., 2013).

## SAMPLING RESULTS

### Detections of Pesticides and Related Degradates

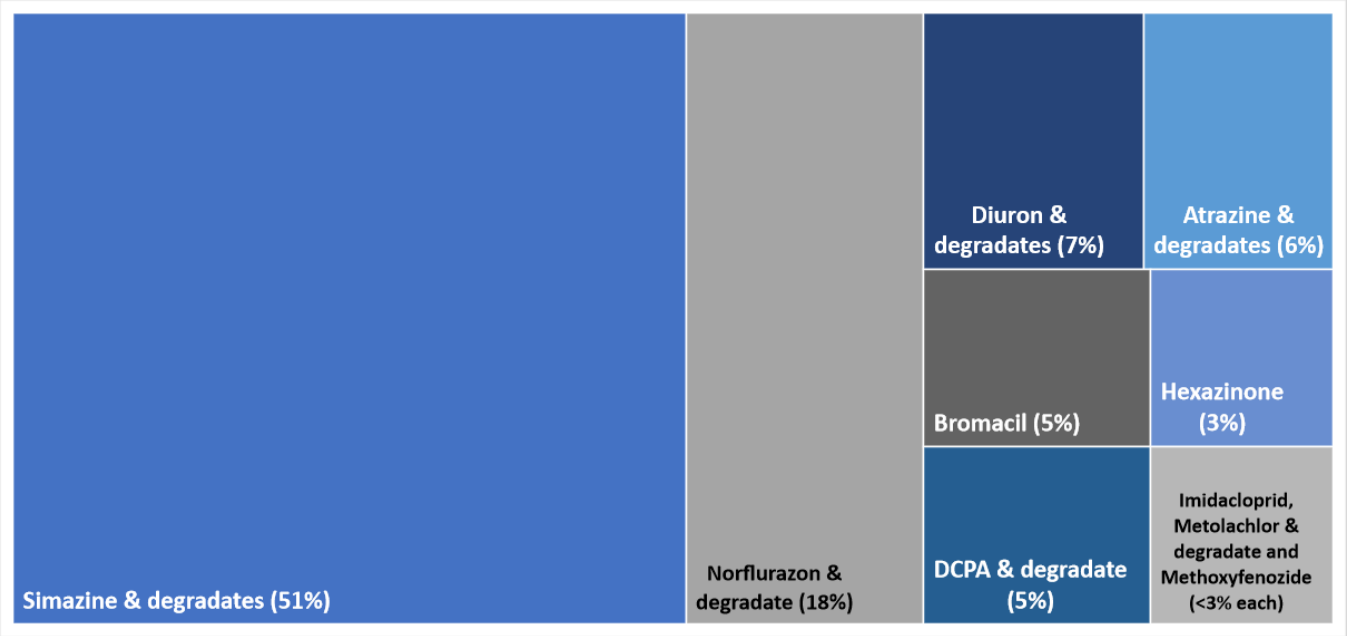
This 2022 annual report includes well sampling data from DPR, SWRCB, and USGS for the sampling period of January through December 2021. Some of the USGS data included in the annual report are listed as preliminary and could be subject to change. Table 1 consists of well sampling data from all three agencies.

The three agencies sampled a total of 5,195 wells for one or more of 196 pesticides or degradates. Of the wells sampled, 476 wells had reported detections of one or more pesticides or degradates. Thirty-nine pesticides or degradates were detected, ten of which are not registered for use in California (e.g., detections from legacy pesticide use or non-pesticidal use).

Sampling data were collected from wells in 57 counties; Del Norte County was not sampled by any agency during the period covered by the 2022 annual report. Twenty-nine counties had wells with detections. (See Appendix D for county sampling results.)

The following figure provides the top ten registered AIs and their degradates detected by all three agencies at or above the SL as a percent of the top ten (Figure 3).

**Figure 3. Top ten registered pesticides and their degradates with the most detections**



## Table 1. Summary of the well sampling results by pesticide or degradate

**Note:** Definitions of acronyms and abbreviations are available on pages v-vi.

**Reporting Limit Range:**

- **Zero (0) reporting limit** indicates no value was reported for at least some of the analyses.
- Some detection values listed in this table are below the reporting limit. Each reporting agency determines the value they will report regardless of "accepted" reporting limits. For instance, USGS may report *estimated values*, which can be below reporting limits.

**Detected Concentrations:**

- **Reported ranges of concentrations detected** are listed for pesticides or degradates (rows with detections are in **bold** for emphasis). Duplicate samples (samples taken from the same location on the same day) are not counted here, only the maximum concentration of the two samples is listed. Tables 2B–2E provide more information about the detections.
- **Dashes (-)** indicate no residues were detected.

**Parent Compound Registration Status:**

- **REG** indicates the parent pesticide is currently registered for use in California.
- **nr** indicates the parent pesticide is currently not registered for use in California (e.g., detections from legacy pesticide use or non-pesticidal use).

| Pesticide or Degradate | Positive Samples/ Samples Taken | Positive Wells/ Wells Sampled | Positive Counties/ Counties Sampled | Reporting Limit Range (ppb) | Detected Concentration Range (ppb) | Sampling Agencies | Parent Compound Registration Status |
|---|---|---|---|---|---|---|---|
| **1-Naphthol (degradate of carbaryl and naphthalene)** | **2/156** | **2/156** | **2/21** | **0 - 6** | **0.0043 - 0.0045** | **USGS** | **REG** |
| **1,2-DCP** | **73/6890** | **29/3508** | **11/57** | **0 - 2.5** | **0.0016 - 1.2** | **SWRCB USGS** | **nr** |
| 1,3-D | 0/6219 | 0/3206 | 0/57 | 0.5 | - | SWRCB | REG |
| 2-Ethyl-6-methylaniline (degradate of diuron) | 0/156 | 0/156 | 0/21 | 0 - 3.7 | - | USGS | REG |
| 2,4-D | 0/2026 | 0/1523 | 0/45 | 0.1 - 10 | - | SWRCB | REG |
| 2,4-DB | 0/310 | 0/240 | 0/23 | 2 - 10 | - | SWRCB | REG |
| 2,4-Dichlorophenol (degradate of 2,4-D) | 0/1 | 0/1 | 0/1 | 5 | - | SWRCB | REG |
| 2,4,5-T | 0/586 | 0/490 | 0/33 | 0 - 2 | - | SWRCB | nr |
| 2,4,6-Trichlorophenol | 0/1 | 0/1 | 0/1 | 5 | - | SWRCB | nr |
| 2,6-Diethylaniline (degradate of alachlor) | 0/156 | 0/156 | 0/21 | 0 - 0.026 | - | USGS | nr |
| **3,4-Dichloroaniline (degradate of diuron, linuron, propanil and iprodione)** | **4/156** | **4/156** | **3/21** | **0 - 4** | **0.0037 - 0.0066** | **USGS** | **REG** |
| **3,5-Dichloroaniline (degradate of dichloran)** | **4/156** | **4/156** | **3/21** | **0 - 4** | **0.003 - 0.023** | **USGS** | **REG** |
| 4-Chloro-ortho-cresol (degradate of MPCA) | 0/156 | 0/156 | 0/21 | 0 - 4 | - | USGS | REG |
| 4-Nitrophenol (degradate of parathion) | 0/1 | 0/1 | 0/1 | 5 | - | SWRCB | nr |

| Pesticide or Degradate | Positive Samples/ Samples Taken | Positive Wells/ Wells Sampled | Positive Counties/ Counties Sampled | Reporting Limit Range (ppb) | Detected Concentration Range (ppb) | Sampling Agencies | Parent Compound Registration Status |
|---|---|---|---|---|---|---|---|
| **ACET (degradate of atrazine and simazine)** | **49/150** | **46/147** | **2/20** | **0.03** | **0.036 - 0.776** | **DPR** | **REG** |
| Acetochlor | 0/462 | 0/286 | 0/23 | 0 - 2 | - | SWRCB USGS | nr |
| Acifluorfen | 0/280 | 0/188 | 0/20 | 0 - 1 | - | SWRCB | nr |
| Acrylonitrile | 0/42 | 0/36 | 0/8 | 0 - 5 | - | SWRCB USGS | nr |
| Alachlor | 0/3145 | 0/2351 | 0/50 | 0 - 1 | - | DPR SWRCB USGS | nr |
| Alachlor 2nd Amide (degradate of alachlor) | 0/156 | 0/156 | 0/21 | 0 - 3.7 | - | USGS | nr |
| Aldicarb | 0/982 | 0/819 | 0/36 | 0.5 - 3 | - | SWRCB | nr |
| Aldicarb sulfone (degradate of aldicarb) | 0/984 | 0/821 | 0/36 | 0.5 - 4 | - | SWRCB | nr |
| Aldicarb sulfoxide (degradate of aldicarb) | 0/971 | 0/808 | 0/36 | 0.5 - 3 | - | SWRCB | nr |
| Aldrin | 0/1082 | 0/741 | 0/32 | 0 - 0.1 | - | SWRCB | REG |
| Alpha-BHC | 0/239 | 0/151 | 0/8 | 0 - 0.05 | - | SWRCB | nr |
| Alpha-Chlordane | 0/147 | 0/106 | 0/14 | 0.05 - 0.097 | - | SWRCB | nr |
| Alpha-Endosulfan | 0/499 | 0/374 | 0/28 | 0 - 1 | - | SWRCB USGS | nr |
| Atraton | 0/20 | 0/17 | 0/5 | 0.097 - 0.5 | - | SWRCB | nr |
| **Atrazine** | **25/3566** | **25/2737** | **9/51** | **0 - 4** | **0.003 - 0.11** | **DPR SWRCB USGS** | **REG** |
| Azinphos-Methyl | 0/255 | 0/253 | 0/32 | 0 - 20 | - | DPR USGS | nr |
| Azinphos-Methyl oxygen analog (degradate of azinphos-methyl) | 0/156 | 0/156 | 0/21 | 0 - 4 | - | USGS | nr |
| Azoxystrobin | 0/99 | 0/97 | 0/19 | 0.02 | - | DPR | REG |
| Benefin | 0/156 | 0/156 | 0/21 | 0 - 20 | - | USGS | REG |
| Bensulfuron methyl | 0/27 | 0/27 | 0/4 | 0.05 | - | DPR | REG |
| Bensulide | 0/99 | 0/97 | 0/19 | 0.02 | - | DPR | REG |
| **Bentazon** | **1/1983** | **1/1482** | **1/43** | **0.5 - 2** | **3.2** | **SWRCB** | **REG** |
| Beta-BHC | 0/294 | 0/171 | 0/8 | 0 - 0.2 | - | SWRCB | nr |

| Pesticide or Degradate | Positive Samples/ Samples Taken | Positive Wells/ Wells Sampled | Positive Counties/ Counties Sampled | Reporting Limit Range (ppb) | Detected Concentration Range (ppb) | Sampling Agencies | Parent Compound Registration Status |
|---|---|---|---|---|---|---|---|
| Beta-Cypermethrin | 0/156 | 0/156 | 0/21 | 0 - 3.8 | - | USGS | nr |
| Bispyribac-Sodium | 0/27 | 0/27 | 0/4 | 0.05 | - | DPR | REG |
| **Bromacil** | **21/1191** | **17/898** | **3/39** | **0.02 - 10** | **0.026 - 5.02** | **DPR SWRCB** | **REG** |
| Butachlor | 0/1150 | 0/820 | 0/35 | 0.05 - 0.5 | - | SWRCB | nr |
| Captan | 0/45 | 0/42 | 0/3 | 0.1 | - | SWRCB | REG |
| Carbaryl | 0/1256 | 0/1080 | 0/42 | 0 - 5 | - | DPR SWRCB USGS | REG |
| Carbofuran | 0/1995 | 0/1610 | 0/48 | 0 - 20 | - | DPR SWRCB USGS | nr |
| **Carbon disulfide** | **7/1887** | **7/697** | **7/37** | **0 - 5** | **0.1 - 0.4** | **SWRCB USGS** | **nr** |
| Carbophenothion | 0/45 | 0/42 | 0/3 | 0.1 | - | SWRCB | nr |
| **Chlorantraniliprole** | **1/99** | **1/97** | **1/19** | **0.02** | **0.266** | **DPR** | **REG** |
| Chlordane | 0/1618 | 0/1134 | 0/39 | 0.05 - 0.1 | - | SWRCB | nr |
| **Chloropicrin** | **1/179** | **1/168** | **1/23** | **0 - 1** | **3.21** | **SWRCB USGS** | **REG** |
| Chlorothalonil | 0/395 | 0/235 | 0/18 | 0.05 - 6.5 | - | SWRCB | REG |
| Chlorpropham | 0/111 | 0/79 | 0/6 | 0.097 - 0.1 | - | SWRCB | REG |
| Chlorpyrifos | 0/251 | 0/214 | 0/24 | 0 - 1 | - | SWRCB USGS | REG |
| Chlorpyrifos oxon (degradate of chlorpyrifos) | 0/156 | 0/156 | 0/21 | 0 - 3.7 | - | USGS | REG |
| **Chlorthal-Dimethyl (DCPA)** | **1/169** | **1/168** | **1/22** | **0 - 20** | **0.0033** | **SWRCB USGS** | **REG** |
| Cis-1,3-Dichloropropene | 0/4703 | 0/2611 | 0/53 | 0 - 1 | - | SWRCB USGS | REG |
| Cis-Permethrin | 0/167 | 0/167 | 0/22 | 0 - 0.2 | - | SWRCB USGS | REG |
| Cis-Propiconazole | 0/156 | 0/156 | 0/21 | 0 - 0.1 | - | USGS | REG |
| Clomazone | 0/99 | 0/97 | 0/19 | 0.05 | - | DPR | REG |

| Pesticide or Degradate | Positive Samples/ Samples Taken | Positive Wells/ Wells Sampled | Positive Counties/ Counties Sampled | Reporting Limit Range (ppb) | Detected Concentration Range (ppb) | Sampling Agencies | Parent Compound Registration Status |
|---|---|---|---|---|---|---|---|
| Cyanazine | 0/239 | 0/221 | 0/22 | 0 - 150 | - | SWRCB USGS | REG |
| Cyfluthrin | 0/156 | 0/156 | 0/21 | 0 - 3.8 | - | USGS | REG |
| Cyprodinil | 0/99 | 0/97 | 0/19 | 0.02 | - | DPR | REG |
| **DACT (degradate of simazine)** | **51/150** | **48/147** | **2/20** | **0.05** | **0.052 - 5.937** | **DPR** | **REG** |
| Dalapon | 0/1940 | 0/1446 | 0/43 | 0.4 - 10 | - | SWRCB | nr |
| **DBCP** | **1192/4400** | **297/2482** | **14/48** | **0 - 0.1** | **0.004 - 0.93** | **SWRCB USGS** | **nr** |
| **DCPA degradates (non specific)** | **17/483** | **17/285** | **6/25** | **0.1 - 1** | **0.11 - 8.1** | **SWRCB** | **REG** |
| DDD (degradate of DDT) | 0/398 | 0/237 | 0/17 | 0 - 0.65 | - | SWRCB | nr |
| DDE (degradate of DDE) | 0/347 | 0/191 | 0/9 | 0 - 0.2 | - | SWRCB | nr |
| DDT | 0/394 | 0/233 | 0/15 | 0 - 0.11 | - | SWRCB | nr |
| DDVP | 0/249 | 0/212 | 0/24 | 0 - 0.097 | - | SWRCB USGS | REG |
| **DEA (degradate of atrazine)** | **40/306** | **40/303** | **9/32** | **0 - 5** | **0.004 - 0.251** | **DPR USGS** | **REG** |
| Delta-BHC | 0/395 | 0/235 | 0/15 | 0 - 0.2 | - | SWRCB | nr |
| Desulfinyl fipronil (degradate of fipronil) | 0/156 | 0/156 | 0/21 | 0 - 3.8 | - | USGS | REG |
| Desulfinyl fipronil amide (degradate of fipronil) | 0/156 | 0/156 | 0/21 | 0 - 3.8 | - | USGS | REG |
| Diazinon | 0/1034 | 0/864 | 0/41 | 0 - 12 | - | DPR SWRCB USGS | REG |
| Dicamba | 0/1272 | 0/918 | 0/37 | 0.1 - 1.5 | - | SWRCB | REG |
| Dichlobenil | 0/99 | 0/97 | 0/19 | 0.03 | - | DPR | REG |
| Dichloran | 0/99 | 0/97 | 0/19 | 0.05 | - | DPR | REG |
| Dichlorprop | 0/243 | 0/173 | 0/20 | 0.3 - 1 | - | SWRCB | nr |
| Dicrotophos | 0/156 | 0/156 | 0/21 | 0 - 0.08 | - | USGS | nr |
| Dieldrin | 0/1190 | 0/866 | 0/37 | 0 - 0.2 | - | SWRCB USGS | nr |
| Dimethenamid | 0/99 | 0/97 | 0/19 | 0.02 | - | DPR | REG |
| Dimethoate | 0/1350 | 0/1019 | 0/40 | 0 - 10 | - | DPR | REG |

| Pesticide or Degradate | Positive Samples/ Samples Taken | Positive Wells/ Wells Sampled | Positive Counties/ Counties Sampled | Reporting Limit Range (ppb) | Detected Concentration Range (ppb) | Sampling Agencies | Parent Compound Registration Status |
|---|---|---|---|---|---|---|---|
| | | | | | | SWRCB<br>USGS | |
| Dinoseb | 0/1983 | 0/1475 | 0/44 | 0.2 - 2 | - | SWRCB | nr |
| Diphenamid | 0/111 | 0/79 | 0/6 | 0.097 - 100 | - | SWRCB | nr |
| **Diquat dibromide** | **1/1800** | **1/1402** | **1/42** | **0.38 - 4** | **4** | **SWRCB** | **REG** |
| Disulfoton | 0/366 | 0/332 | 0/33 | 0 - 100 | - | DPR<br>SWRCB<br>USGS | nr |
| Disulfoton sulfone (degradate of disulfoton) | 0/156 | 0/156 | 0/21 | 0 - 3.8 | - | USGS | nr |
| **Diuron** | **21/152** | **21/149** | **2/20** | **0.02 - 0.1** | **0.02 - 0.068** | **DPR<br>SWRCB** | **REG** |
| **DSMN (degradate of norflurazon)** | **41/150** | **40/147** | **2/20** | **0.01** | **0.014 - 1.273** | **DPR** | **REG** |
| Endosulfan II | 0/343 | 0/218 | 0/14 | 0 - 0.2 | - | SWRCB | nr |
| Endosulfan sulfate (degradate of endosulfan) | 0/501 | 0/375 | 0/28 | 0 - 0.2 | - | SWRCB<br>USGS | nr |
| Endothall | 0/1629 | 0/1254 | 0/42 | 5 - 45 | - | SWRCB | REG |
| Endrin | 0/1848 | 0/1268 | 0/41 | 0 - 0.2 | - | SWRCB | nr |
| Endrin aldehyde (degradate of endrin) | 0/343 | 0/218 | 0/14 | 0 - 0.49 | - | SWRCB | nr |
| **EPTC** | **1/313** | **1/249** | **1/22** | **0 - 20** | **0.0322** | **SWRCB<br>USGS** | **REG** |
| Ethion | 0/157 | 0/157 | 0/22 | 0 - 20 | - | SWRCB<br>USGS | nr |
| Ethofumesate | 0/99 | 0/97 | 0/19 | 0.03 | - | DPR | REG |
| Ethoprop (prophos) | 0/255 | 0/253 | 0/32 | 0 - 0.24 | - | DPR<br>USGS | REG |
| **Ethylene dibromide** | **16/3748** | **5/2383** | **4/45** | **0 - 0.02** | **0.02 - 0.09** | **SWRCB<br>USGS** | **nr** |
| **Ethylene dichloride** | **106/7100** | **14/3511** | **3/57** | **0 - 0.95** | **0.04 - 3.4** | **SWRCB<br>USGS** | **nr** |
| Fenamiphos | 0/255 | 0/253 | 0/32 | 0 - 3.8 | - | DPR<br>USGS | nr |
| Fenamiphos sulfone (degradate of fenamiphos) | 0/156 | 0/156 | 0/21 | 0 - 3.8 | - | USGS | nr |

| Pesticide or Degradate | Positive Samples/ Samples Taken | Positive Wells/ Wells Sampled | Positive Counties/ Counties Sampled | Reporting Limit Range (ppb) | Detected Concentration Range (ppb) | Sampling Agencies | Parent Compound Registration Status |
|---|---|---|---|---|---|---|---|
| Fenamiphos sulfoxide (degradate of fenamiphos) | 0/150 | 0/150 | 0/21 | 0 - 0.04 | - | USGS | nr |
| Fipronil | 0/156 | 0/156 | 0/21 | 0 - 3.8 | - | USGS | REG |
| Fipronil sulfide (degradate of fipronil) | 0/156 | 0/156 | 0/21 | 0 - 3.8 | - | USGS | REG |
| Fipronil sulfone (degradate of fipronil) | 0/156 | 0/156 | 0/21 | 0 - 3.8 | - | USGS | REG |
| **Fludioxonil** | **1/99** | **1/97** | **1/19** | **0.03** | **0.316** | **DPR** | **REG** |
| **Flutriafol** | **1/99** | **1/97** | **1/19** | **0.02** | **0.226** | **DPR** | **REG** |
| Fonofos | 0/255 | 0/253 | 0/32 | 0 - 5 | - | DPR USGS | nr |
| **Formaldehyde** | **3/47** | **3/14** | **1/6** | **0 - 2.0** | **3.2 - 9.8** | **SWRCB** | **nr** |
| Gamma-Chlordane | 0/147 | 0/106 | 0/14 | 0.05 - 0.097 | - | SWRCB | nr |
| Glyphosate | 0/1496 | 0/1124 | 0/43 | 5 - 25 | - | SWRCB | REG |
| Halosulfuron-Methyl | 0/27 | 0/27 | 0/4 | 0.05 | - | DPR | REG |
| Heptachlor | 0/1736 | 0/1207 | 0/39 | 0 - 0.01 | - | SWRCB | nr |
| Heptachlor epoxide (degradate of heptachlor) | 0/1739 | 0/1208 | 0/39 | 0 - 0.01 | - | SWRCB | nr |
| Hexachlorobenzene | 0/1867 | 0/1281 | 0/40 | 0.01 - 0.65 | - | SWRCB | nr |
| **Hexazinone** | **8/306** | **8/303** | **6/32** | **0 - 5** | **0.007 - 0.043** | **DPR USGS** | **REG** |
| Hydroxycarbofuran (degradate of carbofuran) | 0/983 | 0/820 | 0/36 | 0.5 - 3 | - | SWRCB | nr |
| **Imidacloprid** | **6/99** | **6/97** | **1/19** | **0.02** | **0.024 - 0.126** | **DPR** | **REG** |
| Iprodione | 0/156 | 0/156 | 0/21 | 0 - 3.8 | - | USGS | REG |
| Isofenphos | 0/156 | 0/156 | 0/21 | 0 - 0.04 | - | USGS | nr |
| Isoxaben | 0/99 | 0/97 | 0/19 | 0.02 | - | DPR | REG |
| Lambda-Cyhalothrin | 0/156 | 0/156 | 0/21 | 0 - 0.2 | - | USGS | REG |
| Lindane (gamma-BHC) | 0/1907 | 0/1286 | 0/41 | 0 - 0.2 | - | SWRCB | nr |
| Linuron | 0/99 | 0/97 | 0/19 | 0.02 | - | DPR | REG |
| Malaoxon (degradate of malathion) | 0/156 | 0/156 | 0/21 | 0 | - | USGS | REG |
| Malathion | 0/394 | 0/337 | 0/33 | 0 - 0.12 | - | DPR SWRCB USGS | REG |
| MCPA | 0/30 | 0/30 | 0/6 | 0.05 - 10 | - | DPR SWRCB | REG |
| Mecoprop | 0/1 | 0/1 | 0/1 | 10 | - | SWRCB | REG |

| Pesticide or Degradate | Positive Samples/ Samples Taken | Positive Wells/ Wells Sampled | Positive Counties/ Counties Sampled | Reporting Limit Range (ppb) | Detected Concentration Range (ppb) | Sampling Agencies | Parent Compound Registration Status |
|---|---|---|---|---|---|---|---|
| Metalaxyl/Mefenoxam | 0/255 | 0/253 | 0/32 | 0 - 0.04 | - | DPR USGS | REG |
| Methidathion | 0/156 | 0/156 | 0/21 | 0 - 0.2 | - | USGS | nr |
| Methiocarb | 0/538 | 0/441 | 0/35 | 0 - 5 | - | DPR SWRCB | REG |
| Methomyl | 0/1083 | 0/918 | 0/40 | 0.02 - 2 | - | DPR SWRCB | REG |
| **Methoxychlor** | **1/1900** | **1/1287** | **1/42** | **0 - 13** | **0.017** | **SWRCB** | **nr** |
| **Methoxyfenozide** | **5/99** | **5/97** | **2/19** | **0.03** | **0.033 - 0.201** | **DPR** | **REG** |
| Methyl bromide | 0/3817 | 0/1989 | 0/50 | 0 - 0.5 | - | SWRCB USGS | REG |
| Methyl iodide | 0/1 | 0/1 | 0/1 | 0 | - | USGS | nr |
| Methyl paraoxon (degradate of methyl parathion) | 0/156 | 0/156 | 0/21 | 0 - 0.04 | - | USGS | nr |
| Methyl parathion | 0/446 | 0/352 | 0/33 | 0 - 0.5 | - | DPR SWRCB USGS | nr |
| **Metolachlor** | **3/1355** | **3/1060** | **2/41** | **0 - 10** | **0.006 - 0.104** | **DPR SWRCB USGS** | **REG** |
| Metribuzin | 0/1348 | 0/1053 | 0/40 | 0 - 0.5 | - | DPR SWRCB USGS | REG |
| **Molinate** | **1/2476** | **1/1852** | **1/49** | **0 - 20** | **7** | **DPR SWRCB USGS** | **nr** |
| Myclobutanil | 0/156 | 0/156 | 0/21 | 0 - 0.2 | - | USGS | REG |
| Napropamide | 0/99 | 0/97 | 0/19 | 0.02 | - | DPR | REG |
| **Norflurazon** | **19/150** | **18/147** | **2/20** | **0.02** | **0.02 - 0.679** | **DPR** | **REG** |
| **Ortho-dichlorobenzene** | **5/6888** | **3/3505** | **3/57** | **0 - 0.5** | **0.015 - 2.1** | **SWRCB USGS** | **nr** |
| Orthosulfamuron | 0/27 | 0/27 | 0/4 | 0.05 | - | DPR | REG |
| Oryzalin | 0/99 | 0/97 | 0/19 | 0.05 | - | DPR | REG |

| Pesticide or Degradate | Positive Samples/ Samples Taken | Positive Wells/ Wells Sampled | Positive Counties/ Counties Sampled | Reporting Limit Range (ppb) | Detected Concentration Range (ppb) | Sampling Agencies | Parent Compound Registration Status |
|---|---|---|---|---|---|---|---|
| Oxamyl | 0/1735 | 0/1354 | 0/42 | 0.5 - 20 | - | SWRCB | REG |
| Oxyfluorfen | 0/156 | 0/156 | 0/21 | 0 - 0.2 | - | USGS | REG |
| **P-DCB** | **3/6892** | **1/3507** | **1/57** | **0 - 0.5** | **0.94 - 2.3** | **SWRCB USGS** | **REG** |
| Para-Chloro-meta-cresol | 0/1 | 0/1 | 0/1 | 5 | - | SWRCB | REG |
| Paraquat dichloride | 0/177 | 0/147 | 0/24 | 0.4 - 20 | - | SWRCB | REG |
| Parathion or ethyl parathion | 0/238 | 0/181 | 0/20 | 0 - 0.03 | - | DPR SWRCB | nr |
| PCP | 0/2113 | 0/1544 | 0/42 | 0.04 - 1 | - | SWRCB | nr |
| PCNB | 0/7 | 0/7 | 0/2 | 0.1 - 0.49 | - | SWRCB | REG |
| Pendimethalin | 0/155 | 0/155 | 0/21 | 0 - 20 | - | USGS | REG |
| Penoxsulam | 0/27 | 0/27 | 0/4 | 0.05 | - | DPR | REG |
| Phorate | 0/255 | 0/253 | 0/32 | 0 - 20 | - | DPR USGS | REG |
| Phoratoxon (degradate of phorate) | 0/156 | 0/156 | 0/21 | 0 - 0.04 | - | USGS | REG |
| Phosmet | 0/156 | 0/156 | 0/21 | 0 - 0.2 | - | USGS | REG |
| Phosmetoxon (degradate of phosmet) | 0/152 | 0/152 | 0/21 | 0 - 3.8 | - | USGS | REG |
| Picloram | 0/1944 | 0/1450 | 0/43 | 0.1 - 1 | - | SWRCB | nr |
| Piperonyl butoxide | 0/99 | 0/97 | 0/19 | 0.03 | - | DPR | REG |
| **Prometon** | **3/406** | **3/382** | **3/33** | **0 - 5** | **0.006 - 0.075** | **DPR SWRCB USGS** | **REG** |
| Prometryn | 0/591 | 0/526 | 0/39 | 0 - 5 | - | DPR SWRCB USGS | REG |
| Propachlor | 0/992 | 0/781 | 0/32 | 0.05 - 0.65 | - | SWRCB | nr |
| Propanil | 0/255 | 0/253 | 0/32 | 0 - 0.177 | - | DPR USGS | REG |
| Propargite | 0/156 | 0/156 | 0/21 | 0 - 0.042 | - | USGS | REG |
| Propiconazole | 0/99 | 0/97 | 0/19 | 0.02 - 0.05 | - | DPR | REG |
| Propoxur | 0/396 | 0/316 | 0/29 | 0 - 5 | - | SWRCB | REG |
| Propyzamide | 0/156 | 0/156 | 0/21 | 0 - 0.24 | - | USGS | REG |

| Pesticide or Degradate | Positive Samples/ Samples Taken | Positive Wells/ Wells Sampled | Positive Counties/ Counties Sampled | Reporting Limit Range (ppb) | Detected Concentration Range (ppb) | Sampling Agencies | Parent Compound Registration Status |
|---|---|---|---|---|---|---|---|
| Pyraclostrobin | 0/99 | 0/97 | 0/19 | 0.02 | - | DPR | REG |
| Secbumeton | 0/6 | 0/6 | 0/3 | 0.5 | - | SWRCB | nr |
| Silvex | 0/1919 | 0/1437 | 0/43 | 0.07 - 1 | - | SWRCB | nr |
| **Simazine** | **94/3593** | **90/2763** | **11/50** | **0 - 5** | **0.003 - 0.14** | **DPR SWRCB USGS** | **REG** |
| **Tebuthiuron** | **1/255** | **1/253** | **1/32** | **0 - 0.24** | **0.017** | **DPR USGS** | **REG** |
| **Tefluthrin** | **2/156** | **2/156** | **2/21** | **0 - 0.2** | **0.004 - 0.005** | **USGS** | **nr** |
| Terbacil | 0/204 | 0/134 | 0/12 | 0.097 - 2 | - | SWRCB | nr |
| Terbufos | 0/156 | 0/156 | 0/21 | 0 - 0.24 | - | USGS | nr |
| Terbufos oxon sulfone (degradate of terbufos) | 0/156 | 0/156 | 0/21 | 0 - 3.8 | - | USGS | nr |
| Terbuthylazine | 0/156 | 0/156 | 0/21 | 0 - 0.08 | - | USGS | REG |
| Terbutryn | 0/20 | 0/17 | 0/5 | 0.097 - 0.5 | - | SWRCB | REG |
| Tetrachloroethane | 0/6717 | 0/3340 | 0/57 | 0.5 | - | SWRCB | nr |
| Thiamethoxam | 0/99 | 0/97 | 0/19 | 0.02 | - | DPR | REG |
| Thiobencarb | 0/2827 | 0/2082 | 0/49 | 0 - 1 | - | DPR SWRCB USGS | REG |
| Toxaphene | 0/1631 | 0/1144 | 0/39 | 0.5 - 1.3 | - | SWRCB | nr |
| Trans-1,3-Dichloropropene | 0/4736 | 0/2645 | 0/54 | 0 - 0.5 | - | SWRCB USGS | REG |
| Trans-Nonachlor (component of chlordane) | 0/145 | 0/105 | 0/13 | 0.05 - 0.097 | - | SWRCB | nr |
| Trans-Permethrin | 0/11 | 0/11 | 0/1 | 0.2 | - | SWRCB | REG |
| Trans-Propiconazole | 0/156 | 0/156 | 0/21 | 0 - 0.1 | - | USGS | REG |
| Triallate | 0/99 | 0/97 | 0/19 | 0.03 | - | DPR | REG |
| Tribufos | 0/156 | 0/156 | 0/21 | 0 - 0.04 | - | USGS | REG |
| Triclopyr | 0/27 | 0/27 | 0/4 | 0.05 | - | DPR | REG |
| **Trifluralin** | **2/389** | **2/326** | **2/31** | **0 - 1** | **0.002 - 0.005** | **SWRCB USGS** | **REG** |
| Uniconazole | 0/71 | 0/69 | 0/17 | 0.05 | - | DPR | REG |

## DPR Responses to Pesticide Detections

As required under the PCPA (FAC section 13152[e][4]), this section of the annual report describes DPR's responses to the pesticide and degradate detections in groundwater by DPR, SWRCB, and USGS (Tables 2A–2E). Responses to pesticide detections in California vary based on several factors described in the Background section of the report, including recently lowering the reporting limits for analysis and updating the SL for detections. If DPR's contract laboratories do not have a method available for registered pesticides or degradates, DPR sets the SL at 0.035 ppb and adds those that exceed the SL to the "watch list". The current SLs are included in Tables 2B–2D.

The following sub-sections and tables provide information on the groundwater detection response and drinking water quality information for the 39 pesticide or degradate compounds reported as detected in 2021, separated into the following categories:

- Abbreviations and definitions for state and federal drinking water health and quality standards (Table 2A)
- GWPL 6800(a) pesticides or degradates (Table 2B)
- GWPL 6800(b) pesticides or degradates (Table 2C)
- Pesticides or degradates registered in California that are not on the GWPL (Table 2D)
- Pesticides or degradates that are no longer or were never registered for use in California (Table 2E)

### Table 2A. Abbreviation definitions for State and Federal Drinking Water Health and Quality Standards[26]

| | |
|---|---|
| **Acute or One-Day HHBP (USEPA)** | USEPA Acute or One-day Human Health Benchmarks for Pesticides (HHBPs) are non-enforceable advisory values in drinking water protective of acute or up to one-day non-carcinogenic effects, assuming that the entire exposure to a given pesticide is from drinking water. https://www.epa.gov/sdwa/human-health-benchmarks |
| **Cancer Descriptor (USEPA)** | (A) human carcinogen; (B1) probable human carcinogen—indicates limited human evidence; (B2) probable human carcinogen—sufficient evidence in animals and inadequate or no evidence in humans; (C) possible human carcinogen; (D) not classifiable as to human carcinogenicity; (E) evidence of no carcinogenicity for humans; (L) likely to be carcinogenic to humans; (N) not likely to be carcinogenic in humans; (S) suggestive evidence of carcinogenic potential. https://www.epa.gov/system/files/documents/2022-01/dwtable2018.pdf |
| **Cancer HBSL (E-6 to E-4) (USGS)** | USGS Cancer Health-Based Screening Levels (HBSLs) are non-enforceable benchmarks protective of cancer effects. The HBSL concentration range represents a one-in-one million ($10^{-6}$) to one-in-ten thousand ($10^{-4}$) cancer risk range. https://water.usgs.gov/water-resources/hbsl/ |

[26] DPR's Pesticide Drinking Water Standards Fact Sheet is available at: https://www.cdpr.ca.gov/docs/emon/grndwtr/gwp_sampling.htm.

| | |
|---|---|
| **Chronic or Lifetime HHBP (USEPA)** | USEPA Chronic or Lifetime Human Health Benchmarks for Pesticides (HHBPs) are non-enforceable advisory values in drinking water protective of chronic non-carcinogenic effects over a lifetime of exposure, assuming that 20% of the exposure to a given pesticide is from water and additional exposure is derived from another source such as food, air, or dermal contact. https://www.epa.gov/sdwa/human-health-benchmarks |
| **Carcinogenic HHBP (E-6 to E-4) (USEPA)** | USEPA Carcinogenic Human Health Benchmarks for Pesticides (HHBPs) are non-enforceable advisory values protective of cancer effects. The HHBP range represents a one-in-one million ($10^{-6}$) to one-in-ten thousand ($10^{-4}$) cancer risk range. https://www.epa.gov/sdwa/human-health-benchmarks |
| **DWEL HA (USEPA)** | A Drinking Water Equivalent Level (DWEL) is a lifetime exposure level, assuming 100% exposure from drinking water, at or below which adverse, non-carcinogenic health effects would not be expected to occur. https://www.epa.gov/system/files/documents/2022-01/dwtable2018.pdf, https://www.epa.gov/sdwa/drinking-water-health-advisories-has |
| **HHRL (CDPR)** | The Human Health Reference Levels (HHRLs) are identified by the California Department of Pesticide Regulation's (CDPR) Human Health Assessment Branch. Residues measured in groundwater exceeding these reference levels indicate a health concern and should be sent to HHA for further evaluation. https://www.cdpr.ca.gov/docs/whs/active_ingredient/index.htm |
| **Lifetime HA (USEPA)** | The Lifetime Health Advisory (HA) is the concentration in drinking water at or below which no adverse non-carcinogenic effects are expected for a lifetime of exposure (for a 70-kg adult drinking 2 L of water/day). The lifetime HA incorporates a drinking water risk concentration factor or a default of 20% of total exposure from all sources. https://www.epa.gov/system/files/documents/2022-01/dwtable2018.pdf, https://www.epa.gov/sdwa/drinking-water-health-advisories-has |
| **MCL (SWRCB)** | The Maximum Contaminant Level (MCL) is an enforceable, health protective drinking water level adopted by the state of California which considers not only a chemicals' health risks but also factors such as their detectability and treatability, as well as costs of treatment. https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/mclreview/mcls_dlrs_phgs.pdf |
| **MCL (USEPA)** | The Maximum Contaminant Level (MCL) is the highest level of a contaminant that is allowed in drinking water. MCLs are federally enforceable standards. https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/mclreview/mcls_dlrs_phgs.pdf, https://water.usgs.gov/water-resources/hbsl/ |

| | |
|---|---|
| **MCLG (USEPA)** | The Maximum Contaminant Level Goal (MCLG) is a non-enforceable, federal health benchmark goal that is set at a level at which no known or anticipated adverse effect on the health of persons is expected to occur and which allows an adequate margin of safety. https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/mclreview/mcls_dlrs_phgs.pdf, https://www.epa.gov/system/files/documents/2022-01/dwtable2018.pdf, https://www.epa.gov/sdwa/drinking-water-health-advisories-has |
| **Non-Cancer HBSL (USGS)** | USGS Non-cancer Health-Based Screening Levels (HBSLs) are non-enforceable benchmarks of concentration protective of chronic non-cancer effects. https://water.usgs.gov/water-resources/hbsl/ |
| **One-Day HA (USEPA)** | The One-Day Health Advisory (HA) is the concentration of a chemical in drinking water that is not expected to cause any adverse non-carcinogenic effects for up to one day of exposure (for a 10-kg child consuming 1 L of water/day). https://www.epa.gov/system/files/documents/2022-01/dwtable2018.pdf, https://www.epa.gov/sdwa/drinking-water-health-advisories-has |
| **PHG (Office of Environmental Health Hazard Assessment; OEHHA)** | Public Health Goals (PHGs), established by the state of California, are concentrations of drinking water contaminants that pose no significant health risk if consumed for a lifetime, based on current risk assessment principles, practices, and methods. https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/mclreview/mcls_dlrs_phgs.pdf |
| **PHC (OEHHA)** | Public Health Concentrations (PHCs), determined by the state of California, are concentrations of a chemical in drinking water that are not expected to pose a significant risk to health when consumed over a lifetime, and are developed using approaches and methods of OEHHA's Public Health Goal Program. If differentiated, **CE** refers to a PHC derived for cancer effects and **NCE** refers to a PHC derived for non-cancer effects. https://oehha.ca.gov/pesticides/pesticides-reports-notices-and-documents |
| **Ten-Day HA (USEPA)** | The Ten-Day Health Advisory (HA) concentration of a chemical in drinking water that is not expected to cause any adverse non-carcinogenic effects for up to ten days of exposure (for a 10-kg child consuming 1 L of water/day). https://www.epa.gov/system/files/documents/2022-01/dwtable2018.pdf, https://www.epa.gov/sdwa/drinking-water-health-advisories-has |

## Responses to detections of pesticides and degradates on the GWPL, 3CCR section 6800(a)

Table 2B includes detections of the seven pesticides that are listed on the GWPL, 3CCR section 6800(a), and their five degradates. Applications of the parent pesticides are regulated as groundwater contaminants within GWPAs under the RMPP (see Appendix A for more information on GWPAs).

- Of those 12 pesticide compounds detected, 17 total detections of at least one of the compounds were in wells above the SL outside of already established GWPAs. DPR will conduct additional evaluation of these detections.
- The remaining wells with detections at or above the SL of the 12 compounds were located inside established GWPAs and the parent pesticide is regulated as a groundwater contaminant.

## Table 2B. Detailed summary of 6800(a)-listed pesticides or degradates detected in groundwater in 2021

Detection concentration ranges and drinking water quality standards are reported in parts per billion (ppb). The last column includes DPR's initial evaluation and response to the reported detections.

| Pesticide or Degradate | Wells with Detections | Detected Concentration Range (ppb) | Wells with Detections at or above the SL* | SL (ppb) | State and Federal Drinking Water Health and Quality Standards (ppb) [Table 2A] | DPR Response to Detections ‡ |
|---|---|---|---|---|---|---|
| **3,4-Dichloroaniline (degradate of diuron, linuron, propanil and iprodione)** | 4 | 0.0037 - 0.0066 | 0 | 0.035 | HHRL (CDPR): 100§ | Note: Parent pesticides are on the GWPL, 3CCR section 6800(a) and (b).<br>--<br>No detections exceeded the SL. |
| **ACET (degradate of atrazine and simazine)** | 46 | 0.036 - 0.776 | 46 | 0.021 | HHRL (CDPR): 17† | All forty-six (46) wells with detections are in GWPAs. |
| **Atrazine** | 25 | 0.003 - 0.11 | 8 | 0.014 | MCL (SWRCB): 1<br>PHG (OEHHA): 0.15<br>HHRL (CDPR): 17†<br>MCL (USEPA): 3<br>MCLG (USEPA): 3<br>DWEL HA (USEPA): 700<br>Cancer Descriptor (USEPA): N | Eight (8) wells with detections exceeded the SL. Four (4) of those wells are in GWPAs. **DPR will evaluate the four (4) wells with detections above the SL that are not in GWPAs.** |

| Pesticide or Degradate | Wells with Detections | Detected Concentration Range (ppb) | Wells with Detections at or above the SL* | SL (ppb) | State and Federal Drinking Water Health and Quality Standards (ppb) [Table 2A] | DPR Response to Detections ‡ |
|---|---|---|---|---|---|---|
| **Bentazon** | 1 | 3.2 | 1 | 0.014 | MCL (SWRCB): 18<br>PHG (OEHHA): 200<br>Chronic or Lifetime HHBP (USEPA): 890<br>Acute or One-Day HHBP (USEPA): 3000<br>One-Day HA (USEPA): 300<br>Ten-Day HA (USEPA): 300<br>DWEL HA (USEPA): 1000<br>Lifetime HA (USEPA): 200<br>Cancer Descriptor (USEPA): E<br>Non-Cancer HBSL (USGS): 1000 | **DPR will evaluate the one (1) well with a detection above the SL because it is not in a rice growing area.** |
| **Bromacil** | 17 | 0.026 - 5.02 | 17 | 0.014 | HHRL (CDPR): 197<br>One-Day HA (USEPA): 5000<br>Ten-Day HA (USEPA): 5000<br>DWEL HA (USEPA): 3500<br>Lifetime HA (USEPA): 70<br>Cancer Descriptor (USEPA): I<br>Non-Cancer HBSL (USGS): 100 | Seventeen (17) wells with detections exceeded the SL. Sixteen (16) of those wells are in GWPAs. **DPR will evaluate the one (1) well with a detection not in a GWPA.** |
| **DACT (degradate of simazine)** | 48 | 0.052 - 5.937 | 48 | 0.035 | HHRL (CDPR): 17[†]<br>Chronic or Lifetime HHBP (USEPA): 11<br>Acute or One-Day HHBP (USEPA): 300 | All forty-eight (48) wells with detections are in GWPAs. |
| **DEA (degradate of atrazine)** | 40 | 0.004 - 0.251 | 12 | 0.014 | HHRL (CDPR): 17[†] | Twelve (12) wells with detections exceeded the SL. Nine (9) of these wells are in GWPAs. **DPR will evaluate the three (3) wells with detections that are not in GWPAs.** |
| **Diuron** | 21 | 0.02 - 0.068 | 21 | 0.014 | HHRL (CDPR): 100[§]<br>One-Day HA (USEPA): 1000<br>Ten-Day HA (USEPA): 1000<br>DWEL HA (USEPA): 100<br>10^-4 Cancer Risk (USEPA): 200<br>Cancer Descriptor (USEPA): L<br>Non-Cancer HBSL (USGS): 20<br>Cancer HBSL (E-6 to E-4) (USGS): 2-200 | Twenty-one (21) wells with detections are in GWPAs. |

| Pesticide or Degradate | Wells with Detections | Detected Concentration Range (ppb) | Wells with Detections at or above the SL* | SL (ppb) | State and Federal Drinking Water Health and Quality Standards (ppb) [Table 2A] | DPR Response to Detections ‡ |
|---|---|---|---|---|---|---|
| **DSMN (degradate of norflurazon)** | 40 | 0.014 - 1.273 | 40 | 0.007 | HHRL (CDPR): 150¶ | Forty (40) wells with detections are in GWPAs. |
| **Norflurazon** | 18 | 0.02 - 0.679 | 18 | 0.014 | HHRL (CDPR): 150¶<br>Chronic or Lifetime HHBP (USEPA): 8.9 | Eighteen (18) wells with detections are in GWPAs. |
| **Prometon** | 3 | 0.006 - 0.075 | 1 | 0.014 | One-Day HA (USEPA): 200<br>Ten-Day HA (USEPA): 200<br>DWEL HA (USEPA): 2000<br>Lifetime HA (USEPA): 400<br>Cancer Descriptor (USEPA): N<br>Non-Cancer HBSL (USGS): 300 | The one (1) well with a detection exceeding the SL is in a GWPA. |
| **Simazine** | 90 | 0.003 - 0.14 | 67 | 0.014 | MCL (SWRCB): 4 PHG (OEHHA): 4<br>HHRL (CDPR): 17†<br>MCL (USEPA): 4<br>MCLG (USEPA): 4<br>DWEL HA (USEPA): 700<br>Cancer Descriptor (USEPA): N | Sixty-seven (67) wells with detections exceeded the SL. Fifty-nine (59) of these wells are in GWPAs. **DPR will evaluate the eight (8) wells with detections that are not in GWPAs.** |

* The Screening Level (SL) is set at 70 percent of the current reporting limit established by DPR's contract laboratory.

‡ Pesticides on the GWPL 3CCR section 6800(a) are those labeled for agricultural, outdoor institutional, or outdoor industrial use that have the potential to pollute groundwater. Section 6800(a) includes seven agricultural herbicides and their degradates that are regulated as groundwater contaminants: atrazine, bentazon, bromacil, diuron, norflurazon, prometon, and simazine. If the parent pesticide of the detected compound is regulated as a groundwater contaminant under 3CCR section 6800(a)—and the well is in a GWPA where use of the pesticide is regulated under the RMPP—current regulatory requirements for use constitutes an adequate response to new detections *unless* concentrations are high enough to indicate existing mitigation measures are not adequate to prevent *pollution*. ("Pollution" is defined in FAC section 13142 as "…the consequence of polluting," and "pollute" means "to introduce a pesticide product into the groundwaters of the state resulting in an active ingredient, other specified ingredient, or a degradation product of a pesticide above a level that does not cause adverse health effects, accounting for an adequate margin of safety."). No further evaluation is required since use is already regulated in those areas.

§ If residues of diuron and 3,4-dichloroaniline are detected in the same groundwater sample, the values should be summed and compared to the HHRL.

† If two or more residues of atrazine, simazine, ACET, DACT, or DEA are detected in the same groundwater sample, the values should be summed and compared to the HHRL.

¶ If residues of norflurazon and DSMN are detected in the same groundwater sample, the values should be summed and compared to the HHRL.

## Responses to detections of pesticides and degradates on the GWPL, 3CCR section 6800(b)

Table 2C includes detections of the pesticides listed as potential groundwater contaminants on the GWPL, 3CCR section 6800(b), and their degradates.

- Seven compounds were detected at or above the SL: chlorantraniliprole, chloropicrin, fludioxonil, hexazinone, imidacloprid, metolachlor, and tebuthiuron.
    - Chlorantraniliprole was detected in one well. DPR is currently reviewing these results and is conducting groundwater monitoring for this pesticide in high use areas statewide (Afyuni and Nordmark, 2022).
    - Chloropicrin and tebuthiuron were each detected in one well and these detections will be evaluated further.
    - Metolachlor was detected in two wells above the SL. DPR re-sampled one of the wells and confirmed the detection. DPR will evaluate the other detection further.
    - Fludioxonil was detected in one well and is part of an ongoing DPR study to determine a source (Kocis, 2020).
    - Hexazinone and imidacloprid were determined not to pollute at the concentrations detected and DPR continually monitors for them (Reardon, 2011; Henderson, 2022).
- The other three compounds—1-Naphthol, 3,5-dichloroanaline, and EPTC were detected at concentrations below the SL.

## Table 2C. Detailed summary of 6800(b)-listed pesticides or degradates detected in groundwater in 2021

Detection concentration ranges and drinking water quality standards are reported in parts per billion (ppb). The last column includes DPR's initial evaluation and response to the detections.

| Pesticide or Degradate | Wells with Detections | Detected Concentration Range (ppb) | Wells with Detections at or above the SL* | SL (ppb) | State and Federal Drinking Water Health and Quality Standards (ppb) [Table 2A] | DPR Response to Detections ‡ |
|---|---|---|---|---|---|---|
| **1-Naphthol (degradate of carbaryl and naphthalene)** | 2 | 0.0043 - 0.0045 | 0 | 0.035 | No health levels available at the state or federal level. | No detections exceeded the SL. |
| **3,5-Dichloroaniline (degradate of dichloran)** | 4 | 0.003 - 0.023 | 0 | 0.035 | Cancer HBSL (E-6 to E-4) (USGS): 0.5-50 | No detections exceeded the SL. |
| **Chlorantraniliprole** | 1 | 0.266 | 1 | 0.014 | HHRL (CDPR): 8316<br>Chronic or Lifetime HHBP (USEPA): 9350 | **DPR will evaluate the one (1) well with a detection above the SL as part of a study by Afyuni and Nordmark (2022).** |

| Pesticide or Degradate | Wells with Detections | Detected Concentration Range (ppb) | Wells with Detections at or above the SL* | SL (ppb) | State and Federal Drinking Water Health and Quality Standards (ppb) [Table 2A] | DPR Response to Detections ‡ |
|---|---|---|---|---|---|---|
| **Chloropicrin** | 1 | 3.21 | 1 | 0.035 | No health levels available at the state or federal level. | **DPR will evaluate the one (1) well with a detection above the SL.** |
| **EPTC** | 1 | 0.0322 | 0 | 0.035 | Chronic or Lifetime HHBP (USEPA): 300<br>Acute or One-Day HHBP (USEPA): 1000 | No detections exceeded the SL. |
| **Fludioxonil** | 1 | 0.316 | 1 | 0.021 | HHRL (CDPR): 331<br>Chronic or Lifetime HHBP (USEPA): 2000 | **One (1) well with a detection exceeded the SL. Fludioxonil had been detected by DPR in this well previously (Davalos, 2021). DPR is currently reviewing these results and conducting further evaluation (Kocis, 2020).** |
| **Hexazinone** | 8 | 0.007 - 0.043 | 8 | 0.007 | One-Day HA (USEPA): 3000<br>Ten-Day HA (USEPA): 2000<br>DWEL HA (USEPA): 2000<br>Lifetime HA (USEPA): 400<br>Cancer Descriptor (USEPA): D<br>Non-Cancer HBSL (USGS): 300 | Eight (8) wells with detections exceeded the SL. Hexazinone was determined not to pollute at the levels detected (Reardon, 2011). |
| **Imidacloprid** | 6 | 0.024 - 0.126 | 6 | 0.014 | HHRL (CDPR): 283<br>Chronic or Lifetime HHBP (USEPA): 500<br>Acute or One-Day HHBP (USEPA): 500 | Six (6) wells with detections exceeded the SL. Imidacloprid was determined not to pollute at the levels detected (Henderson, 2022). |
| **Metolachlor** | 3 | 0.006 - 0.104 | 2 | 0.014 | PHC (OEHHA): 7<br>One-Day HA (USEPA): 2000<br>Ten-Day HA (USEPA): 2000<br>DWEL HA (USEPA): 3500<br>Lifetime HA (USEPA): 700<br>Cancer Descriptor (USEPA): C<br>Non-Cancer HBSL (USGS): 600 | Two (2) wells with detections exceeded the SL. **DPR re-sampled one (1) well, the detection was confirmed, and the results are being evaluated. DPR will evaluate the other well with a detection above the SL.** |

| Pesticide or Degradate | Wells with Detections | Detected Concentration Range (ppb) | Wells with Detections at or above the SL* | SL (ppb) | State and Federal Drinking Water Health and Quality Standards (ppb) [Table 2A] | DPR Response to Detections ‡ |
|---|---|---|---|---|---|---|
| **Tebuthiuron** | 1 | 0.017 | 1 | 0.014 | One-Day HA (USEPA): 3000<br>Ten-Day HA (USEPA): 3000<br>DWEL HA (USEPA): 2000<br>Lifetime HA (USEPA): 500<br>Cancer Descriptor (USEPA): D<br>Non-Cancer HBSL (USGS): 900 | **DPR will evaluate the one (1) well with a detection above the SL.** |

* The Screening Level (SL) is set at 70 percent of the current reporting limit established by DPR's contract laboratory.

‡ Pesticides on the GWPL 3CCR section (b) are those labeled for agricultural, outdoor institutional, or outdoor industrial use that have the potential to pollute groundwater. Section 6800(b) includes 98 pesticides that have the potential to become groundwater contaminants based on their mobility, persistence, and legal uses. The GWPL is available at: http://www.cdpr.ca.gov/docs/legbills/calcode/040101.htm.

### Responses to detections of pesticides and degradates not listed on the GWPL [3CCR sections 6800(a) or (b)]

Seven compounds are registered pesticides or degradates of a parent compound not listed under 3CCR sections 6800(a) or (b). Of the seven detections listed in Table 2D:

- Chlorthal-dimethyl (DCPA) and trifluralin were detected at concentrations below the SL.
- Degradates of chlorthal-dimethyl (DCPA) were determined not to pollute at the levels detected (Leahy, 2018).
- Diquat dibromide was detected in one well and this detection will be evaluated further.
- Flutriafol was detected in one well and methoxyfenozide was detected in five wells. DPR is currently reviewing these results and is conducting groundwater monitoring for these pesticides in high use areas statewide (Afyuni and Nordmark, 2022).
- P-DCB was detected in one well. This pesticide is the main ingredient of mothballs; it is unlikely the source was from agricultural use.

### Table 2D. Detailed summary of pesticides or degradates detected in groundwater not included on the GWPL

Detection concentration ranges and drinking water quality standards are reported in parts per billion (ppb). The last column includes DPR's initial evaluation and response to the pesticide detections.

| Pesticide or Degradate | Wells with Detections | Detected Concentration Range (ppb) | Wells with Detections at or above the SL* | SL (ppb) | State and Federal Drinking Water Health and Quality Standards (ppb) [Table 2A] | DPR Response to Detections |
|---|---|---|---|---|---|---|
| **Chlorthal-dimethyl (DCPA)** | 1 | 0.0033 | 0 | 0.035 | PHC (OEHHA): 2 (CE), 7 (NCE)<br>HHRL (CDPR): †<br>One-Day HA (USEPA): 2000<br>Ten-Day HA (USEPA): 2000<br>DWEL HA (USEPA): 350<br>Lifetime HA (USEPA): 70<br>Cancer Descriptor (USEPA): C<br>Non-Cancer HBSL (USGS): 60<br>Cancer HBSL (E-6 to E-4) (USGS): 20-2000 | No detections exceeded the SL. |

| Pesticide or Degradate | Wells with Detections | Detected Concentration Range (ppb) | Wells with Detections at or above the SL* | SL (ppb) | State and Federal Drinking Water Health and Quality Standards (ppb) [Table 2A] | DPR Response to Detections |
|---|---|---|---|---|---|---|
| **DCPA mono/di-acid degradates (TPA, MTP)** | 17 | 0.11 - 8.1 | 17 | 0.035 | **MTP:**<br>PHC (OEHHA): 2500<br>HHRL (CDPR): †<br><br>**TPA:**<br>PHC (OEHHA): 2500<br>HHRL (CDPR): 70†<br>Chronic or Lifetime HHBP (USEPA): 17500<br>Ten-Day HA (USEPA): 125000 | Seventeen (17) wells with detections exceeded the SL. Chlorthal-dimethyl (DCPA) degradates were determined not to pollute at the levels detected (Leahy, 2018). |
| **Diquat dibromide** | 1 | 4 | 1 | 0.035 | MCL (SWRCB): 20<br>PHG (OEHHA): 94<br>MCL (USEPA): 20<br>MCLG (USEPA): 20<br>Chronic or Lifetime HHBP (USEPA): 30<br>Acute or One-Day HHBP (USEPA): 5000<br>DWEL HA (USEPA): 20<br>Cancer Descriptor (USEPA): E | **DPR will evaluate the one (1) well with a detection above the SL.** |
| **Flutriafol** | 1 | 0.226 | 1 | 0.014 | HHRL (CDPR): 395<br>Chronic or Lifetime HHBP (USEPA): 300<br>Acute or One-Day HHBP (USEPA): 2100 | **DPR will evaluate the one (1) well with a detection above the SL as part of a study by Afyuni and Nordmark (2022).** |
| **Methoxyfenozide** | 5 | 0.033 - 0.201 | 5 | 0.021 | HHRL (CDPR): 504<br>Chronic or Lifetime HHBP (USEPA): 600 | **DPR will evaluate the five (5) wells with detections above the SL as part of a study by Afyuni and Nordmark (2022).** |
| **P-DCB** | 1 | 0.94 - 2.3 | 1 | 0.035 | MCL (SWRCB): 5<br>PHG (OEHHA): 6<br>MCL (USEPA): 75<br>MCLG (USEPA): 75<br>One-Day HA (USEPA): 11000<br>Ten-Day HA (USEPA): 11000<br>DWEL HA (USEPA): 4000<br>Lifetime HA (USEPA): 75<br>Cancer Descriptor (USEPA): C | **DPR will evaluate the one (1) well with a detection above the SL. Previous detections in other wells were determined to not be from agricultural use.** |

| Pesticide or Degradate | Wells with Detections | Detected Concentration Range (ppb) | Wells with Detections at or above the SL* | SL (ppb) | State and Federal Drinking Water Health and Quality Standards (ppb) [Table 2A] | DPR Response to Detections |
|---|---|---|---|---|---|---|
| **Trifluralin** | 2 | 0.002 - 0.005 | 0 | 0.035 | One-Day HA (USEPA): 80<br>Ten-Day HA (USEPA): 80<br>DWEL HA (USEPA): 700<br>Lifetime HA (USEPA): 20<br>10^-4 Cancer Risk (USEPA): 400<br>Cancer Descriptor (USEPA): C<br>Non-Cancer HBSL (USGS): 200<br>Cancer HBSL (E-6 to E-4) (USGS): 10-1000 | No detections exceeded the SL. |

* The Screening Level (SL) is set at 70 percent of the current reporting limit established by DPR's contract laboratory.

† The HHRL for TPA was determined under a special/non-standard process and is related to health reference levels determined by USEPA for DCPA and degradates (TPA, MTP):
https://www.cdpr.ca.gov/docs/hha/memos/tpa%20in%20ground%20water%20reply%20final%2002232017%20complete%20executed.pdf;
https://www.epa.gov/ccl/regulatory-determination-2-support-documents-dacthal-mono-acid-mtp-and-di-acid-tpa-degradates.

## Detections of pesticides not registered in California

Ten of the compounds detected are not registered for use as a pesticide in California (e.g., detections from legacy pesticide use or non-pesticidal use). DPR includes these compounds in the annual report and WIDB but does not conduct further evaluation. These compounds are 1,2-DCP, carbon disulfide, DBCP, ethylene dibromide, ethylene dichloride, formaldehyde, methoxychlor, molinate, ortho-dichlorobenzene, and tefluthrin.

### Table 2E. Detailed summary of compounds detected in groundwater that are not currently registered for use as a pesticide in California

Detection concentration ranges and drinking water quality standards are reported in parts per billion (ppb). The last column includes the year the compound was last registered for use as a pesticide in California.

| Pesticide or Degradate | Wells with Detections | Detected Concentration Range (ppb) | State and Federal Drinking Water Health and Quality Standards (ppb) [Table 2A] | Registration Status |
|---|---|---|---|---|
| **1,2-DCP** | 29 | 0.0016 - 1.2 | MCL (SWRCB): 5<br>PHG (OEHHA): 0.5<br>MCL (USEPA): 5<br>MCLG (USEPA): 0<br>Ten-Day HA (USEPA): 90<br>10^-4 Cancer Risk (USEPA): 60<br>Cancer Descriptor (USEPA): B2 | Not registered for use in California since 1990**.** |
| **Carbon disulfide** | 7 | 0.1 - 0.4 | Non-Cancer HBSL (USGS): 600 | Not registered for use in California since 1987. |
| **DBCP** | 297 | 0.004 - 0.93 | MCL (SWRCB): 0.2<br>PHG (OEHHA): 0.003<br>MCL (USEPA): 0.2<br>MCLG (USEPA): 0<br>One-Day HA (USEPA): 200<br>Ten-Day HA (USEPA): 50 $10^{-4}$<br>Cancer Risk (USEPA): 3<br>Cancer Descriptor (USEPA): B2 | Not registered for use in California since 1979. |

| Pesticide or Degradate | Wells with Detections | Detected Concentration Range (ppb) | State and Federal Drinking Water Health and Quality Standards (ppb) [Table 2A] | Registration Status |
|---|---|---|---|---|
| **Ethylene dibromide** | 5 | 0.02 - 0.09 | MCL (SWRCB): 0.05<br>PHG (OEHHA): 0.01<br>MCL (USEPA): 0.05<br>MCLG (USEPA): 0<br>One-Day HA (USEPA): 8<br>Ten-Day HA (USEPA): 8<br>DWEL HA (USEPA): 300<br>10^-4 Cancer Risk (USEPA): 2<br>Cancer Descriptor (USEPA): L | Not registered for use in California since 1987. |
| **Ethylene dichloride** | 14 | 0.04 - 3.4 | MCL (SWRCB): 0.5<br>PHG (OEHHA): 0.4<br>MCL (USEPA): 5<br>MCLG (USEPA): 0<br>One-Day HA (USEPA): 700<br>Ten-Day HA (USEPA): 700<br>10^-4 Cancer Risk (USEPA): 40<br>Cancer Descriptor (USEPA): B2 | Not registered for use in California since 1987. |
| **Formaldehyde** | 3 | 3.2 - 9.8 | One-Day HA (USEPA): 10000<br>Ten-Day HA (USEPA): 5000<br>DWEL HA (USEPA): 7000<br>Lifetime HA (USEPA): 1000<br>Cancer Descriptor (USEPA): B1 | Not registered for use in California since 2020. |
| **Methoxychlor** | 1 | 0.017 | MCL (SWRCB): 30<br>PHG (OEHHA): 10<br>MCL (USEPA): 40<br>MCLG (USEPA): 40<br>One-Day HA (USEPA): 50<br>Ten-Day HA (USEPA): 50<br>DWEL HA (USEPA): 200<br>Lifetime HA (USEPA): 40<br>Cancer Descriptor (USEPA): D | Not registered for use in California since 2000. |
| **Molinate** | 1 | 7 | MCL (SWRCB): 20<br>PHG (OEHHA): 1<br>Non-Cancer HBSL (USGS): 0.6 | Not registered for use in California since 2009. |

| Pesticide or Degradate | Wells with Detections | Detected Concentration Range (ppb) | State and Federal Drinking Water Health and Quality Standards (ppb) [Table 2A] | Registration Status |
|---|---|---|---|---|
| **Ortho-dichlorobenzene** | 3 | 0.015 - 2.1 | MCL (SWRCB): 600<br>PHG (OEHHA): 600<br>MCL (USEPA): 600<br>MCLG (USEPA): 600<br>One-Day HA (USEPA): 9000<br>Ten-Day HA (USEPA): 9000<br>DWEL HA (USEPA): 3000<br>Lifetime HA (USEPA): 600<br>Cancer Descriptor (USEPA): D | Not registered for use in California since 1985. |
| **Tefluthrin** | 2 | 0.004 - 0.005 | Acute or One-Day HHBP (USEPA): 30 | Never registered for use in California. |

## REFERENCES


Contact GWPP@cdpr.ca.gov for references not currently available on the web.

Afyuni, M. and C. Nordmark, 2022. Study 333: Protocol for Groundwater Protection List Monitoring for methoxyfenozide, chlorantraniliprole, and flutriafol in high use, vulnerable areas. California Department of Pesticide Regulation, Environmental Monitoring Branch. Available at: https://www.cdpr.ca.gov/docs/emon/pubs/protocol/333_prtcl_2022.pdf (verified August 2023).

Braun, A.L. and L.S. Hawkins. 1991. Presence of bromacil, diuron, and simazine in surface water runoff from agricultural fields and non-crop site in Tulare County, California. California Department of Pesticide Regulation, Environmental Monitoring Branch.

Clayton, M. 2011. Selection of pesticide active ingredients for future analytical method development and ground water monitoring. California Department of Pesticide Regulation, Environmental Monitoring Branch.

Davalos, J. 2021. Monitoring the concentrations of detected pesticides in wells located in highly sensitive areas (Well Network sampling). Annual Update 2020. California Department of Pesticide Regulation, Environmental Monitoring Branch. Available at: https://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/study_228_2020.pdf (verified August 2023).

Ganapathy, C. 2022. Summary of program policies and documentation specifying the response to detections reported to the Department of Pesticide Regulation (Z-Study and N-Memo). California Department of Pesticide Regulation, Environmental Monitoring Branch.

Garretson, C. 1999. Study 182: Protocol for monitoring the concentration of detected pesticides in wells located in highly sensitive areas. California Department of Pesticide Regulation, Environmental Monitoring Branch. Available at: https://www.cdpr.ca.gov/docs/emon/pubs/protocol/study182_1999.pdf (verified August 2023).

Henderson, J. 2022. Director's decision in response to the Pesticide Registration and Evaluation Committee's Subcommittee findings and recommendations regarding the detection of imidacloprid in groundwater. California Department of Pesticide Regulation. Available at: https://www.cdpr.ca.gov/docs/emon/grndwtr/imidacloprid/imidacloprid_director's_decision.pdf (verified August 2023).

Hutson, J.L. 2003. Leaching Estimation and Chemistry Model LEACHM Model Description and User's Guide. Revision January 2003. Associated with Model Version 4. School of Chemistry, Physics and Earth Sciences. The Flinders University of South Australia. GPO Box 2100, Adelaide, SA5001.

Johnson, B. 1991. Setting revised specific numerical values. California Department of Pesticide Regulation, Environmental Monitoring Branch.

Kocis, T. 2020. Protocol for follow-up groundwater monitoring of fludioxonil. California Department of Pesticide Regulation, Environmental Monitoring Branch. Available at: https://www.cdpr.ca.gov/docs/emon/pubs/protocol/study328_protocol_fludioxonil.pdf (verified August 2023).

Leahy, B. 2017. Director's decision in response to the Pesticide Registration and Evaluation Committee's Subcommittee findings regarding the detection of metolachlor/S-metolachlor degradation products in groundwater. California Department of Pesticide Regulation. Available at: https://www.cdpr.ca.gov/docs/emon/grndwtr/metolSmetol_directors_response.pdf (verified August 2023).

Leahy, B. 2018. Director's decision in response to the Pesticide Registration and Evaluation Committee's Subcommittee findings regarding the detection of chlorthal-dimethyl degradation products in ground water. California Department of Pesticide Regulation. Available at: https://www.cdpr.ca.gov/docs/emon/grndwtr/chlorthal_dimethyl_directors_response.pdf (verified August 2023).

Marade, S.J. and J. Troiano. 2000. Sections of land requiring special assignment as runoff or leaching Ground Water Protection Areas. California Department of Pesticide Regulation, Environmental Monitoring Branch.

Reardon, C. 2011. Notice of decision concerning the Director's response to the Pesticide Registration and Evaluation Committee's Subcommittee findings regarding the detection of hexazinone in ground water. California Department of Pesticide Regulation. Available at: https://www.cdpr.ca.gov/docs/emon/grndwtr/hexazinone/directors_decision.pdf (verified August 2023).

Spurlock, F. 2000. Effect of irrigation scheduling on movement of pesticides to ground water in coarse soils: Monte Carlo analysis of simulation modeling. California Department of Pesticide Regulation, Environmental Monitoring Branch.

Troiano, J. and M. Clayton. 2009. Modification of the probabilistic modeling approach to predict well water concentrations used for assessing the risk of ground water contamination by pesticides. California Department of Pesticide Regulation, Environmental Monitoring Branch. Available at: https:/www.cdpr.ca.gov/docs/emon/pubs/ehapreps/analysis_memos/final_probabilisticmodel_2014.pdf (verified August 2023).

Troiano, J., C. Garretson, C. Krauter, J. Brownell, and J. Hutson. 1993. Influence of amount and method of irrigation water application on leaching of atrazine. J. Environ. Qual. Volume 22, Issue 2. Available at: https://doi.org/10.2134/jeq1993.00472425002200020009x (verified January 2023).

Troiano, J., J. Marade, and F. Spurlock. 1999. Empirical modeling of spatial vulnerability applied to a norflurazon retrospective well study in California. California Department of Pesticide Regulation, Environmental Monitoring Branch. J. Environ. Qual. Volume 28, Issue 2. Available at: https://doi.org/10.2134/jeq1999.00472425002800020005x (verified August 2023).

Troiano, J., F. Spurlock, and J. Marade. 2000. Update of the California vulnerability soil analysis for movement of pesticides to ground water: California Department of Pesticide Regulation, Environmental Monitoring Branch. October 14, 1999. Abstract available at: https://www.cdpr.ca.gov/docs/emon/grndwtr/vasmnt/eh0005_abstract.pdf (verified August 2023).

Troiano, J., C. Garretson, A. DaSilva, J. Marade, and T. Barry. 2013. Pesticide and nitrate trends in domestic wells where pesticide use is regulated in Fresno and Tulare counties, California. J. Environ. Qual. Volume 42, Issue 6. Available at: https://doi.org/10.2134/jeq2013.06.0219 (verified August 2023).

## APPENDIX A: GROUNDWATER PROTECTION AREAS

Groundwater Protection Areas (GWPAs) are defined as one-square-mile sections of land that DPR has determined to be sensitive to the movement of pesticides to groundwater. GWPAs are established based on either 3CCR section 6800(a)-listed pesticide[27] or degradate detections in groundwater, or by using the CALVUL computer model. Pesticides listed in 3CCR section 6800(a) are regulated as groundwater contaminants in GWPAs and their use is prohibited unless specific management practices are implemented. There are currently 3,840 GWPAs in California encompassing over 2.45 million acres. Table A-1 lists the pesticides and degradates that are regulated in GWPAs.

**Table A-1: Seven pesticides listed under 3CCR section 6800(a) of the GWPL and their degradates**

| Pesticides | Degradates |
|---|---|
| Atrazine | 3,4-Dichloroaniline (degradate of diuron, linuron, propanil and iprodione) |
| Bentazon | ACET (degradate of atrazine and simazine) |
| Bromacil | DACT (degradate of simazine) |
| Diuron | DEA (degradate of atrazine) |
| Norflurazon | DSMN (degradate of norflurazon) |
| Prometon | |
| Simazine | |

### History of GWPA Development

Early research conducted by DPR scientists enabled DPR to identify two important soil conditions that contribute to groundwater contamination: 1) coarse-textured soils where *leaching* is the predominant contamination pathway (Troiano et al., 1993); and 2) hardpan soil layers where *runoff* from the application site into dry wells or areas with high infiltration rates is the predominant contamination pathway (Braun and Hawkins, 1991). DPR identified depth-to-groundwater as another factor contributing to contamination when DPR scientists discovered that pesticide detections were more frequent in areas of shallow groundwater (Troiano et al., 1999).

In 2004, DPR implemented regulations that replaced Pesticide Management Zones (PMZs) with GWPAs[28]. PMZs were one-square-mile sections of land that required mitigation only after specific pesticides were detected in groundwater. In contrast, GWPAs identify sections vulnerable to pesticide contamination and require specific management practices of pesticides listed in 3CCR section 6800(a) regardless of whether they were detected in groundwater within that section. The empirical model CALVUL was used to identify the vulnerable areas by analyzing soil type and depth-to-groundwater data. DPR based designations of GWPAs primarily on this CALVUL modeling

[27] Pesticides listed in 3CCR section 6800(a): atrazine, bentazon, bromacil, norflurazon, prometon, simazine, and diuron (except for diuron products with less than 7% diuron that are applied to foliage).

[28] GWPAs are classified in regulation as sections of land characterized by either coarse-textured or hardpan soils with a ten-year spring-averaged annual estimated depth-to-groundwater of 70 feet or less.

effort and then also included all the former (and draft) PMZs from 1989 to 1999 in the designations. DPR's use of the CALVUL model increased the area under regulation from 313,000 acres (the acreage identified as PMZs) to about 2.4 million acres (PMZs plus GWPAs). The science and regulatory aspects are explained in more detail in the following sections.

## Initial Basis for GWPA Designation

In 2004, DPR implemented regulations that established GWPAs for *leaching* or *runoff* pathways based on the following factors (Troiano et al., 2000; Marade and Troiano, 2000):

- If a section of land had an estimated depth-to-groundwater of 70 feet or less and the predominant soil type was characterized as coarse-textured, it was identified as a *leaching* GWPA. If the section had an estimated depth-to-groundwater of 70 feet or less and the soil contained a hardpan layer, it was identified as a *runoff* GWPA.

- If a section had both leaching and runoff characteristics (coarse-textured soil with a hardpan layer), it was identified as a leaching GWPA if the mean hardpan depth was greater than 48 inches, or as a runoff GWPA if the mean hardpan depth was less than 48 inches.

- If a section did not meet the above criteria but was previously identified as a PMZ, it was classified as a leaching or runoff GWPA as follows:

    - If the predominant soil in the section was coarse-textured, it was classified as a leaching GWPA; otherwise, the section was classified as a runoff GWPA.

    - If the PMZ lacked soil survey data, it was assigned a GWPA pathway based on soil condition information provided by local agencies. DPR also assessed agronomic practices in the section to determine whether leaching or runoff was the apparent pathway for recharge of water to groundwater.

## New GWPA Designations

DPR establishes new GWPAs based on the following factors:

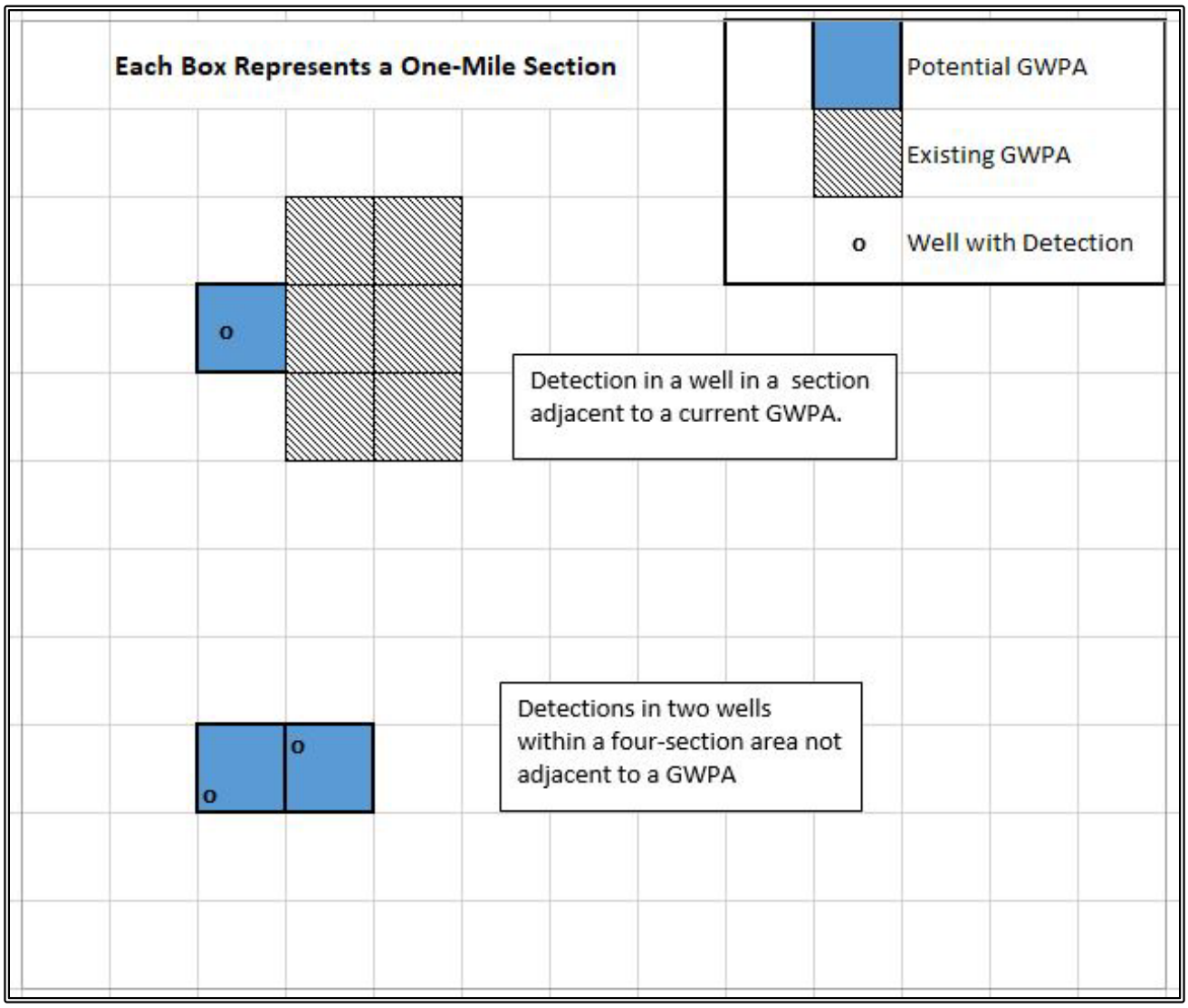
- CALVUL modeling identifies the section as vulnerable; or

- Active ingredients listed in 3CCR section 6800(a), or their degradation products, are detected in:
    - One well in a section that is adjacent to a GWPA; or
    - Two or more wells within a four-section area that is not adjacent to an existing GWPA. (See **Figure A-1** to understand how new GWPAs are added based on detections.)

In 2020, DPR designated 122 additional sections (approximately 78,000 acres) in 15 counties as GWPAs based on the detections of active ingredients listed in 3CCR section 6800(a) or their degradation products. The document previously incorporated by reference in the definitions of

3CCR section 6000 was amended to include the new GWPAs and was retitled "*Ground Water Protection Areas 2018 (Rev. 10/18).*" The document identifies each GWPA as either a leaching or runoff GWPA. Currently, there are 3,840 GWPAs in California (**Figure A-1**).

**Figure A-1. Determination of detection-based GWPAs**



## Figure A-2. Groundwater Protection Areas (GWPAs)

## Pesticide Use in GWPAs

Individuals using 3CCR section 6800(a) pesticides registered for agricultural, outdoor industrial, and outdoor institutional use in GWPAs are required to modify their use practices. Users must obtain a Restricted Materials permit from their CACs. The permit or Notice of Intent identifies the management practices required for each type of GWPA.[29] At least one of the following management practices (or an alternative management practice approved by the DPR Director) must be met for the following types of GWPA:

- **3CCR section 6487.3 Engineered Rights-of-Way** within a GWPA:

    1) Runoff is directed to a vegetated area or a fallow field;
    2) Compliance with a permit issued pursuant to the storm water provisions of the federal Clean Water Act; or
    3) The property owner complies with the requirements of 3CCR section 6487.4 (see below).

- **3CCR section 6487.4 Runoff GWPAs**:

    1) Application timing is limited to the period April 1 – July 31;
    2) The soil is disturbed prior to pesticide application;
    3) The pesticide is incorporated into the soil;
    4) The pesticide is applied as a band treatment; or
    5) Runoff is retained on- or off-site, or directed to a fallow field.

- **3CCR section 6487.5 Leaching GWPAs**:

    1) The permittee shall not apply any irrigation water for six months following application of the pesticide;
    2) The pesticide shall be applied to the planting bed or the berm above the level of irrigation water; or
    3) Irrigation shall be managed according to a specified formula.

The permittee must notify the CAC within 24 to 48 hours prior to application to give the CAC an opportunity to inspect the site. Pre-application site inspections allow CACs to determine whether the use modifications are protective and, if they are not, to revise the permit accordingly.

[29] More information on how DPR and CACs regulate the use of groundwater contaminants in vulnerable areas is available at: http://www.cdpr.ca.gov/docs/emon/grndwtr/gwp_id_gwpa.htm.

## APPENDIX B: PRINCIPAL SAMPLING AGENCIES

The principal agencies contributing groundwater monitoring data for this annual Well Sampling Report are DPR, SWRCB, and USGS. Each agency's unique regulatory responsibilities define the pesticides selected for monitoring, type and sensitivity of laboratory analyses, well types sampled, sampling locations, and sampling frequency. For instance, DPR primarily samples shallow, domestic wells in areas where agricultural pesticides are used, while SWRCB assesses the overall quality of groundwater used for consumption (regardless of the frequency or intensity of pesticide use near sampled wells).

### Department of Pesticide Regulation

DPR's Groundwater Protection Program samples groundwater as a function of its responsibilities under the PCPA. (See the **Background** section of this report for a detailed description.)

### State Water Resources Control Board

SWRCB is responsible for enforcement of the federal and California Safe Drinking Water Acts. To meet the goal of ensuring delivery of safe drinking water, SWRCB's Division of Drinking Water (DDW) oversees approximately 7,500 public water systems and establishes health-protective drinking water standards. These standards, known as maximum contaminant levels (MCLs), are developed by evaluating the health risks presented by a chemical, and by assessing the technical and economic factors related to its use (such as treatment efficacy and cost). SWRCB establishes a contaminant's MCL at a level as close to the public health goal[30] (PHG) set by the Office of Environmental Health Hazard Assessment (OEHHA) as is technically and economically feasible, placing primary emphasis on the protection of public health (see the MCL process).

- The Division of Drinking Water (DDW) regulates public water systems to ensure the delivery of safe drinking water; oversees water recycling projects; issues permits for water treatment devices; supports and promotes water system security; and performs many other functions. DDW consists of two field operations branches and a Program Management Branch. The Northern and Southern California field operations branches are responsible for enforcing the federal and California Safe Drinking Water Acts and regulatory oversight of public water systems. The Program Management Branch includes the Data/Toxicology Office, which compiles, evaluates, and reports drinking water quality data for public water systems.

- DDW performs a role that was previously performed by the California Department of Public Health (CDPH); this role includes reporting pesticide detections in drinking water wells to DPR.

[30] Public Health Goals are concentrations of drinking water contaminants that pose no significant health risk if consumed for a lifetime, based on current risk assessment principles, practices, and methods.

SWRCB also monitors groundwater as a function of its Groundwater Ambient Monitoring and Assessment Program (GAMA).[31] This program is designed to improve groundwater quality and increase public availability of information about groundwater quality. SWRCB expanded the GAMA Program following implementation of the Groundwater Quality Monitoring Act of 2001 (Part 2.76 [commencing with section 10780], Division 6 of the Water Code). This law resulted in a publicly-accepted plan to monitor and assess "priority basins"— basins that account for over 90 percent of the groundwater used in California. The GAMA Program includes four projects:

- The GAMA Priority Basin Project monitors dozens of chemicals at very low detection limits. Monitoring and assessment of priority basins are completed every ten years; trend monitoring is performed every three years. SWRCB collaborates with USGS and the Lawrence Livermore National Laboratory (LLNL) to implement the GAMA Priority Basin Project.

- The GAMA Domestic Well Project samples multiple areas in coordination with county environmental health departments. It also provides water quality information to domestic well users.

- The GAMA Special Studies Project partners with LLNL to conduct groundwater studies that evaluate nitrate, wastewater, and groundwater recharge. LLNL scientists use tools that include Tritium-Helium age dating and computer modeling. The University of California, Davis, also contributes to the GAMA Special Studies Project.

- The GeoTracker GAMA information management system enables users (scientists, regulators, water managers, educators, and the public) to access millions of data records from SWRCB and Regional Water Quality Control Boards, Department of Water Resources, DPR, and USGS. GeoTracker GAMA provides access to a Google map-based database that provides the results of groundwater quality testing, groundwater level evaluations, environmental monitoring well logs, and links to published reports.

## United States Geological Survey

USGS compiles surface water, groundwater, and water quality data from local databases to develop a national water information system. For California, the USGS groundwater database contains records from 4,562 wells sampled for pesticides and about 79,000 wells sampled for other constituents. This information is available through the Water Quality Portal: https://www.waterqualitydata.us/ or https://waterdata.usgs.gov/nwis/qw.

[31] For more information about SWRCB's GAMA Program, go to http://www.waterboards.ca.gov/gama/.

## APPENDIX C: THE WELL INVENTORY DATABASE

In the early 1980s, DPR established the Well Inventory Database (WIDB) under the authority granted in FAC section 13152(c) and began collecting groundwater sampling data from public agencies. The database currently contains almost 3 million records, including monitoring data from over 30,000 public and private wells sampled for nearly 500 different pesticides and degradates (**Figure C-1**). Over 6,600 of the wells in the database have reported detections of at least one pesticide or degradate (**Figure C-2**). The 2022 annual report added data for 5,195 wells sampled for pesticides or degradates; 476 of those wells had at least one reported detection (**Figure C-3**). Although approximately 45 agencies submitted data for inclusion in the database in the past, most data now added comes from DPR, SWRCB, and USGS.

The WIDB includes the following information:

- Well location by county
- Well type (domestic, agricultural, industrial, large water system)
- Well sampling agency and study number(s)
- Sample date, analysis date, analyzing laboratory
- Chemical analyzed, concentration detected, method detection limit or reporting limit
- Unusual or important notes about the detection or the analytical method
- Legal agricultural use determination/point or nonpoint source determination
- Year the analysis/detection was added to the database

The dataset available on the website for samples collected in 2021 is in a different format than previous years. This dataset does not include the exact well location for any wells sampled by DPR; instead, the latitude and longitude data provided for DPR-sampled wells are the centroid of their respective public lands survey system section. Data acquired from other agencies through California Safe Drinking Water Information System and the Water Quality Portal contain publicly available latitude and longitude and are included in this dataset. Additionally, all wells/samples, regardless of sampling agency, are identified by county, the county-meridian-township-range and section (COMTRS), and the unique well key assigned to all wells in the WIDB.

The WIDB is available for download at:
https://www.cdpr.ca.gov/docs/emon/grndwtr/well_inventory_database/index.htm.

Due to privacy concerns, DPR does not release well owner information. See DPR's policy on the release of well sampling data at:
http://www.cdpr.ca.gov/docs/emon/grndwtr/wellinv/data_policy.htm.

**Figure C-1. All wells in the DPR Well Inventory Database**

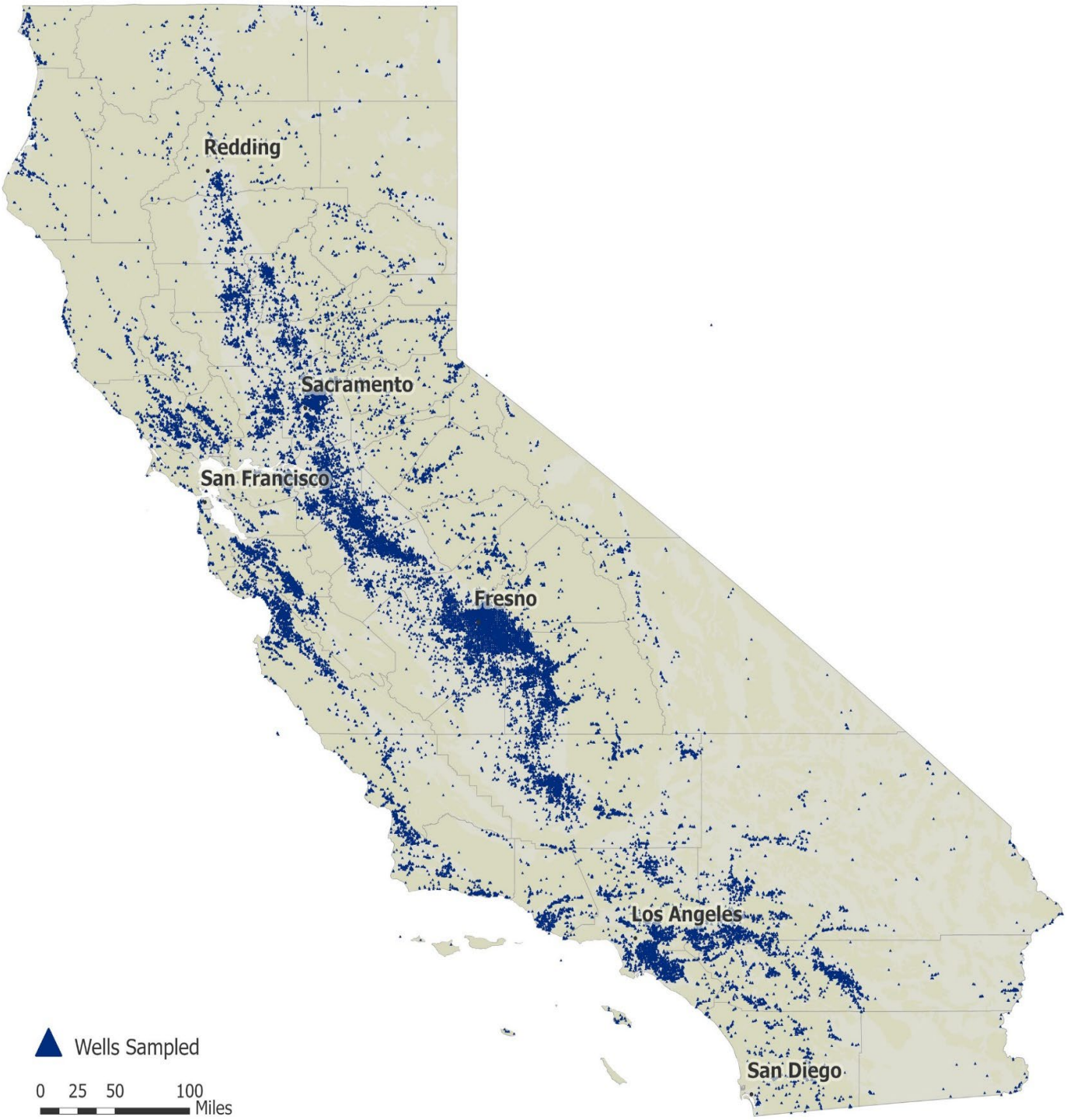
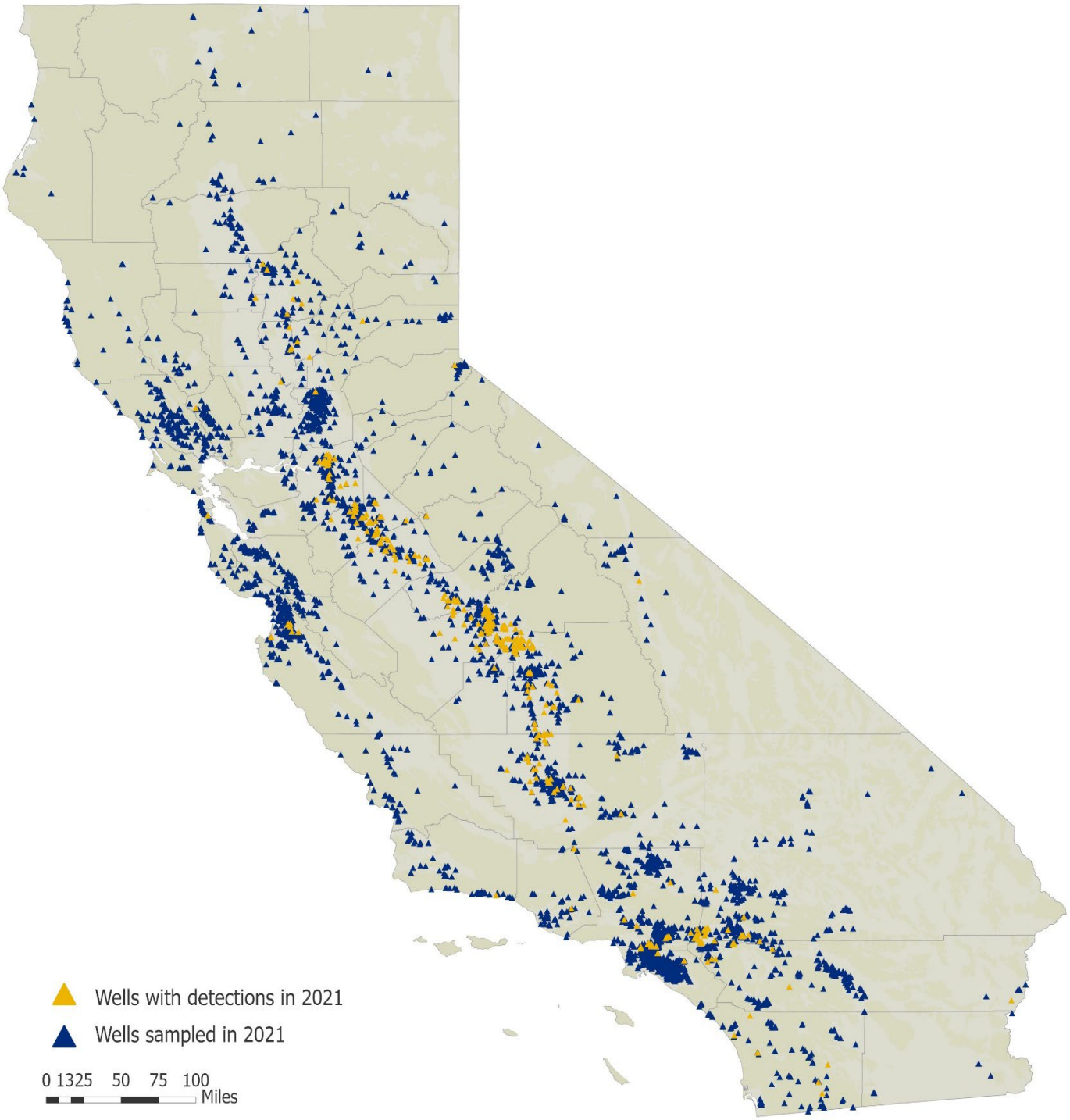


**Figure C-2. All wells in the DPR Well Inventory Database with detections of pesticides or degradates**

**Figure C-3. Well data added to the DPR Well Inventory Database in the 2022 report**



## APPENDIX D: WELL SAMPLING RESULTS SUMMARIZED BY COUNTY

Table D-1, summarizes the following information for each county:

- Total number of wells sampled and tested for pesticides or degradates
- Total number of wells with reported detections
    - Any wells tested multiple times during the year were only counted once
- Total number of specific pesticides or degradates tested
- Total number of specific pesticides or degradates detected
    - A well may be tested for a single chemical or a screen of multiple chemicals, and have various chemicals reported as detected. Also, an individual chemical can be detected in several wells. Each of these scenarios is accounted for in the appropriate column as described in the header row.

Table D-2 provides details on the detections listed in Table D-1. The table only shows the counties with detections and the respective pesticides or degradates detected.

- 'Wells Tested' shows the number of wells in the county tested for the detected chemical
- 'Wells With Detections' shows the number of wells that had detections
- 'Concentration Range' is the concentration levels of the chemical reported in parts per billion (ppb) from the lowest to the highest detection
- 'DPR Evaluation' lists whether the detected pesticide or degradate is currently registered for use in California, and if the detection(s) require additional evaluation. Detections of pesticides at levels below the SL, pesticides previously determined not to pollute at the levels detected, and pesticides on the 6800(a)-list detected in GWPAs will not require additional follow-up. Detections of unregistered pesticides may be from historical use (i.e., DBCP), and DPR will generally not conduct additional evaluation unless illegal use is suspected.

A list of all pesticides and degradates monitored in each county, whether detected or not, is available on request from DPR's Groundwater Protection Program.

Full Well Inventory Database downloads are available at https://www.cdpr.ca.gov/docs/emon/grndwtr/well_inventory_database/index.htm.

### Table D-1. Summary of sampling results by county

Total number of wells sampled, pesticides and degradates tested, wells with detections, and the number of specific pesticides and degradates detected for each California county in the 2022 report. Dashes (-) = no residues were detected.

| County | Wells Tested | Wells With Detections | Pesticides and Degradates Tested | Individual Chemicals Detected |
|---|---|---|---|---|
| Alameda | 26 | - | 119 | - |
| Alpine | 3 | - | 35 | - |
| Amador | 12 | - | 35 | - |
| Butte | 83 | 6 | 139 | 7 |
| Calaveras | 4 | - | 14 | - |
| Colusa | 14 | - | 83 | - |
| Contra Costa | 18 | - | 66 | - |
| El Dorado | 24 | 1 | 109 | 1 |
| Fresno | 308 | 142 | 158 | 20 |
| Glenn | 23 | 3 | 153 | 3 |
| Humboldt | 7 | - | 9 | - |
| Imperial | 10 | - | 36 | - |
| Inyo | 49 | 1 | 127 | 1 |
| Kern | 361 | 42 | 127 | 7 |
| Kings | 25 | 1 | 97 | 1 |
| Lake | 30 | - | 93 | - |
| Lassen | 9 | - | 11 | - |
| Los Angeles | 760 | 27 | 152 | 6 |
| Madera | 130 | 19 | 164 | 1 |
| Marin | 20 | - | 36 | - |
| Mariposa | 22 | 2 | 18 | 1 |
| Mendocino | 51 | - | 96 | - |
| Merced | 105 | 24 | 135 | 11 |
| Modoc | 2 | - | 8 | - |
| Mono | 15 | - | 123 | - |
| Monterey | 186 | 10 | 82 | 2 |
| Napa | 65 | 1 | 50 | 1 |
| Nevada | 29 | 1 | 170 | 1 |
| Orange | 196 | 1 | 77 | 1 |
| Placer | 15 | - | 43 | - |
| Plumas | 12 | - | 12 | - |
| Riverside | 237 | 11 | 158 | 5 |
| Sacramento | 267 | 1 | 112 | 1 |
| San Benito | 32 | - | 54 | - |
| San Bernardino | 394 | 43 | 90 | 5 |
| San Diego | 125 | 7 | 174 | 5 |
| San Francisco | 6 | - | 37 | - |

| County | Wells Tested | Wells With Detections | Pesticides and Degradates Tested | Individual Chemicals Detected |
|---|---|---|---|---|
| San Joaquin | 205 | 32 | 128 | 3 |
| San Luis Obispo | 69 | - | 58 | - |
| San Mateo | 47 | 1 | 143 | 1 |
| Santa Barbara | 68 | 1 | 126 | 2 |
| Santa Clara | 117 | - | 143 | - |
| Santa Cruz | 57 | - | 130 | - |
| Shasta | 33 | - | 18 | - |
| Sierra | 2 | - | 10 | - |
| Siskiyou | 27 | 1 | 70 | 2 |
| Solano | 22 | - | 60 | - |
| Sonoma | 205 | - | 120 | - |
| Stanislaus | 187 | 35 | 178 | 11 |
| Sutter | 24 | 3 | 119 | 4 |
| Tehama | 45 | - | 25 | - |
| Trinity | 1 | - | 7 | - |
| Tulare | 264 | 55 | 135 | 20 |
| Tuolumne | 14 | - | 69 | - |
| Ventura | 55 | 1 | 55 | 1 |
| Yolo | 54 | 2 | 110 | 2 |
| Yuba | 24 | 2 | 95 | 3 |

## Table D-2. Pesticides or degradates as detected by county and DPR evaluation

| County | Pesticide or Degradate Detected | Wells Tested | Wells With Detections | Concentration Range (ppb) | DPR Evaluation |
|---|---|---|---|---|---|
| Butte | Atrazine | 33 | 1 | 0.029 | Registered 6800(a) pesticide. **One (1) well with a detection is not in a GWPA and will be evaluated.** |
| Butte | Carbon disulfide | 57 | 1 | 0.1 | Not registered for use in California since 1987. |
| Butte | DBCP | 29 | 1 | 0.004 | Not registered for use in California since 1979. |
| Butte | DCPA mono/di-acid degradates (TPA, MTP) | 2 | 1 | 0.32 | Degradate of a registered pesticide. These degradates were determined not to pollute at the level detected (Leahy, 2018). |
| Butte | DEA (degradate of atrazine) | 26 | 3 | 0.008 - 0.251 | Degradate of a registered 6800(a) pesticide. Two (2) wells had detections below the SL. **One (1) well with a detection above the SL is not in a GWPA and will be evaluated.** |
| Butte | Prometon | 26 | 1 | 0.011 | Registered 6800(a) pesticide. One (1) well with a detection is in a GWPA. |
| Butte | Simazine | 33 | 2 | 0.004 - 0.006 | Registered 6800(a) pesticide. Two (2) wells had detections below the SL. |
| El Dorado | DCPA mono/di-acid degradates (TPA, MTP) | 16 | 1 | 0.11 | Degradate of a registered pesticide. These degradates were determined not to pollute at the level detected (Leahy, 2018). |
| Fresno | ACET (degradate of atrazine and simazine) | 53 | 34 | 0.036 - 0.406 | Degradate of a registered 6800(a) pesticide. Thirty-four (34) wells with detections are in GWPAs. |
| Fresno | Atrazine | 148 | 3 | 0.003 - 0.063 | Registered 6800(a) pesticide. One (1) well with a detection is in a GWPA. Two (2) wells had detections below the SL. |
| Fresno | Bromacil | 85 | 8 | 0.026 - 5.02 | Registered 6800(a) pesticide. Eight (8) wells with detections are in GWPAs. |
| Fresno | Carbon disulfide | 9 | 1 | 0.3 | Not registered for use in California since 1987. |
| Fresno | Chlorantraniliprole | 19 | 1 | 0.266 | Registered pesticide. **One (1) well with a detection will be evaluated (Afyuni and Nordmark, 2022).** |
| Fresno | DACT (degradate of simazine) | 53 | 36 | 0.052 - 2.581 | Degradate of a registered 6800(a) pesticide. Thirty-six (36) wells with detections are in GWPAs. |
| Fresno | DBCP | 204 | 93 | 0.01 - 0.77 | Not registered for use in California since 1979. |

| County | Pesticide or Degradate Detected | Wells Tested | Wells With Detections | Concentration Range (ppb) | DPR Evaluation |
|---|---|---|---|---|---|
| Fresno | DEA (degradate of atrazine) | 61 | 5 | 0.004 - 0.105 | Degradate of a registered 6800(a) pesticide. Two (2) wells with detections are in GWPAs. Three (3) wells had detections below the SL. |
| Fresno | Diuron | 53 | 14 | 0.02 - 0.068 | Registered 6800(a) pesticide. Fourteen (14) wells with detections are in GWPAs. |
| Fresno | DSMN (degradate of norflurazon) | 53 | 33 | 0.014 - 0.708 | Degradate of a registered 6800(a) pesticide. Thirty-three (33) wells with detections are in GWPAs. |
| Fresno | Ethylene dibromide | 161 | 1 | 0.028 | Not registered for use in California since 1987. |
| Fresno | Fludioxonil | 19 | 1 | 0.316 | Registered pesticide. One (1) well had a detection above the SL. Fludioxonil was detected by DPR in this well previously (Davalos, 2021). **DPR is currently reviewing these results and conducting further evaluation (Kocis, 2020).** |
| Fresno | Flutriafol | 19 | 1 | 0.226 | Registered pesticide. **One (1) well with a detection will be evaluated (Afyuni and Nordmark, 2022).** |
| Fresno | Hexazinone | 61 | 2 | 0.015 - 0.043 | Registered pesticide. This pesticide was determined not to pollute at the levels detected (Reardon, 2011). |
| Fresno | Imidacloprid | 19 | 6 | 0.024 - 0.126 | Registered pesticide. This pesticide was determined not to pollute at the levels detected (Henderson, 2022). |
| Fresno | Methoxyfenozide | 19 | 4 | 0.033 - 0.201 | Registered pesticide. **Four (4) wells with detections will be evaluated (Afyuni and Nordmark, 2022).** |
| Fresno | Norflurazon | 53 | 13 | 0.025 - 0.679 | Registered 6800(a) pesticide. Thirteen (13) wells with detections are in GWPAs. |
| Fresno | Prometon | 63 | 1 | 0.075 | Registered 6800(a) pesticide. One (1) well with a detection is in a GWPA. |
| Fresno | Simazine | 148 | 40 | 0.005 - 0.111 | Registered 6800(a) pesticide. Thirty-seven (37) wells with detections are in GWPAs. Three (3) wells had detections below the SL. |
| Fresno | Trifluralin | 8 | 1 | 0.002 | Registered pesticide. One (1) well had a detection below the SL. |
| Glenn | Carbon disulfide | 1 | 1 | 0.1 | Not registered for use in California since 1987. |
| Glenn | Hexazinone | 11 | 1 | 0.0111 | Registered pesticide. This pesticide was determined not to pollute at the level detected (Reardon, 2011). |

| County | Pesticide or Degradate Detected | Wells Tested | Wells With Detections | Concentration Range (ppb) | DPR Evaluation |
|---|---|---|---|---|---|
| Glenn | Methoxyfenozide | 10 | 1 | 0.0345 | Registered pesticide. **One (1) well with a detection will be evaluated (Afyuni and Nordmark, 2022).** |
| Inyo | Tefluthrin | 7 | 1 | 0.005 | Never registered for use in California. |
| Kern | 1-Naphthol (degradate of carbaryl and naphthalene) | 15 | 1 | 0.0045 | Degradate of a registered pesticide. One (1) well had a detection below the SL. |
| Kern | 1,2-DCP | 194 | 6 | 0.0028 - 1 | Not registered for use in California since 1990. |
| Kern | 3,4-Dichloroaniline (degradate of diuron, linuron, propanil and iprodione) | 15 | 1 | 0.0066 | Degradate of a registered 6800(a) pesticide. One (1) well had a detection below the SL. |
| Kern | Atrazine | 207 | 4 | 0.005 - 0.007 | Registered 6800(a) pesticide. Four (4) wells had detections below the SL. |
| Kern | DBCP | 244 | 34 | 0.011 - 0.77 | Not registered for use in California since 1979. |
| Kern | DEA (degradate of atrazine) | 15 | 3 | 0.006 - 0.009 | Degradate of a registered 6800(a) pesticide. Three (3) wells had detections below the SL. |
| Kern | Simazine | 208 | 4 | 0.003 - 0.103 | Registered 6800(a) pesticide. Three (3) wells had detections below the SL. **One (1) well with detections above the SL is not in a GWPA and will be evaluated.** |
| Kings | Carbon disulfide | 2 | 1 | 0.1 | Not registered for use in California since 1987. |
| Los Angeles | Atrazine | 250 | 4 | 0.057 - 0.11 | Registered 6800(a) pesticide. One (1) well with a detection is in a GWPA. **Three (3) wells with detections above the SL are not in GWPAs and will be evaluated.** |
| Los Angeles | Bromacil | 116 | 1 | 0.1 - 0.15 | Registered 6800(a) pesticide. **One (1) well with detections above the SL is not in a GWPA and will be evaluated.** |
| Los Angeles | DBCP | 166 | 5 | 0.012 - 0.19 | Not registered for use in California since 1979. |
| Los Angeles | Ethylene dichloride | 740 | 11 | 0.263 - 3.4 | Not registered for use in California since 1987. |
| Los Angeles | Methoxychlor | 224 | 1 | 0.017 | Not registered for use in California since 2000. |
| Los Angeles | Simazine | 250 | 10 | 0.054 - 0.14 | Registered 6800(a) pesticide. Four (4) wells with detections are in GWPAs. **Six (6) wells with detections above the SL are not in GWPAs and will be evaluated.** |
| Madera | DBCP | 69 | 19 | 0.014 - 0.65 | Not registered for use in California since 1979. |
| Mariposa | Ethylene dichloride | 10 | 2 | 0.76 - 0.88 | Not registered for use in California since 1987. |

| County | Pesticide or Degradate Detected | Wells Tested | Wells With Detections | Concentration Range (ppb) | DPR Evaluation |
|---|---|---|---|---|---|
| Merced | 1,2-DCP | 61 | 6 | 0.0016 - 0.0172 | Not registered for use in California since 1990. |
| Merced | 3,5-Dichloroaniline (degradate of dichloran) | 23 | 2 | 0.005 - 0.023 | Degradate of a registered pesticide. Two (2) wells had detections below the SL. |
| Merced | Atrazine | 70 | 6 | 0.006 - 0.02 | Registered 6800(a) pesticide. One (1) well with a detection is in a GWPA. Five (5) wells had detections below the SL. |
| Merced | Carbon disulfide | 23 | 1 | 0.4 | Not registered for use in California since 1987. |
| Merced | DBCP | 73 | 12 | 0.012 - 0.17 | Not registered for use in California since 1979. |
| Merced | DEA (degradate of atrazine) | 25 | 11 | 0.005 - 0.045 | Degradate of a registered 6800(a) pesticide. Two (2) wells with detections are in GWPAs. Eight (8) wells had detections below the SL. **One (1) well with detections above the SL is not in a GWPA and will be evaluated.** |
| Merced | Hexazinone | 25 | 1 | 0.015 | Registered pesticide. This pesticide was determined not to pollute at the level detected (Reardon, 2011). |
| Merced | Metolachlor | 28 | 1 | 0.104 | Registered pesticide. **This well was re-sampled by DPR and the detection was confirmed. Results of the study are being evaluated.** |
| Merced | Ortho-dichlorobenzene | 61 | 1 | 0.015 | Not registered for use in California since 1985. |
| Merced | Simazine | 70 | 10 | 0.003 - 0.044 | Registered 6800(a) pesticide. Three (3) wells with detections are in GWPAs. Seven (7) wells had detections below the SL. |
| Merced | Tefluthrin | 23 | 1 | 0.004 | Never registered for use in California. |
| Monterey | DCPA mono/di-acid degradates (TPA, MTP) | 24 | 7 | 0.17 - 1.7 | Degradate of a registered pesticide. These degradates were determined not to pollute at the levels detected (Leahy, 2018). |
| Monterey | Formaldehyde | 7 | 3 | 3.2 - 9.8 | Not registered for use in California since 2020. |
| Napa | 1,2-DCP | 19 | 1 | 1.2 | Not registered for use in California since 1990. |
| Nevada | Ortho-dichlorobenzene | 15 | 1 | 0.79 | Not registered for use in California since 1985. |
| Orange | Simazine | 106 | 1 | 0.1 | Registered 6800(a) pesticide. One (1) well with a detection is in a GWPA. |
| Riverside | 1,2-DCP | 175 | 1 | 0.85 | Not registered for use in California since 1990. |

| County | Pesticide or Degradate Detected | Wells Tested | Wells With Detections | Concentration Range (ppb) | DPR Evaluation |
|---|---|---|---|---|---|
| Riverside | 3,4-Dichloroaniline (degradate of diuron, linuron, propanil and iprodione) | 1 | 1 | 0.004 | Degradate of a registered 6800(a) pesticide. One (1) well had a detection below the SL. |
| Riverside | Carbon disulfide | 26 | 1 | 0.1 | Not registered for use in California since 1987. |
| Riverside | DBCP | 105 | 7 | 0.012 - 0.23 | Not registered for use in California since 1979. |
| Riverside | Simazine | 115 | 2 | 0.04 - 0.056 | Registered 6800(a) pesticide. Two (2) wells with detections are in GWPAs. |
| Sacramento | DCPA mono/di-acid degradates (TPA, MTP) | 6 | 1 | 8.1 | Degradate of a registered pesticide. These degradates were determined not to pollute at the level detected (Leahy, 2018). |
| San Bernardino | 1,2-DCP | 262 | 2 | 0.53 - 0.87 | Not registered for use in California since 1990. |
| San Bernardino | Bentazon | 207 | 1 | 3.2 | Registered 6800(a) pesticide. **One (1) well with a detection is not in a rice growing area and will be evaluated.** |
| San Bernardino | DBCP | 278 | 34 | 0.01 - 0.18 | Not registered for use in California since 1979. |
| San Bernardino | DCPA mono/di-acid degradates (TPA, MTP) | 26 | 6 | 0.45 - 4.9 | Degradate of a registered pesticide. These degradates were determined not to pollute at the levels detected (Leahy, 2018). |
| San Bernardino | Diquat dibromide | 203 | 1 | 4 | Registered pesticide. **One (1) well with a detection will be evaluated.** |
| San Diego | 1,2-DCP | 93 | 2 | 0.51 - 0.57 | Not registered for use in California since 1990. |
| San Diego | DBCP | 74 | 2 | 0.022 - 0.93 | Not registered for use in California since 1979. |
| San Diego | DEA (degradate of atrazine) | 8 | 1 | 0.004 | Registered 6800(a) pesticide. One (1) well had a detection below the SL. |
| San Diego | Simazine | 85 | 2 | 0.005 - 0.006 | Registered 6800(a) pesticide. Two (2) wells had detections below the SL. |
| San Diego | Tebuthiuron | 8 | 1 | 0.017 | Registered pesticide. **One (1) well with a detection will be evaluated.** |
| San Joaquin | 1,2-DCP | 97 | 3 | 0.53 - 0.71 | Not registered for use in California since 1990. |
| San Joaquin | DBCP | 142 | 28 | 0.01 - 0.67 | Not registered for use in California since 1979. |
| San Joaquin | Ethylene dibromide | 132 | 2 | 0.02 - 0.09 | Not registered for use in California since 1987. |

| County | Pesticide or Degradate Detected | Wells Tested | Wells With Detections | Concentration Range (ppb) | DPR Evaluation |
|---|---|---|---|---|---|
| San Mateo | DCPA mono/di-acid degradates (TPA, MTP) | 2 | 1 | 0.21 | Degradate of a registered pesticide. These degradates were determined not to pollute at the level detected (Leahy, 2018). |
| Santa Barbara | 1,2-DCP | 60 | 1 | 0.0032 | Not registered for use in California since 1990. |
| Santa Barbara | Ethylene dichloride | 60 | 1 | 0.04 | Not registered for use in California since 1987. |
| Siskiyou | Atrazine | 12 | 1 | 0.0216 | Registered 6800(a) pesticide. One (1) well with a detection is in a GWPA. |
| Siskiyou | DEA (degradate of atrazine) | 12 | 1 | 0.0375 | Degradate of a registered 6800(a) pesticide. One (1) well with a detection is in a GWPA. |
| Stanislaus | 1-Naphthol (degradate of carbaryl and naphthalene) | 19 | 1 | 0.0043 | Degradate of a registered pesticide. One (1) well had a detection below the SL. |
| Stanislaus | 1,2-DCP | 122 | 2 | 0.0034 - 0.0062 | Not registered for use in California since 1990. |
| Stanislaus | 3,5-Dichloroaniline (degradate of dichloran) | 19 | 1 | 0.004 | Degradate of a registered pesticide. One (1) well had a detection below the SL. |
| Stanislaus | Atrazine | 57 | 4 | 0.004 - 0.007 | Registered 6800(a) pesticide. Four (4) wells had detections below the SL. |
| Stanislaus | Chloropicrin | 19 | 1 | 3.21 | Registered pesticide. **One (1) well with a detection will be evaluated.** |
| Stanislaus | Chlorthal-dimethyl (DCPA) | 19 | 1 | 0.0033 | Registered pesticide. One (1) well had a detection below the SL. |
| Stanislaus | DBCP | 141 | 23 | 0.007 - 0.81 | Not registered for use in California since 1979. |
| Stanislaus | DEA (degradate of atrazine) | 22 | 9 | 0.006 - 0.026 | Degradate of a registered 6800(a) pesticide. One (1) well with a detection is in a GWPA. Seven (7) wells had detections below the SL. **One (1) well with a detection above the SL is not in a GWPA and will be evaluated.** |
| Stanislaus | Hexazinone | 22 | 2 | 0.007 - 0.035 | Registered pesticide. This pesticide was determined not to pollute at the levels detected (Reardon, 2011). |
| Stanislaus | Metolachlor | 23 | 2 | 0.006 - 0.018 | Registered pesticide. One (1) well had a detection below the SL. **One (1) well with a detection above the SL will be evaluated.** |

| County | Pesticide or Degradate Detected | Wells Tested | Wells With Detections | Concentration Range (ppb) | DPR Evaluation |
|---|---|---|---|---|---|
| Stanislaus | Simazine | 56 | 4 | 0.005 - 0.03 | Registered 6800(a) pesticide. One (1) well with a detection is in a GWPA. Three (3) wells had detections below the SL. |
| Sutter | 1,2-DCP | 15 | 1 | 0.0261 | Not registered for use in California since 1990. |
| Sutter | Ortho-dichlorobenzene | 15 | 1 | 0.98 - 2.1 | Not registered for use in California since 1985. |
| Sutter | P-DCB | 15 | 1 | 0.94 - 2.3 | Registered pesticide. **One (1) well with a detection will be evaluated.** |
| Sutter | Simazine | 14 | 1 | 0.038 | Registered 6800(a) pesticide. **One (1) well with a detection above the SL is not in a GWPA and will be evaluated.** |
| Tulare | 1,2-DCP | 118 | 4 | 0.002 - 0.0082 | Not registered for use in California since 1990. |
| Tulare | 3,4-Dichloroaniline (degradate of diuron, linuron, propanil and iprodione) | 9 | 2 | 0.0037 - 0.0053 | Degradate of a registered 6800(a) pesticide. Two (2) wells had detections below the SL. |
| Tulare | 3,5-Dichloroaniline (degradate of dichloran) | 9 | 1 | 0.003 | Degradate of a registered pesticide. One (1) well had a detection below the SL. |
| Tulare | ACET (degradate of atrazine and simazine) | 16 | 12 | 0.072 - 0.776 | Degradate of a registered 6800(a) pesticide. Twelve (12) wells with detections are in GWPAs. |
| Tulare | Atrazine | 171 | 1 | 0.008 | Registered 6800(a) pesticide. One (1) well had a detection below the SL. |
| Tulare | Bromacil | 56 | 8 | 0.3 - 1.456 | Registered 6800(a) pesticide. Eight (8) wells with detections are in GWPAs. |
| Tulare | Carbon disulfide | 10 | 1 | 0.1 | Not registered for use in California since 1987. |
| Tulare | DACT (degradate of simazine) | 16 | 12 | 0.199 - 5.937 | Degradate of a registered 6800(a) pesticide. Twelve (12) wells with detections are in GWPAs. |
| Tulare | DBCP | 189 | 37 | 0.01 - 0.75 | Not registered for use in California since 1979. |
| Tulare | DEA (degradate of atrazine) | 25 | 6 | 0.006 - 0.035 | Degradate of a registered 6800(a) pesticide. Six (6) wells with detections are in GWPAs. |
| Tulare | Diuron | 16 | 7 | 0.026 - 0.037 | Registered 6800(a) pesticide. Seven (7) wells with detections are in GWPAs. |
| Tulare | DSMN (degradate of norflurazon) | 16 | 7 | 0.014 - 1.273 | Degradate of a registered 6800(a) pesticide. Seven (7) wells with detections are in GWPAs. |

| County | Pesticide or Degradate Detected | Wells Tested | Wells With Detections | Concentration Range (ppb) | DPR Evaluation |
|---|---|---|---|---|---|
| Tulare | EPTC | 9 | 1 | 0.0322 | Registered pesticide. One (1) well had a detection below the SL. |
| Tulare | Ethylene dibromide | 181 | 1 | 0.027 | Not registered for use in California since 1987. |
| Tulare | Hexazinone | 25 | 1 | 0.011 | Registered pesticide. This pesticide was determined not to pollute at the level detected (Reardon, 2011). |
| Tulare | Molinate | 58 | 1 | 7 | Not registered for use in California since 2009. |
| Tulare | Norflurazon | 16 | 5 | 0.02 - 0.374 | Registered 6800(a) pesticide. Five (5) wells with detections are in GWPAs. |
| Tulare | Prometon | 30 | 1 | 0.006 | Registered 6800(a) pesticide. One (1) well had a detection below the SL. |
| Tulare | Simazine | 171 | 14 | 0.004 - 0.065 | Registered 6800(a) pesticide. Twelve (12) wells with detections are in GWPAs. Two (2) wells had detections below the SL. |
| Tulare | Trifluralin | 9 | 1 | 0.005 | Registered pesticide. One (1) well had a detection below the SL. |
| Ventura | DBCP | 13 | 1 | 0.02 | Not registered for use in California since 1979. |
| Yolo | Ethylene dibromide | 40 | 1 | 0.036 | Not registered for use in California since 1987. |
| Yolo | Hexazinone | 2 | 1 | 0.018167 | Registered pesticide. This pesticide was determined not to pollute at the level detected (Reardon, 2011). |
| Yuba | Atrazine | 5 | 1 | 0.006 | Registered 6800(a) pesticide. One (1) well had a detection below the SL. |
| Yuba | DBCP | 6 | 1 | 0.044 | Not registered for use in California since 1979. |
| Yuba | DEA (degradate of atrazine) | 5 | 1 | 0.008 | Degradate of a registered 6800(a) pesticide. One (1) well had a detection below the SL. |

## GLOSSARY OF TERMS

| TERM | DEFINITION |
|---|---|
| AB 2021 | See “Pesticide Contamination Prevention Act.” |
| AB 2701 | AB 2701 (Chapter 644, Statutes of 2004) amended the Pesticide Contamination Prevention Act (PCPA) to require DPR to post specified information on sampling for pesticide residues in California groundwater to its website. This law replaced the previous requirement that DPR submit the sampling information in a written report to the Legislature. |
| 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. The remainder of the product consists of one or more *inert ingredients* (such as water, solvents, emulsifiers, surfactants, clay, and propellants), for reasons other than pesticidal activity. |
| Agricultural Commissioner | Local officials whose duties include pesticide use enforcement in their counties. |
| Agricultural use | The use of any pesticide, method, or device for the control of plant or animal pests, or any other pests, or the use of any pesticide to regulate plant growth or defoliation of plants. Agricultural use includes but is not limited to commercial production of animals or plants (including forest), parks, golf courses, cemeteries, roadsides, rights-of-way, and nurseries. It excludes pesticides intended for:<br>a) Home use<br>b) Structural pest control<br>c) Industrial or institutional use<br>d) The control of an animal pest under the written prescription of a veterinarian<br>e) Uses by certain local districts or agencies that operate under a cooperative agreement with the California Department of Public Health, such as many mosquito abatement districts.<br>See also “legal agricultural use.” |
| Analysis | For well water sampling data in the Well Inventory Database, it is the act of determining whether a substance is present in a water sample using laboratory methodology. |

| TERM | DEFINITION |
|---|---|
| CalEPA | California Environmental Protection Agency. Comprised of the Department of Pesticide Regulation, the Department of Toxic Substances Control, the State Water Resources Control Board, the California Air Resources Board, the Department of Resources Recycling and Recovery (CalRecycle), and the Office of Environmental Health Hazard Assessment. |
| California Code of Regulations (CCR) | Regulations formally adopted by state agencies. Regulations about pesticides and pest control operations are mainly in Title 3, Division 6 and Title 16, Division 19. |
| Chemigation | Applying pesticide through an irrigation system or mixing with irrigation water before the water is applied to the soil or crop. |
| Degradation | With respect to pesticides, degradation is the breakdown of the parent chemical by the action of microbes, water, air, sunlight, or other agents into daughter products (degradates) that may undergo further degradation by similar processes.<br>With respect to groundwater quality, degradation refers to a reduction of water quality. |
| Detection | A well water sample in which the presence of a pesticide is detected at or above the minimum detection limit of the analytical instruments used for analysis of the pesticide. A detection may be designated as confirmed or unconfirmed. |
| Director | In the context of this report, “Director” means Director of the Department of Pesticide Regulation. |
| Environmental fate | Describes the processes by which pesticides move and are transformed in the environment, including persistence in air, water, and soil; reactivity and degradation; migration in groundwater; and bioaccumulation in aquatic or terrestrial organisms. |
| Food and Agricultural Code (FAC) | Food and Agricultural Code. Divisions 6 and 7 of the FAC pertain to the registration, sale, and use of pesticides. |
| Formulation | Pesticide product as sold, usually a mixture of active and inert ingredients. |
| Groundwater | Water found below the surface of the land, usually in porous rock formations. |

| TERM | DEFINITION |
|---|---|
| Groundwater Protection Area (GWPA) | A geographic area defined in state regulations as vulnerable to pesticide contamination though the mechanism of either leaching or runoff. |
| Groundwater Protection List (GWPL) | A list of pesticides having the potential to pollute groundwater included in 3CCR section 6800. |
| Inert ingredient | Any substance other than an active ingredient which is intentionally included in a pesticide product. Also known as “other” ingredients, they do not attack a particular pest but may be chemically or biologically active. |
| Leaching | A pathway by which agricultural pesticides may reach groundwater; the process by which residues are dissolved in soil water and follow the movement of water through the soil matrix as it recharges a groundwater aquifer. |
| Legal agricultural use | The application of a pesticide, according to its labeled directions and in accordance with federal and state laws and regulations, for agricultural use as defined in FAC section 11408.<br>See also “agricultural use.” |
| Maximum contaminant level (MCL) | MCLs are health protective drinking water standards to be met by public water systems. MCLs consider not only a chemical’s health risks but also factors such as its detectability, treatability, and the cost of treatment. |
| Maximum contaminant level goal (MCLG) | The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals. |
| Mitigation measure | A use practice designed to reduce the risk of harm to people or the environment. |
| Model | Mathematical equations that represent certain processes. These equations can be implemented in a computer program to facilitate calculations and to test model predictions against measured data. |
| Monitoring well | A well principally used for any of the follow purposes: (1) observing groundwater levels and flow conditions, (2) obtaining samples for determining groundwater quality, or (3) evaluating hydraulic properties of water-bearing strata. |

| TERM | DEFINITION |
|---|---|
| Non-agricultural use | *See "agricultural use."* |
| Nonpoint source | Pollution sources that are diffuse and do not have a distinct discharge point (compare with *point source*), for example, applications of agricultural pesticides to crops. |
| Permit | Time- and site-specific permits are issued by County Agricultural Commissioners to use pesticides designated as restricted materials. |
| Pest | Any undesired insect, rodent, nematode, fungus, bird, vertebrate, invertebrate, weed, virus, bacteria, or other microorganisms (except microorganisms on or in humans or animals) declared to be injurious to human health or the environment. |
| Pest control | The use or application of any pesticide. It also means using any substance, method, or device to control pests; prevent, destroy, repel, mitigate, or correct any pest infestation or disorder of plants; or inhibit, regulate, stimulate, or otherwise alter plant growth by direct application to plants. |
| Pesticide | A substance, or mixture of substances, intended to defoliate plants, regulate plant growth, or prevent, destroy, repel, or mitigate any insects, fungi, bacteria, weeds, rodents, predatory animal, or any other form of plant or animal life declared to be a pest detrimental to vegetation, man, animal, or households, or any environment. Also, in California only, a spray adjuvant. |
| Pesticide Contamination Prevention Act (PCPA, AB 2021) | A law, effective January 1, 1986, added agricultural use sections 13141 through 13152 to Division 7 of the FAC. The PCPA requires the following: 1) each registrant of an agricultural use pesticide to submit environmental fate data to DPR; 2) the Director to use those data to establish a list of pesticides with the potential to pollute groundwater (GWPL); 3) the Director to monitor groundwater for these pesticides; 4) all local, county, and state agencies to report to DPR the results of pesticides sampled in groundwater; 5) the Director to maintain a specified well sampling database and to post certain information annually on DPR's website about pesticides in groundwater; and 6) a specified subcommittee and the Director to conduct a formal review to determine if continued use of a pesticide can be allowed if it is detected and verified in groundwater due to legal agricultural use. |

| TERM | DEFINITION |
|---|---|
| Pesticide Management Zone (PMZ) | A geographic surveying unit of approximately one-square-mile, considered vulnerable to groundwater contamination based on detections of pesticides or pesticide degradates in groundwater due to agricultural use. PMZs were formally listed in 3CCR section 6802 and were pesticide specific. The use of a pesticide inside its PMZs was subject to certain groundwater protection restrictions and requirements. All PMZs were reclassified as GWPAs in May 2004. |
| 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. |
| Pollution | Food and Agricultural Code section 13142 defines "*pollution" as "*the consequence of polluting," and "*pollute*" as "…to introduce a product into the groundwaters of the state resulting in an active ingredient, other specified ingredient, or a degradation product of a pesticide above a level that does not cause adverse health effects, accounting for an adequate margin of safety." |
| Public health goal (PHG) | OEHHA establishes PHGs. Based on current risk assessment principles, practices, and methods, PHGs are concentrations of drinking water contaminants that pose no significant health risk if consumed for a lifetime. OEHHA establishes PHGs pursuant to Health and Safety Code section 116365(c) for contaminants with MCLs. |
| Range | When used in the context of mapping locations, a range is 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.<br>A range is a vertical column of townships. |
| Registered pesticide | A pesticide product approved by the USEPA and DPR for use in California. |
| Regulations | State agencies adopt regulations 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. |

| TERM | DEFINITION |
|---|---|
| Reporting limit | The minimum value for an analysis method and chemical that a reporting laboratory/agency lists they will accept as a valid detection of that chemical. Values below that level may not be reported or may be reported as a trace. The Reporting Limit value should be greater than zero. In this document, a "Reporting Limit" of zero (0) indicates an agency did not specify a Reporting Limit in their data.<br><br>DPR defines the reporting limit as the lowest amount detected following the analytical method set at a level high enough to account for matrix effects (1 to 5 times the method detection limit). In contrast, trace concentrations are the concentrations between the method detection limit and the reporting limit and may not be as reliably quantified. Other agencies use different terminology and standards for their limits. |
| Restricted material | Restricted materials are pesticides deemed to have a higher potential to cause harm to public health, farm workers, domestic animals, honeybees, the environment, wildlife, or other crops compared to other pesticides. With certain exceptions, restricted materials may be purchased and used only by or under the supervision of a **certified** commercial or private applicator under a **permit** issued by the County Agricultural Commissioner (CAC). |
| Screening level (SL) | DPR's GWPP sets the screening level at 70 percent of the current reporting limit established by DPR's contract laboratory and conducts additional evaluation of detections that are at or above this concentration. |
| Senate Bill (SB) 1117 | SB 1117 of 2014 amended the Pesticide Contamination Prevention Act (PCPA) to require DPR to regulate each active ingredient, other specified ingredient, or degradation product of a pesticide on the GWPL that is detected as a result of legal agricultural use. It also revises the information that DPR is required to post on its website to include pesticide degradation products and other specified ingredients.<br><br>SB 1117 also revises the information included in the GWPL to include not only each active ingredient, but other specified ingredients or degradation product(s) of a pesticide that, when applied, have the potential to pollute groundwater. It also requires DPR's Director—in consultation with a specified subcommittee of the Director's Pesticide Registration and Evaluation Committee—to develop a peer-reviewed method to determine pollution potential using specific numerical values. |
| Section | Section/Township/Range: Public Land Survey System units. A section is a one-square-mile block of land containing 640 acres. A township typically has 36 sections. A range is a vertical column of townships. |

| TERM | DEFINITION |
|---|---|
| Specific numerical values (SNV) | The PCPA requires certain numeric threshold values to be established 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 field dissipation SNV has not been established). The PCPA associates these properties with the longevity and mobility of a pesticide in the soil and requires the establishment of SNVs in regulation as a means of predicting which pesticides are likely to pollute groundwater. |
| Township | When used in the context of mapping locations, a township is a public land surveying unit that is a square parcel of land, six miles on each side. The location of a township is established as being x number of six-mile units east or west of a north-south line running through an initial point (called the "principal meridian") and x number of six-mile units north or south of an east-west line running through another point (called the "baseline").<br>A township typically has 36 sections. |
| Well Inventory Database (WIDB) | A statewide database, required by the PCPA and maintained by DPR, of wells sampled for pesticides and pesticide degradates. |
| Well Inventory Report (WIR) | The annual sampling report for pesticide residues in California well water (this report) is sometimes referred to as the Well Inventory Report because it describes the data entered into the Well Inventory Database. |