Protecting the Environment

The Food and Agriculture Code (FAC) directs the Department of Pesticide Regulation (DPR) to protect the environment and continuously evaluate currently registered products. The continuous evaluation of pesticides supports the certification of DPR's regulatory program as the functional equivalent of an environment impact statement under the California Environmental Quality Act.

DPR has more than 25 years of experience in monitoring the environment for pesticides, evaluating pesticide sources and mitigating adverse effects of pesticide use on air, ground water and surface water quality. Environmental data collected by DPR are critical to the department's continuing evaluation of pesticide use and helps it carry out programs to prevent pesticide pollution. Scientists design and conduct studies to provide data that help assess human exposures and ecological effects of pesticide residues in the environment. Specific examples include:

- Evaluating the effect of application methods and management practices on the movement of pesticides.
- Monitoring the off-site movement of pesticides after application to evaluate the potential for contamination of air, surface water, ground water, or crops.
- Conducting studies to develop and evaluate measures designed to mitigate the adverse effects of pesticides.

Monitoring the environment involves taking samples and analyzing them for specific chemical residues. DPR develops sampling methods for pesticide residues and contracts with the California Department of Food and Agriculture (CDFA) Center for Analytical Chemistry for analytical method development.

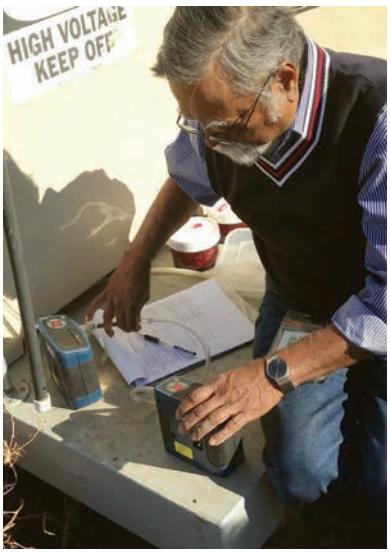
The Environmental Monitoring Branch has the lead role in carrying out the department's environmental protection programs.

Projects focus on monitoring under environmental conditions specific to California. Other agencies that may also sample for pesticides in the environment include the U.S. Geological Survey (USGS), the U.S. Environmental Protection Agency (U.S. EPA), and state agencies such as the Air Resources Board (ARB), State Water Resources Control Board, Regional Water Quality Control Boards, Department of Fish and Wildlife (DFW) and Department of Public Health (DPH). Although these data are useful to DPR, the purpose of such sampling is to meet their specific legal mandates or program objectives and not necessarily DPR's. If pesticides are detected by other agencies, DPR may do more sampling to confirm the detections, characterize the nature and extent of the detections and, if necessary, determine how the off-site movement of pesticides may be mitigated.

DPR's statutory authorities allow it to change pesticide use practices quickly. For example, through restricted material permit conditions, DPR can place limits on the quantity, area and method of application to reduce pesticide problems. Site-specific permits to use restricted materials are issued by county agricultural commissioners (CACs), who can require applicators to use extra control measures if needed to reduce the potential for environmental harm on surrounding areas. DPR has oversight of the permit process and uses data from scientific studies to develop suggested mitigation measures that CACs may include in their permits. The department may also adopt regulations that impose regional or statewide pesticide use requirements on all affected applicators.

DPR scientists take soil core samples in an alfalfa field at the University of California, Davis, to determine various soil properties.

Monitoring pesticide runoff from a California alfalfa field.



It is the public policy of the state that emissions of toxic air contaminants should be controlled to levels which prevent harm to the public health.

— Toxic Air Contaminant Act (1983)

EVALUATING PESTICIDES IN AIR

The Air Program conducts air monitoring, evaluation and mitigation under its general reevaluation mandate and under the mandates of the Toxic Air Contaminant Act (Chapter 1047, Statutes of 1983, AB 1807, amended by Chapter 1380, Statutes of 1984, AB 3219).

Activities to prevent or reduce the adverse effects of pesticides on air include:

- Measures to reduce pesticide sources of volatile organic compounds.
- Air monitoring, evaluation and mitigation as part of DPR's continuous evaluation mandate, including establishment of an air monitoring network.

Toxic Air Contaminant (TAC) Program

The TAC program is one of several options DPR can use to control airborne pesticide residues. TACs are air pollutants that may cause or contribute to increases in serious illness or death, or may pose a present or potential hazard to human health. The law focuses on identifying, evaluating and controlling pollutants in ambient community air. In carrying out the law, DPR must:

- Review the physical properties, environmental fate and human health effects of the candidate pesticide.
- Find out the levels of the pesticide in air.
- Estimate human exposure and the potential human health risk from those exposures.

The law requires DPR to list in regulation both those pesticides previously identified under federal laws as Hazardous Air Pollutants (HAPs) and those identified by DPR through the evaluation process of the TAC statute. For the latter group, DPR must then decide the appropriate degree of control measures.

DPR's TAC Program consists of two phases: risk assessment (evaluation and identification) and risk management (control). The first phase involves an extensive evaluation of the candidate pesticide to assess the potential adverse health effects and to estimate levels of exposure associated with its use. DPR, in consultation with CalEPA's Office of Environmental Health Hazard Assessment (OEHHA) and ARB, first prioritizes pesticides for risk assessment based on how much of the pesticide is used and sold in California, its persistence in the atmosphere and health effects information. DPR then requests ARB to conduct monitoring studies to measure the air concentrations of pesticides.

For each candidate pesticide, ARB collects samples near an application site and in ambient air of nearby communities. Because most large-scale pesticide applications are seasonal and occur in agricultural areas, ARB conducts monitoring in areas of high use and at times when use is at its peak. This worst-case information can help determine the ambient exposures of people living in all areas where the pesticide is used.

Continuing the evaluation for each pesticide, the law requires DPR to prepare a report that includes:

- An assessment of exposure of the public to ambient concentrations of the pesticide.
- A risk assessment which includes data on health effects, including potency, mode of action and other biological factors.
- A review of the environmental fate and use of the pesticide.
- The results of monitoring studies conducted in California to measure the levels of the candidate pesticide in ambient air.

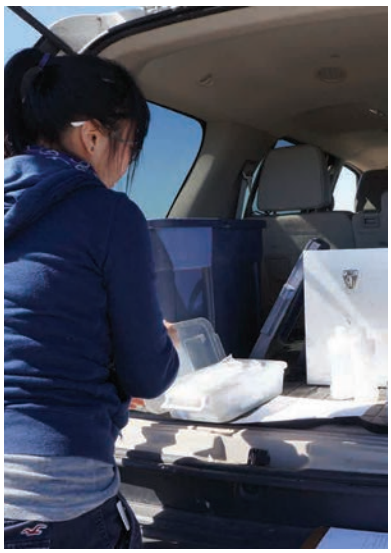
The report is peer-reviewed by OEHHA, ARB and the TAC Scientific Review Panel (SRP), a panel of experts representing a range of scientific disciplines. Based on this comprehensive evaluation, DPR receives a recommendation from the SRP on whether

the pesticide meets the criteria for listing as a TAC. If the pesticide meets the criteria, DPR adopts a regulation listing it as a TAC.

Once a candidate pesticide is listed as a TAC, it enters the mitigation phase. When a TAC pesticide that is a HAP goes through a risk assessment, it enters the mitigation phase as well. Consulting with OEHHA, ARB and local air pollution control districts, DPR examines the need for and suitable degree of controls. If reductions in exposure are needed, DPR must develop control measures to reduce emissions to levels that adequately protect public health. DPR must use the best practicable control techniques available, which may include:

- Requesting that the registrant work with U.S. EPA to change use instructions on the product label.
- Requiring applicator training.
- Limiting application methods, crops or locations.
- Reclassifying the pesticide as a restricted material, meaning that a site-specific permit would be required and added controls imposed, based on local conditions.
- Banning the use by canceling a product's registration.

The Air Program conducts monitoring studies and data analysis to determine potential mitigation measures that are finalized in consultation with ARB, OEHHA, the Department of Food and Agriculture, CACs and air pollution control districts.



Data collection at an air monitoring station in Salinas in 2014.

Reducing Volatile Organic Compounds (VOCs) in the air

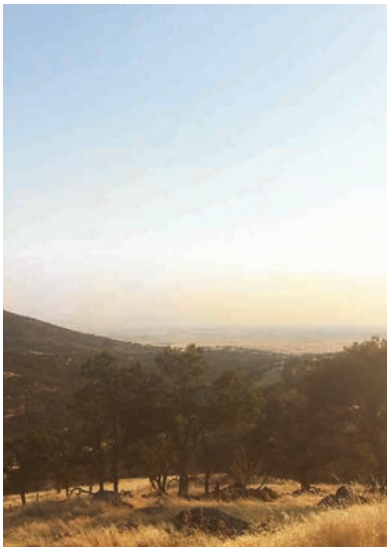
Under the federal Clean Air Act, each state must have a State Implementation Plan (SIP) for achieving and maintaining federal ambient air quality standards, including the standard for ozone. VOCs are carbon compounds that are released or evaporate into the atmosphere. There, they can react with other substances to form ground-level ozone, a component of smog. In California, the primary source of VOCs is vehicle exhaust. Industrial operations also emit VOCs, as do thousands of products, including pesticides.

Nonattainment Areas (NAAs) are regions in California that do not meet either federal or state ambient air quality standards. A state's SIP, which must be approved by U.S. EPA, identifies reductions in emissions from different sources in each region to meet the standard and the controls needed to do so.

ARB, which coordinates the overall development of the SIP, is responsible for developing measures to reduce pesticide VOC emissions from consumer products. DPR has responsibility for reducing VOC emissions from agricultural and structural pesticides. The project resulted in the nation's first-ever regulations to control pesticide VOCs by reducing emissions from agricultural fumigants. ARB and DPR worked together to develop a plan to track and reduce pesticide VOC sources in NAAs as part of the 1994 California SIP. In the SIP, DPR committed to reduce agricultural and commercial structural pesticide sources of VOCs by 20 percent compared with the 1990 base year in four of five NAAs that exceeded federal ozone standards: Sacramento Metro, Southeast Desert, South Coast, and Ventura. In the San Joaquin Valley NAA the SIP goal is to reduce pesticide VOCs by 12 percent compared to the 1990 base.

DPR's approach to reducing pesticide VOC emissions includes:

- Finding out the VOC emission potential of pesticide products.
- Estimating and tracking pesticide VOC emissions based on use reporting and emission potential data.
- Allowing only low-emission methods of field fumigant applications in three of the NAAs that require a reduction in pesticide emissions.



Heavily agricultural San Joaquin County is a "nonattainment" area for ozone pollution.

- Placing prohibitions on the use of certain “high-VOC” products in the San Joaquin Valley NAA.
- Developing a VOC emission inventory and tracking emissions. Accurate data on the amount of VOCs emitted by pesticides are critical to developing practical emission control measures.

In 1994, DPR began data call-ins asking registrants to determine the VOC emission potential of their products, preferably by analyzing products using the thermogravimetric analysis (TGA) method. If TGA analysis is not available, DPR uses other approaches to decide emission potentials, such as estimation based on the confidential statement of formula on file with DPR or by assigning a default value based on formulation.

DPR uses data on VOC content and pesticide use to estimate emissions from reported agricultural and commercial structural applications in each NAA. Pesticide use reports provide the quantity of pesticide used. Under state law, all agricultural pesticide use must be reported to DPR, as does the use of pesticides by pest control businesses.

A further adjustment is made when estimating emissions from applications of field fumigants. Because DPR has air monitoring data from fumigant applications, the calculation is adjusted to account for how emissions vary depending on fumigation method.

DPR’s VOC emission inventory database includes only pesticide applications made between May 1 and Oct. 31, the peak ozone season in California. It contains data for every year since 1990. The department updates the database when pesticide use report data from the previous year become available. Each year contains about 2.5 million pesticide use records and emission potential (EP) values for about 5,000 products.

DPR prepares an annual estimate of VOC commercial structural pesticide applications in the five NAAs. Only agricultural and commercial structural pesticide applications are included. (ARB tracks emissions from consumer pesticide products.) DPR uses the VOC inventory to identify the various pesticide sources of VOCs, track changes in pesticide VOC emissions over time, suggest and evaluate potential VOC emission reduction strategies, and track progress in meeting VOC reduction goals.

Voluntary measures to reduce VOC emissions

DPR continues to promote the reduction of VOC emissions through various nonregulatory approaches, which include:

- Pesticide manufacturers altering formulations to remove or reduce VOC-emitting ingredients.
- Pesticide users switching to low-VOC formulations.
- Registration of new products designed to be used at low rates.
- Encouraging greater use of integrated pest management practices, which typically reduce pesticide use.
- Assisting ARB, U.S. Department of Agriculture and others in researching methods to reduce VOC emissions.

These measures, combined with DPR restrictions on fumigants designed to reduce air toxins, cut pesticide VOCs below the target level in the Sacramento Metro and South Coast NAAs. However, pesticide VOCs in the Southeast Desert, Ventura and San Joaquin Valley NAAs remained above the SIP goal in some years. DPR continued its nonregulatory measures (particularly outreach to reduce applications of VOC-emitting pesticides) but in the mid-2000s began developing regulatory controls.

Regulatory controls

In January 2008, DPR put regulations in place that included specific emission target levels for each of the five NAAs. The regulations require low-emission fumigation methods in certain NAAs. If, despite these application method restrictions, pesticide VOC emissions exceed specified trigger levels, DPR is required to ensure the benchmark is achieved by establishing a fumigant limit and grower emission allowance system. The regulations also required that pesticide use reports in the five NAAs specify the application method for field fumigations. This allows DPR to better estimate and therefore track VOC emissions in each NAA and make any needed changes in controls to ensure that VOC reductions meet the SIP goal each year.

Many liquid pesticide products contain solvents that emit VOCs. In 2005, DPR began a formal reevaluation of certain nonfumigant pesticide products, a necessary first step to requiring reformulation of pesticides to lower the VOC content and restricting use of products with higher VOCs. As a result, pesticide makers reformulated several high-use, high-VOC pesticide products, replacing them with low-VOC versions.

In each of the three NAAs that required the use of low-emission methods for fumigant use, VOC emissions from fumigants were reduced. However, data showed that VOC emissions in the San Joaquin Valley NAA, were not low enough to ensure that SIP goals would be met in the future. Therefore, in 2013, DPR adopted regulations that set a trigger level of emissions that, if exceeded, would invoke pesticide use limitations to reduce VOC emission from certain nonfumigant pesticide products. If the trigger level is exceeded, the use of high-VOC products containing one of seven active ingredients is prohibited. The restrictions apply to the use of certain products of abamectin, chlorpyrifos, gibberellins, and oxyfluorfen for use on seven crops during the peak ozone season that contribute the most to nonfumigant VOC emissions.

Community air monitoring

Past air monitoring focused on short-term monitoring for a single chemical. To generate better data on long-term exposure, DPR had begun planning a network of monitoring stations to sample for pesticides in the air over two or more years. In 2000, methods were developed for a study conducted in a small agricultural city in Santa Barbara County that enabled the Air Program to monitor for multiple chemicals in a single sample. The study monitored air concentrations at several locations in the community during a 10-week period. In 2006, the Air Program used the methods developed for a year-long study that monitored ambient air in Parlier, a Fresno County community, as part of CalEPA's Environmental Justice Action Plan to learn what pesticides were in the air of a rural farm community. The Parlier project served to test and perfect sampling protocols, develop health screening levels, improve and expand laboratory analytical methodology, and fine-tune approaches to data analysis.

To learn more about pesticides in air and improve protective measures as necessary, DPR established the nation's first Air Monitoring Network to sample community air for pesticides in early 2011. DPR set up monitoring stations in two San Joaquin Valley communities and one in the Salinas Valley. Project objectives are to:

- Identify common pesticides in air and determine seasonal, annual and multiple-year concentrations.
- Compare concentrations to subchronic and chronic health screening levels.
- Track trends in air concentrations over time.
- Estimate cumulative exposure to multiple pesticides with common modes of action.
- Work to correlate concentrations with use and weather patterns.

The network supplements TAC monitoring by providing data for long-term exposures to multiple pesticides. DPR selected up to 32 pesticides to monitor based on use and volatility (both indicators of exposure), their DPR risk assessment priority

Air monitoring in Parlier in 2006.

An unmanned aerial vehicle demonstration at a vineyard near Napa in 2015.

(an indicator of toxicity), and their suitability for laboratory analysis using available methods. DPR selected the communities based on several factors, including the amount of pesticides used and demographics related to risk assessment (for example, numbers of children and farmworkers).

The Air Program collects one 24-hour sample each week in each community. Based on the results from the department's Parlier study, sampling a single location weekly will provide enough data to estimate long-term concentrations.

DPR reassessed and secured additional resources for the Air Monitoring Network in 2016, in consultation with its Pesticide Registration and Evaluation Committee and stakeholders. DPR (with assistance from the Air Resources Board) will conduct year-round air monitoring at eight locations in the San Joaquin Valley and Central Coast regions for two years. DPR selected four communities primarily based on high use of four fumigants and four communities based on high use of 11 organophosphates. These are the pesticides with higher exposures according to the monitoring since 2011, but all sites will be monitored for the 32 pesticides included in the original Air Monitoring Network.

Other air monitoring programs

Separate from the TAC program, the Air Program conducts air monitoring as part of its continuing evaluation of pesticides. The Air Program takes the lead in characterizing the source and recommending mitigation measures for off-target movement of pesticide residues in air that have resulted in crop damage, illegal crop residues, environmental contamination, or public complaints of odor or other problems. These monitoring studies help DPR evaluate the likelihood of pesticides causing health problems for workers using pesticides and for people living near treated areas, and to provide data to develop new use practices designed to prevent harm. DPR periodically monitors to evaluate the effectiveness of its risk reduction measures. If air monitoring finds unacceptable levels of pesticides in ambient air, the data help fine-tune control measures. As part of the evaluation, the Air Program conducts monitoring targeted at specific application methods. For example, studies are conducted to determine emission rates of new field fumigation methods, and off-site concentrations of fumigants from commodity treatments. In addition, the Air Program conducts studies to determine potential drift from new application equipment, such as unmanned aerial vehicles.

PROTECTING WATER QUALITY

DPR's programs to protect ground and surface water address both agricultural and nonagricultural sources of pesticide residues in water and include pollution prevention and response elements.

In California, DPR and the State and Regional Water Boards have mandates and authorities bearing on pesticides and water quality. DPR is the lead agency for regulating the registration, sales and use of pesticides in California. The State Water Board is the lead agency for coordinating and controlling water quality in California. The State Water Board and the nine Regional Boards carry out statewide and regional programs under the Porter-Cologne Act and federal programs mandated by the Clean Water Act.

Management Agency Agreement: DPR and the State Water Board have a management agency agreement (MAA) that identifies primary areas of responsibility and authority and provides methods to ensure continuing coordination at the state and regional levels. It identifies the roles of the water boards regarding water quality protection and the role of DPR in pesticide regulation. The MAA and its implementation plan describe how staff-level communication and collaboration can be effectively used to prevent and respond to the occurrence of pesticides in surface water. The MAA and implementation plan also promote the sharing of program

information, monitoring data, best management practices, and scientific studies related to pesticide residues in surface water. The MAA and associated implementation plan are undergoing updates and revisions in 2016. The updated plan will go beyond providing guidance on staff level interactions and incorporate an executive charter between DPR and State Board management. In addition, the updated plan will include the Surface Water Response Process established in 2003 that delineates interagency interactions in response to pesticide detections in surface water.

SURFACE WATER PROTECTION PROGRAM

The goals of DPR's Surface Water Protection Program (SWPP) include:

- Preventing pesticide pollution by working with the Pesticide Registration Branch through the registration evaluation process.
- Characterizing pesticide residues in surface water bodies (including rivers, streams and agricultural drains).
- Identifying sources of contamination.
- Determining the mechanisms of off-site movement of pesticides to surface water.
- Evaluating monitoring data and water quality effects thresholds as part of continuous evaluation to identify potential risk of pesticides to the aquatic environment.
- Developing and promoting site-specific mitigation strategies.
- When warranted, adopting restrictions to further protect surface water from contamination.

As a part of the registration process, SWPP scientists evaluate new active ingredients and selected products that have the potential to adversely impact surface water. When possible, our scientists use computer modeling tools that utilize pesticide application scenarios, physicochemical properties, and toxicity data to predict off-site transport and risks to sensitive aquatic organisms. Models provide consistent and reliable information that our scientists can use, along with their expert knowledge, to provide recommendations to the Pesticide Registration Branch.

SWPP designs and conducts monitoring to assess pesticide contamination of surface water in both agricultural and urban watersheds. This involves identifying and prioritizing active ingredients and breakdown products that warrant surface water monitoring through consideration of pesticide use data, aquatic toxicity, physicochemical properties, product application information, and historical monitoring data. SWPP analyzes pesticide monitoring data as part of DPR's continuous evaluation process. SWPP monitoring data, as well as those from external sources, are collected and made publicly available through our Surface Water Database (SURF).

SWPP also conducts research to characterize the factors that lead to off-site movement of pesticides and to develop use practices to prevent such movement. The program supplements in-house research studies by contracting with university researchers for studies related to the impacts of pesticides in agricultural and urban environments. Research areas include source identification, management practices, analytical method development, aquatic toxicity, and outreach. Scientific findings from SWPP research studies and urban and agricultural monitoring programs are summarized in departmental reports and journal articles. SWPP also takes part in DPR's formal reevaluation of already registered products that may have caused or are likely to cause a significant adverse impact to the aquatic environment. When a pesticide enters reevaluation, DPR reviews existing data and may require registrants to provide additional data. Examples of reevaluations that were initiated at SWPP's request include those for diazinon, chlorpyrifos, copper antifouling paint, and pyrethroid products.

Surface water sampling in Roseville in 2014.

Stormwater sampling at Salt Creek, Orange County.

In coordination with the State and Regional Water Boards, DPR investigates occurrences of pesticides of concern and determines the course of action to reduce or eliminate the impact of pesticides on surface water quality. Staff develops mitigation measures through a scientific understanding of pesticide sources and transport mechanisms. DPR may seek to reduce contamination initially through voluntary and cooperative efforts, which may include outreach programs to educate specific user groups (e.g. growers, professional applicators) or the public on ways to reduce pesticide contamination in both urban and agricultural settings.

If voluntary efforts do not adequately mitigate the impacts, DPR can use its regulatory authority to impose restrictions. DPR may modify the use of pesticides by regulation or permit conditions to prevent excessive residues from reaching surface water.

Urban Pyrethroid Surface Water Regulations

In the early 2000s, increased applications of pyrethroids for outdoor residential pest control led to frequent detections and occasional observed toxicity in urban streams and creeks. DPR evaluated available pyrethroid surface water data and subsequently initiated a reevaluation on pyrethroid products in 2006 to determine the pesticide application practices and transport pathways that resulted in surface water contamination. In 2012, surface water regulations were adopted to restrict pyrethroid application practices to reduce off-site transport. DPR has been engaged in outreach and education efforts aimed towards urban pest control professionals to emphasize the importance of these regulations and promote compliance. Monitoring and focused research studies are underway to evaluate efficacy of the adopted regulations.

Dormant Spray Water Quality Program

Spraying of Central Valley orchard crops during cold weather, when the trees are dormant, kills overwintering insects and diseases. However, organophosphate insecticides used as dormant sprays cause problems when drift occurs or when storm runoff washes residues into rivers and streams. To deal with the problem, DPR established its Dormant Spray Water Quality Program in 1996. Rather than immediately move to mandatory restrictions, DPR and CACs asked local resource conservation districts, farmers and pesticide manufacturers to develop methods to control off-site movement of these chemicals. However, DPR monitoring conducted over several years determined that voluntary practices had not been enough to reduce the movement of harmful pesticides to surface water. In 2007, DPR adopted regulations requiring the use of alternative pesticides, a buffer zone between the application and waterways, or other means to prevent potential contamination.

Rice Pesticides Monitoring Program

In the early 1980s, rice herbicides killed fish in Sacramento Valley agricultural drains and created taste problems in Sacramento city drinking water. Beginning in 1983, CDFA (and later DPR), CACs, DFG (later CDFW), the State and Central Valley Water Boards, and the rice industry worked together to develop and put into place a plan to control discharges of pesticides from rice fields. Holding water in the rice fields, the pesticides could degrade enough to reduce toxicity to acceptable levels in receiving waters.

DPR and CACs put in place controls on the use of rice herbicides to meet water quality standards established by the Central Valley Water Board. Through a combination of mandated restricted materials permits issued by CACs and management practices carried out by rice growers, this program has been successful in reducing pesticide loading in waterways receiving rice field runoff. CACs continue to conduct water-hold and other inspections to enforce controls.

Until 2003, DPR monitored for rice pesticides each year in agricultural drains

next to rice fields and in areas of the Sacramento River that receive rice field water. In 2003, the California Rice Commission, a commodity group representing California rice growers and handlers, took over responsibility for monitoring surface water and documenting grower compliance with the rice pesticides program. DPR provides oversight and continues to work with the Regional Water Board and the rice industry to ensure continued protection of water quality.

GROUND WATER PROTECTION PROGRAM

The State Water Board began monitoring ground water for toxic metals, nitrates and organic pesticides in 1978, finding widespread contamination by the fumigant DBCP, which had been canceled in 1977.

A more limited CDFA monitoring project in 1982 of 217 well sites found DBCP, simazine, ethylene dibromide and carbofuran. It was followed in 1983 by a Water Board report—the first comprehensive analysis of pesticides in California ground water—which found that more than 50 pesticides had been found in 23 counties. DBCP alone was found in more than 2,000 wells.

In 1984, CDFA began developing a plan to selectively control the application of ground-applied pesticides. At the same time, reports of pesticides in ground water also came to the attention of the Legislature. In 1985, the Assembly Office of Research published *The Leaching Fields: A Nonpoint Threat to Groundwater*, which reported detection of 57 pesticides in ground water, 22 of which were because of agricultural use. The report predicted that more widespread contamination would be found and recommended more sampling to find out its extent.

The Pesticide Contamination Prevention Act (PCPA)

This law (Statues of 1985, Chapter 1298, AB 2021; amended in 2014 by SB 1117) was designed to prevent further pollution of drinking water sources, based on an assumption that movement of a pesticide to ground water could be predicted by its physicochemical and environmental fate characteristics. The PCPA placed several mandates on the department, registrants and government agencies that test well water for pesticides.

- **Environmental fate data**. Registrants of agricultural-use pesticides must submit data to DPR on the physical and chemical properties of pesticide products that describe their persistence and mobility. California's definition of "agricultural use" encompasses use not only in production agriculture but also along rights-of-way and in landscaped areas such as golf courses, parks and cemeteries. (*See discussion of the agricultural-use definition in Chapter 11.*)
- **Identify potential contaminants**. DPR scientists use this environmental fate data to identify pesticides with the potential to pollute ground water. DPR identifies specific trigger values (called specific numerical values, SNVs) by comparing chemical properties between pesticides or their degradation products known to contaminate ground water to other pesticides, including their degradation products that were sampled but not detected in ground water. The last update to the SNVs occurred in 1991. The amount of well sampling data and chemical analysis has greatly increased since then so the lists will be updated to reflect current knowledge. This new list will be subject to statistical analyses whereby the results will likely warrant an update of the current SNVs.

Groundwater Protection List

As mandated in the PCPA, DPR adopts regulations placing an active ingredient on its Groundwater Protection List (GWPL) if the chemical properties indicate a potential to pollute ground water. The requirement for the data call-in of chemical properties used for identification and listing an active ingredient now includes consideration of their major degradation products.

DPR monitors private drinking water wells for traces of pesticides.

Well water sampling is an important component of DPR's Ground Water Protection Program.

DPR was also required to develop a database of wells sampled for pesticides. Under the PCPA, all state and local agencies must report to DPR results of wells sampled for pesticides.

Monitoring

DPR must also sample ground water in areas where agricultural pesticides are used to find out if these pesticides have moved to ground water. In 2016, there were 105 registered pesticide active ingredients on the GWPL, about a third of all pesticide active ingredients used in agriculture. Because analytical methods are usually not available to measure each at the low concentrations normally found in well water, substantial work is needed to develop a method before monitoring can be done. Therefore, to increase the efficiency and reduce the cost of monitoring, the GWPL list has been prioritized using data on:

- Detections in ground water in the United States or other countries.
- Amount of pesticide used in California.
- Results from a calibrated model that uses environmental fate data to compare pesticide movement among active ingredients.

The result is a list of active ingredients identifying the priority for analytical method development and monitoring. DPR scientists also developed spatial information that allows targeted sampling that produces the highest probability of detecting residues in wells. Spatial databases used to determine sampling sites include pesticide use, soil properties, depth to ground water and previous detections.

Detection process

When a pesticide or pesticide degradate is detected in ground water, DPR takes several actions, including:

- Confirming the detection by analyzing a backup sample or resampling the well.
- Locating and sampling wells in the area near the original detection to find out the extent of contamination and if the detection was a result of legal agricultural use. (If there is evidence of illegal pesticide use or point sources, the detection is referred to the State Water Board.)
- Determining if the detected concentration poses an immediate threat to public health. If so, DPR can suspend the use of the pesticide. If residues do not pose an immediate threat to public health, it triggers a response outlined in the PCPA. This includes convening a three-member subcommittee of DPR's Pesticide Registration and Evaluation Committee to decide if use can continue and, if so, under what limits. The subcommittee is comprised of staff from OEHHA, the Water Board and DPR.
- Putting measures into place to prevent further contamination.

Regulatory controls to prevent ground water contamination

By 2010, DPR had reviewed eight pesticide active ingredients under the formal review process and adopted regulations to prevent their continued movement to ground water. The first set of regulations DPR put into place in the 1990s targeted only geographical sections of land where residues had been found in well water. A new approach based on years of research by DPR scientists resulted in regulations in 2004 that provide an extra layer of prevention by including areas with soil and depth-to-ground-water properties similar to areas where residues had previously been found. These vulnerable areas are denoted as ground water protection areas (GWPAs). More than 3,700 GWPAs cover roughly 2.3 million acres in California.

GWPAs are designated by the pathway for movement of residues to ground water. Areas classified as "leaching" have coarse-textured, sandy soil where residues move

directly down from application sites with water as it recharges the aquifer. GWPAs labeled as "runoff" areas are where residues move in rainfall or irrigation runoff that facilitates rapid movement to subsurface soils.

Use of listed pesticides in a GWPA requires a permit from the CAC. Growers are required to select a management practice described in regulation. Applicability of management practices is based on soil characteristics. For example, in a runoff area, the applicator could choose to hold all irrigation and rainfall drainage or runoff through the field for six months after the application. The management practice is an enforceable condition of the permit and CACs have the authority to conduct inspections to determine whether permit conditions have been met.

Among other restrictions to protect ground water are runoff protections for wellheads, regulating pesticide use on roadsides and preventing backflow of pesticides during chemigation.

To help carry out mandated activities, DPR's staff has incorporated scientific approaches to:

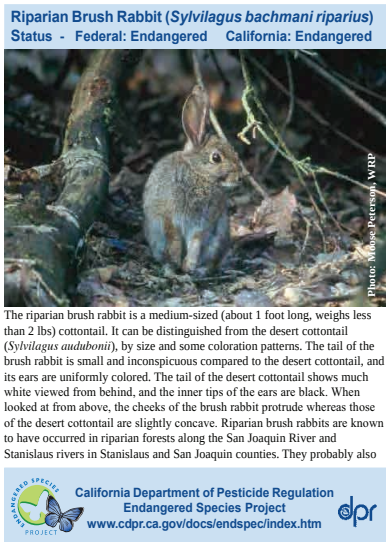
- **Understand pathways of movement to ground water.** DPR did its first investigations on how pesticides moved to ground water in the 1980s. It was followed by dozens of other studies on monitoring and analytical methods, modeling approaches, determination of the sources of contamination and pathways to soil, and the effects of agronomic and geologic factors on pesticide movement into soil.
- **Develop mitigation measures matched to the specific pathway of pesticide movement to ground water to prevent contamination.** In coarse-textured soils, control of irrigation percolation water is most important. In contrast, for soils where runoff is the pathway of off-site movement, one key option is incorporating residues from the surface application into the soil.
- **Evaluate pesticide products before registration to identify and, if needed, mitigate potential hazards to ground water**. If a pesticide is identified as having high potential to affect ground water, DPR may request the registrant to add restrictions to the label or conduct more studies on the environmental fate of the product. If mitigation is not possible, DPR could also decline to register the pesticide.
- **Track the effectiveness of regulations**. In 1999, DPR began a program to monitor the concentration of pesticide residues in wells known to be contaminated. Collected data and statistical analysis are posted online. Since initiation of DPR's monitoring of domestic wells in Fresno and Tulare counties in regulated Ground Water Protection Areas in 2000, decreases in well water have been measured for residues of simazine, diuron, and bromacil, providing an indication that mitigation measures have been effective.

ENDANGERED SPECIES PROJECT

In California, DPR has been studying endangered species protection issues through an interagency agreement with U.S. EPA since 1988. DPR activities include mapping sites occupied by federally listed species, evaluating pesticide exposure risks to inhabited sites, classifying risk and developing protection strategies.

As of 2016, there were 316 federally listed endangered or threatened species in California. The nine listed populations of salmon and steelhead occupy the most area, defined as watersheds that cover roughly 40 percent of the state, including several entire coastal counties. All other terrestrial and inland aquatic species cover about 20 percent of the state, overlapping to some extent with the salmon and steelhead watersheds. Of the terrestrial species, San Joaquin kit fox has the greatest overlap with agricultural areas, accounting for about 10 million acres over 14 counties, mostly in the agriculturally rich southern San Joaquin Valley.

Salt marsh harvest mice (above) and kit foxes (below) are among the species monitored by DPR scientists.



A field identification card created by DPR's Endangered Species Project.

The risks of pesticide exposure to nontarget and endangered species are evaluated from registered use patterns, history of fish or wildlife impacts from pesticides and a comparison of the biology of the nontarget species with the pesticide use pattern.

DPR's Endangered Species Project (part of the Pest Management and Licensing Branch) coordinates endangered species protection strategies with California Department of Fish and Wildlife (CDFW), California Department of Food and Agriculture (CDFA) and the California Agriculture Commissioners (CACs). Alternative protection strategies and the State Plan developed under this project are subject to U.S. EPA authorization and U.S. Fish and Wildlife Service approval.

The distribution of most endangered species has not been officially defined. Surveying for the presence of many species is expensive and unreliable. Changing land uses, including field rotations, land development and natural variables such as the mobility of some species, food supply, droughts, floods and wildfires cause many species to redistribute faster than surveys can be completed. Surveying for the current distribution of species is therefore reserved for special cases where no other approach is feasible to limit pesticide exposure to nontarget species.

Usually, the best estimate of current distribution comes from past sightings and current evaluations of land use in these areas. The best available compilation of sightings for federally listed species (and other species of special status) in California is CDFW's Natural Diversity Database (NDDB). Sites in the NDDB are often defined by a central point and a radius (up to one mile) that encompasses the area of an occurrence of a species. More precise information is used where available.

DPR converts the NDDB data into a list of sections appended through the Public Land Survey System (PLSS) of township, range and section (TRS) coordinates for each location where these species may be found. Within these sections, a habitat description accompanies protection strategies. This limits strategies to areas that meet the conditions of habitat for a species.

Endangered species are not economic pests. There is no essential conflict between using pesticides and protecting endangered species if nontarget hazards of pesticides are understood and satisfactory protection strategies developed and used to avoid nontarget exposures. Protection strategies rely on the differences between endangered species and the species that are the target of pesticide applications. Differences in the size, activity patterns, food preferences, seasonal presence and behavior can be used to selectively expose pests to a pesticide while minimizing the risk to endangered species.

Pesticide applicator training is essential to the success of DPR's Endangered Species Project. Beginning in 1996, DPR developed endangered species field identification cards, slide presentations and other instructional materials to help pest control professionals, farmers and other pesticide applicators identify endangered species and their habitats. DPR staff distributes these materials at continuing education seminars. They are also posted online.

DPR staff also works with federal agencies such as the National Marine Fisheries Service and the Fish and Wildlife Service to help develop more accurate pesticide exposure assessments of endangered species used in biological opinions. These assessments, which are key to determining the need for additional protective measures, are often based on conservative assumptions because data on pesticide use and the presence of pesticides in the environment are scarce. In California, however, these data are detailed and extensive enough to help explain historic conditions in endangered species habitat and predict possible impairments in the future. These data sets, especially when used with pesticide dispersion and exposure models, can help refine understanding of how pesticide use may affect endangered species and what protective measures are appropriate.

PRESCRIBE SEARCH TOOL

In 2005, DPR introduced a web-based tool to give pesticide users and CACs customized information to protect endangered and threatened species. Called PRESCRIBE (Pesticide Regulation Endangered Species Custom Real-time Internet Bulletin Engine), it allows users to select a geographical area and pesticides of interest and receive a computer-generated "prescription" of applicable use limits to protect endangered species in that area. PRESCRIBE provides pesticide users with current, authoritative, comprehensive information on species distribution, pesticide products and corresponding pesticide use limitations to protect endangered species while maintaining the widest array of pest control alternatives.

With the increased popularity of smart phones and tablets, mobile internet usage has increased dramatically over the years. In response to the rising number of mobile users, DPR launched PRESCRIBE Mobile in February of 2014. PRESCRIBE Mobile identifies a user's location by using the mobile device (smart phone, tablet) global positioning capabilities to reference geographic coordinates. It then identifies listed species that may be present, down to a one-square-mile area, and provides use limitations to protect the species from the pesticide to be used in that site.

Until PRESCRIBE went online, CACs and pesticide users had to extract information from DPR's lengthy, printed county endangered species bulletins. It was difficult to figure out if an endangered species was in an area and if the pesticide to be applied was a problem for it.

The pesticide use limits presented by PRESCRIBE are the same as those in the paper bulletins. However, they are delivered in a one- or two-page report that provides the user with instructions relevant to the locations where the pesticide will be used, and only for the pesticide that will be used.

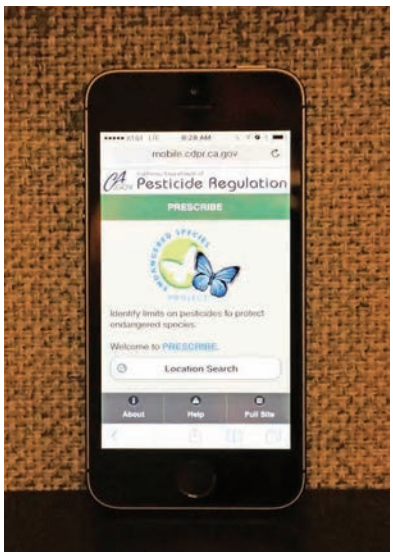
EMERGENCY PROJECTS MONITORING

CDFA uses ground applications of pesticides to eradicate infestations of exotic pests, such as the Mediterranean fruit fly and gypsy moth. DPR scientists monitor selected treatments to provide information on pesticide concentrations in soil, air, foliage and turf, and in fresh produce grown in treated areas. Surface water and runoff from irrigation and rainfall is also sampled and analyzed. DPR selects sampling sites in consultation with CDFA, CACs, CDFW, and the Regional Water Boards. DPR shares monitoring results with government agencies and other stakeholders, and posts them online. This information is used to help ensure the public is not exposed to levels of pesticides that may cause adverse health effects. If monitoring indicates levels of concern, DPR works with other agencies to identify the sources of the problem and investigates how to resolve them.

PESTICIDE CONTAINER RECYCLING

Although other states have programs to recycle pesticide containers, California's 2008 legislation (SB 1723, Chapter 533) was the nation's first pesticide container recycling law. It was amended in 2010 (AB 2612, Chapter 393). Under the law, registrants of production agricultural and commercial pesticides (including spray adjuvants), packaged in rigid, nonrefillable, high-density polyethylene containers of 55 gallons or less must establish or take part in a container recycling program. Participating registrants must report each year to DPR on their recycling.

As of 2014, more than 16 million pounds of containers had been collected. The recycling rate for pesticide containers is posted on the DPR website: http://www.cdpr.ca.gov/docs/mill/container_recycling/pest_container.htm



DPR's PRESCRIBE app provides users with information on pesticide-use requirements in place to protect local endangered species.

A 2016 agricultural pesticide container drop-off event in Imperial County was overseen by DPR and funded by U.S. EPA.