Assembly
California Legislature

ASSEMBLY COMMITTEE ON
ENVIRONMENTAL SAFETY
AND TOXIC MATERIALS
BILL QUIRK, CHAIR
ASSEMBLYMEMBER, TWENTIETH DISTRICT

AND

ASSEMBLY BUDGET SUBCOMMITTEE #3

JOINT INFORMATIONAL HEARING ON PESTICIDE REGULATION IN CALIFORNIA: PROTECTING OUR PEOPLE AND ENVIRONMENT

To:	Members of the Assembly Committee on Environmental Safety & Toxic Materials and Members of the Assembly Budget Subcommittee #3
From:	Chairs, Assemblymembers Bill Quirk and Richard Bloom
Subject:	Joint Informational Hearing: Pesticide Regulation in California: Protecting Our People and Environment
Date:	March 8, 2022

Introduction

Pesticides are distinct from other toxic substances. While most environmental toxins are an unwanted by-product of a process (for example, effluent from a manufacturing plant or emissions from an automobile engine), pesticides are chemicals designed to harm a target pest and are purposely introduced into the environment to manage viruses, bacteria, insects, weeds, rodents, or other pests. Pesticides can also harm people, non-target animals, and the environment, and it is crucial to appreciate that pesticides and their effects are not far-removed from all Californians' lives. Pesticides are on the food we eat, in the air we breathe, the water we drink, the parks our children play in, the disinfectants we use in our houses, and beyond. Pesticides can be useful, but as substances with inherent organismal toxicity, the benefits of pesticide use must be weighed against the risks to public health, the environment, and non-target organisms.

This joint informational hearing, the first in a series investigating pesticide regulation in California, is meant to serve as an introductory overview of the California Department of Pesticide Regulation (DPR), especially as its programs and projects relate to safeguarding our people and environment and to transitioning to safer, more sustainable pest management practices.

Pests and Pesticides

A pest is defined as any organism that causes damage or economic loss or transmits or produces disease. Pests can include organisms from across the biological tree of life: viruses, bacteria, fungi, plants (weeds), and animals from invertebrates (e.g. insects) to mammals (e.g. rodents). While pests and pesticide use are most commonly associated with agriculture, we all frequently encounter pest pressures. Examples of such include mosquitoes we try to mitigate with repellant sprays, microbial pests such as mold and mildew we remove with disinfectant household products, cockroaches we target with sprays and baits, weed growth in gardens we control with herbicides, or algal growth in swimming pools and water bodies we inhibit with algaecides.

According to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA, 1947), and the California Food and Agriculture Code, Section 12753, a pesticide is a substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest; for use as a plant regulator, defoliant, or desiccant; and any nitrogen stabilizer. California law also classifies spray adjuvants as pesticides. Given the relatively broad definition, 'pesticide' thus serves as an umbrella term for a variety of products beyond traditional chemical compounds intended for pest control.

Pesticides broadly fall into one of five categories:

1. Conventional pesticides: these are synthetic chemicals with pesticidal activity that are formulated in a number of physical states such as solids, liquids, emulsions, sprays, fumigants, dusts, impregnated materials, etc.

2. Biochemical and microbial pesticides (biopesticides): biochemical pesticides are naturally occurring substances that control pests by a mechanism other than toxicity; microbial pesticides are pathogens of the target pest that inhibit or kill them.

3. Antimicrobial pesticides: these target the growth and/or survival of microorganisms such as viruses, bacteria, and fungi.

4. Spray adjuvants: these are broadly defined as non-pesticide materials used with a pesticide product or pesticide spray mixture to improve the performance or physical properties of that product or spray mixture (e.g. emulsifiers, spreaders, etc.).

5. Plant growth regulators: these alter the rate of growth or maturation of a target plant.

Notably, there are products with pesticidal function that are exempt from the registration process in California:

- Low-risk ingredients with pesticidal activity, such as garlic and cedar
- Over-the-counter products to treat head lice
- Cosmetics and similar products intended for application to the human body, including antibacterial soaps and antifungal creams

- Fertilizers, nutrients, and other substances used to promote plant survival and health
- Biological control agents, such as insectivores

California law makes clear distinctions between agricultural and non-agricultural uses of pesticides: Agricultural uses are classified as either production agricultural or nonproduction agricultural. Production agricultural use is defined as any use to produce a plant or animal agricultural product (food, feed, fiber, ornamental, or forest) that will be distributed in the channels of trade. Nonproduction agricultural uses include watersheds, rights-of-way, and landscaped areas such as parks, golf courses, recreational areas, and cemeteries. Non-agricultural uses are specified as those for home, industrial (e.g. factories), institutional (e.g. hospitals), structural, vector control (e.g. mosquito abatement), and veterinary purposes.

The Department of Pesticide Regulation

DPR's Mission

Since most pesticides are, by design, inherently toxic to their target pest – and excess amounts of any substance may be harmful – pesticide use must be strictly controlled. Amendments to FIFRA have delegated responsibility and authority to states for training, registration, and enforcement through cooperative agreements, with U.S. EPA maintaining oversight responsibility over state programs. In California, these duties lie with the Department of Pesticide Regulation (DPR). DPR is housed within the California Environmental Protection Agency (CalEPA) and has had the express mission "to protect human health and the environment by regulating pesticide sales and use, and by fostering reduced-risk pest management."

California's first laws to regulate pesticides were in response to consumer fraud cases and counterfeit, adulterated, and mislabeled products in the early 1900s. For much of the 20th century, the California Department of Food and Agriculture (CDFA) was tasked with the regulation of pesticides and related law enforcement. In 1991, CalEPA was established to unify the state's environmental authority, bringing the Air Resources Board, the State Water Resources Control Board, the Integrated Waste Management Board, the Department of Toxic Substances Control, the Office of Environmental Health Hazard Assessment (OEHHA), and DPR under one agency. Pesticide-related statutory responsibilities and authorities were transferred to DPR. Today, CDFA maintains only the analytical pesticide residue laboratory; structural pesticide control is housed at the Department of Consumer Affairs; and local enforcement lies with County Agricultural Commissioners (CACs) who receive guidance and support from DPR.

DPR's Structure

In addition to its Administrative Services Division and the Office of Technology Services, DPR has six programmatic branches that work to fulfill DPR's responsibilities and goals:

1. Pesticide Registration Branch: responsible for the scientific evaluation and registration of pesticide products. Any pesticide product must be registered with the state before its sale, possession, or use. The branch coordinates the required scientific data evaluation process across DPR's branches and with other relevant state agencies. It also serves as the primary liaison to companies applying to register their products.

2. Pest Management and Licensing Branch: evaluates pesticide and pest management problems and awards grants to develop and promote new strategies that reduce adverse environmental effects and hazards from pesticide use in agricultural and non-agricultural settings. This branch oversees, among others, the Pesticide Use Reporting Program, the Licensing and Certification Program, and the School and Child Care Integrated Pest Management (IPM).

3. Human Health Assessment Branch: reviews toxicological studies, prepares risk assessments, and evaluates the adequacy of product labels.

4. Worker Health and Safety Branch: evaluates exposure and performs risk assessments to develop and implement mitigation measures that reduce the risk of workers and public exposure to pesticides.

5. Environmental Monitoring Branch: monitors the environment to determine the fate of pesticides and analyzes potential hazards in air, soil, and ground and surface water. The branch develops methods for the collection and analysis of environmental samples for pesticides. It also provides environmental monitoring data necessary for emergency eradication projects, environmental contamination assessments, pesticide registration and reevaluation, and human exposure evaluations.

6. Pesticide Enforcement Branch: enforces federal and state laws and regulations pertaining to proper and safe use of pesticides. The branch has oversight responsibility for pesticide incident investigations, provides guidance to county regulators, trains inspectors, and evaluates the effectiveness of county pesticide use programs. Locally, pesticide use enforcement is largely carried out by CACs and their staff to whom the Pesticide Enforcement Branch provides training, coordination, and technical support.

Pesticide Use Reporting

The Food Safety Act of 1989 (Chapter 1200, AB 2161) gave DPR clear statutory authority to require full reporting of agricultural pesticide use. Each year, DPR is tasked with collecting and processing all records of agricultural pesticide applications, and, since 2011, does so using the online CalAgPermits tool. Pesticide uses are reported to CACs who, in turn, report the data to DPR. California's pesticide use reporting program is the most comprehensive of its kind and mandates reporting of the following uses:

- Production of any agricultural commodity (except livestock),
- Treatment of postharvest agricultural commodities,
- Landscape maintenance in parks, golf courses, cemeteries, and similar sites defined in California code as agricultural use,
- Roadside and railroad rights-of-way,
- Poultry and fish production,
- Application of a restricted material,
- Application of a pesticide with known potential to pollute groundwater when used outdoors, including in industrial and institutional settings (non-agricultural), and
- Application by licensed pest control operators, including agricultural and structural applicators and professional landscape gardeners

Consumer home and garden and most industrial and institutional uses are exempt from reporting.

Pesticide use data are leveraged for better risk assessments, to improve worker safety and public health, protect water and air quality and wildlife, for local enforcement efforts, and to inform pest management alternatives. Thus, pesticide applications for production agriculture are subject to additional reporting details that include the amount and type of pesticide; the date, time, and precise geographic location of application; identifying information of the operator; the commodity, crop, or type of site treated; and the means of application.

Given that California growers produce half the nation's fresh produce, pesticide use data became even more informative with the passage of the 1996 federal Food Quality Protection Act (FQPA) which set new food safety standards for pesticide tolerances. Tolerances are the amount of pesticide residue that may remain on a harvested crop. Pesticide use report data have been instrumental in (re)assessing tolerances and calculating dietary risk from pesticides.

Sources of Funding

According to the Governor's Proposed 2022-2023 Budget, DPR has a total of $135 million to cover its program costs, which include approximately 438 positions. Additionally, DPR receives less than 10% of its funds from the state General Fund (approximately $10 million). DPR's primary fund source is the Department of Pesticide Regulation Fund, $119 million in total, and is comprised of a variety of sources, mainly renewal fees ($21 million) and regulatory fees ($97 million), including the mill fee.

DPR also receives federal funds to support joint programs and fulfill cooperative agreements. The department's main revenue sources are:

- The 'mill' assessment: the fee levied on pesticide sales at the point of first sale into the state. This is, by far, the greatest source of revenue for DPR (see below).
- Product registration and renewal fees: annual fee imposed on manufacturers, importers, and dealers who wish to label and sell a pesticide product in the state. At current levels, these fees generate approximately $21 million.
- Licensing and certification fees: fees imposed on people and businesses that sell, apply, or recommend the use of pesticides. This includes examination and licensure of pesticide applicators, aircraft pilots, pest control dealer agents, pest control advisors, and businesses that sell or apply pesticides or use pest control methods or devices for hire. DPR also accredits more than 2,000 continuing education courses.
- Civil penalties.
- Other fees and reimbursements.
- Funds from U.S. EPA and the U.S. Department of Agriculture.

The Mill Fee

All DPR registered pesticides are subject to the 'mill assessment' fee upon sale into the state. A 'mill' is one-tenth of a cent ($0.001). The maximum assessment rate is set by statute in the Food and Agriculture Code (FAC) sections 12841 and 12841.1 at 21 mills, or 2.1 cents, for every dollar in pesticide sales. An additional 0.75 mill is assessed on agricultural and dual-use products; these revenues support CDFA's pesticide Consultation and Analysis Unit. Products registered for manufacturing use only, i.e. sold for repackaging or to manufacture other pesticide products, are exempt from the mill fee. In that case, the fee is assessed at the point of sale of the repackaged or completed product.

The mill assessment is self-reported and reporting and payment responsibilities lie with the person or entity with first knowledge of a sale, at the time of sale. Those subject to the fee are required to maintain records and may be audited by DPR. If investigators find sales of unregistered products or unpaid mill assessments, sellers must pay the amount owed and a 10% late penalty. A civil penalty may also be levied.

Revenues from mill assessment are placed in the DPR Fund, pursuant to FAC section 12841(g), and make up the majority of funding (approximately 80%) available to the department's programmatic branches. Importantly, an amount equal to 7.6 mills per dollar of pesticide sales per year is allocated to County Agricultural Commissioners for local enforcement action.

Through funding allocated to DPR in the 2021-2022 state budget, DPR recently announced a contract with Crowe LLC to examine the department's current and future funding structure and make recommendations on how to address its structural deficit in order to maintain its pest management programs while also accelerating the transition to more sustainable pest management practices.

Local Enforcement: County Agricultural Commissioners

California's geographic and population size and the diversity of its agricultural commodities necessitate a more complex partnership between state and local authorities compared with any other state in the nation. While DPR is responsible for the delivery of an effective statewide pesticide regulatory program, the legislature has delegated local pesticide use enforcement to County Agricultural Commissioners (CACs).

County boards of supervisors appoint CACs who must be licensed by the state. Numbering approximately 400 in total, CACs and their staff of inspector-biologists receive funding for their enforcement activities from DPR, including the equivalent of 0.76% of all pesticide sales in the state, their respective county governments, grants, fees, fines, and CDFA. CACs are tasked with the enforcement of laws and regulations that cover environmental protection, pest prevention, worker and consumer protection, and other special services. Each year, CACs must negotiate a pesticide enforcement work plan that prioritizes worker protection, illness investigations, application of high-toxicity pesticides, and agricultural pesticide applications near parks and schools with DPR.

Critically, CACs investigate reports of illnesses and injuries associated with pesticide use. They are also responsible for the inspection of operations and records of growers, non-agricultural pesticide applicators, pest control businesses (agricultural and structural), farm labor contractors, and government agencies to ensure compliance with safety standards and requirements. They further certify private applicators, issue restricted materials permits, train field workers, and conduct public outreach efforts. CAC staff also conduct inspections to prevent pesticide misapplication and drift, ground and surface water contamination, and to protect endangered species and non-target wildlife.

Administrative enforcement authority for pesticide use violations is solely placed with CACs. DPR has no such authority, but may provide oversight and guidance to CACs. CAC administrative penalties are governed by DPR regulations that categorize violations based on degree of severity. The maximum penalty has been statutorily capped at $5,000 for over 25 years. Criminal and civil actions can also be taken against licensees and other pesticide users. Criminal action can be filed by a county district attorney, typically at the request of a CAC, or by the State Attorney General at the request of DPR. Civil action can only be filed by the Attorney General. Civil penalties typically do not exceed $10,000, but may be increased to $25,000 if violations were intentional or repeated. When civil penalties are not warranted, violation notices, compliance interviews, warning letters, and cease-and-desist orders are additional tools CACs have at their disposal to gain compliance.

Communities and stakeholders have raised concerns regarding enforcement by the CACs. In order to increase compliance and improve local implementation of statewide pesticide use enforcement priorities, DPR has proposed a budget trailer bill (as part of the Governor's proposed 2022-2023 budget) to amend statute to add DPR administrative penalty authority, increase statutory penalty caps, and improve pesticide residue enforcement.

Protecting Public Health

California law requires DPR to prohibit the use of any pesticide that "endangers the agricultural and nonagricultural environment, is not beneficial for the purposes for which it is sold, or is misrepresented" (Statutes of 1969, Chapter 1169). To this end, DPR must continuously evaluate, and reevaluate, registered pesticide products to determine their effects on human and environmental health and detect and mitigate unforeseen outcomes. Evaluations of pesticides include risk assessments, exposure monitoring, investigation of reported illnesses and adverse effects on humans and the environment, and monitoring of air and water quality. Since passage of the 1984 Birth Defect Prevention Act, DPR must also review health effect studies that investigate chronic toxicity, mutagenicity, neurotoxicity, oncogenicity, and reproductive effects and teratology of any new active ingredient before its registration.

Worker Safety and Health Monitoring

Worker health and safety are regulated by federal and state laws. California was first in the nation to set training requirements for pesticide handlers and develop a pesticide illness reporting and investigation system. Several current DPR regulatory requirements are more stringent than standards set by U.S. EPA, such as worker safety regulations applying to all persons who handle pesticides or face exposure to pesticide residues, not just those in agricultural settings.

Problems with notification and hazard communication led to changes in DPR regulations in 2009. These include requiring pesticide applicators to notify growers before and after a pesticide was used; requiring growers to ensure prior notification of employees working within one-quarter mile of a treated area; notifying persons other than employees and contractors who are known to likely enter an area before and after application; and to provide clear and unimpeded access to information about pesticides used to employees.

Further, DPR requires yearly training of all employees who handle pesticides on hazard communication, first aid, handler safety, storage and transport, protective equipment, and respiratory protection. Through the Pesticide Illness Surveillance Program, DPR also evaluates information from CACs about occupational and non-occupational health effects and illness episodes related to pesticides. These data can reveal patterns of problems associated with a particular active ingredient, product formulation, violations of label instructions, or issues of label clarity.

In addition, DPR administers the California Medical Supervision Program in conjunction with OEHHA. This program is designed to protect workers who regularly mix, load, or apply highly toxic organophosphate and N-methyl carbamate insecticides. These chemicals inhibit cholinesterase, an enzyme that helps regulate nerve impulses. Overexposure to these cholinesterase inhibitors can result in blurred vision, diarrhea, tremors, seizures, and death. Through the supervision program, workers are continuously

monitored to detect reductions in blood cholinesterase levels prior to symptom onset. If excessive exposure is detected, an employer must reexamine the workplace and pesticide handling procedures; employees with sub-threshold cholinesterase levels must be shielded from further exposure until subsequent testing demonstrates it is safe to resume.

Pesticide Residue Monitoring

Pesticide residue monitoring came in response to several reports of illnesses and seizures of produce with high levels of arsenic (used as an insecticide) in the 1920s. Indeed, the United Kingdom (UK) government issued warnings of American-grown fruit after finding arsenic levels above permitted limits in 1925; California fruit sales plummeted, prompting the first residue analyses in the state.

Today, CDFA's Center for Analytical Chemistry, contracted by DPR, samples for more than 300 pesticide compounds and breakdown products on domestic and imported agricultural commodities. Special emphasis is given to food consumed by infants and children and those pesticides known to cause cancer or reproductive harm. DPR also selects commodities and sampling locations that reflect differences in consumption patterns of different cultural, ethnic, and socioeconomic groups.

Residue monitoring is directed toward enforcement of U.S. EPA tolerances which are set by the 1996 Food Quality Protection Act. The law preempts states from setting their own tolerances. If illegal residues are found, DPR removes the produce from sale, verifies the result, and either destroys the produce or returns it to its source. Similar produce from the owner of the commodity is also quarantined and tested. If toxicological analysis reveals residue levels that may result in adverse health outcomes, DPR works with the Department of Health to issue alerts to consumers who may have purchased the produce. In 2015, pesticide residues were detected in 60.1% of tested produce; 1.2% of the tested samples contained residues exceeding tolerance limits.

Integrated Pest Management

Given the inherent toxicity of synthetic pesticides and the potential for serious adverse events for human and environmental health, there is great interest in identifying lower-risk and effective alternatives for pest management. That is the goal of integrated pest management (IPM).

According to the University of California Statewide IPM program (UC-IPM), "IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism.

Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment."

IPM seeks to leverage environmental factors that affect a pest and its ability to thrive in order to keep the organism from becoming a problem in the first place. Strategies used in IPM include pest monitoring, biological controls (e.g. natural predators), cultural controls (e.g. changing irrigation practices), and mechanical and physical controls (e.g. traps, steam sterilization of soil, barriers). When chemical controls are necessary, IPM calls for the use of target-specific and least-toxic pesticides with the least harm to people and environment in conjunction with non-chemical controls.

In 2021, DPR and CDFA convened the Sustainable Pest Management Work Group with the goal of developing a roadmap of recommendations and measurable goals to accelerate a system-wide transition to more sustainable pest management, a target that has been elusive. The work group is tasked with considering how to minimize the reliance on high-toxicity pesticides by deploying traditional and novel practices to protect and preserve soil health, water resources, air quality and biodiversity, while also ensuring economic viability for growers and consumers. The group is also charged with identifying solutions that protect the health and safety of the most affected workers and communities and eliminate racial and other disparities associated with adverse effects of pesticide use. Release of a draft roadmap is expected in Spring 2022.

Protecting Children from Pesticide Exposure

Animal studies have demonstrated the negative impacts of pesticide exposure on neurological function, especially during the critical *in utero* and early postnatal developmental periods. Cases of acute pesticide poisoning of children have further highlighted the negative impact pesticides may have on the developing brain and nervous system. To better understand the relationship between pesticide exposure and neurobehavioral outcomes, UC Berkeley's Center for Environmental Research and Children's Health has been conducting the longest-running longitudinal birth cohort study of pesticides and other environmental exposures among children in farmworker communities: the CHAMACOS study. In 1999-2000, 601 pregnant women living in the Salinas Valley were enrolled and families followed for 19 years. Exposure to pesticides and other chemicals was measured and assessments of health, growth, and development taken every 1-2 years. An additional 300 children were enrolled at the age of 9 in 2010-2011; more than 600 individuals continue to participate in the study and will be followed into adulthood.

Among many findings, the CHAMACOS study, which is led by Dr. Brenda Eskenazi, has revealed that organophosphate exposure during pregnancy is associated with shorter pregnancy, poorer neonatal reflexes, lower IQ, reduced cognitive functioning, and greater risk of attention problems in children. High levels of DDT (an organochlorine pesticide) in pregnant women's blood were associated with poorer mental development in

their children at age 2. Almost 200 papers have been published using the comprehensive CHAMACOS dataset.

Given the elevated risk of toxicity during child development, DPR collects use information from businesses that apply pesticides at California public K-12 schools and licensed childcare centers (collectively: school sites). The Healthy Schools Act (Statutes of 2000, AB 2260) requires pesticide use reporting to school district and child care center staff. In 2018, the state has also adopted regulations that set minimum distance standards for specific agricultural pesticide applications near school sites and require annual notification to those school sites. For example, aerial and other pesticide applications that have an elevated risk of unintended drift must leave a buffer zone of at least 0.25mi from the school site during typical operating hours. These regulations along with increased communication between growers, CACs, and school sites aim to reduce the chances of unintended pesticide exposure to children.

In addition, the Healthy Schools Act requires DPR to help school sites with the adoption of IPM plans which became mandatory in 2014 (SB 1405, Chapter 848). DPR is tasked with providing guidance on the essential elements of IPM; developing criteria to identify least-hazardous pest management practices; setting up a school IPM website as a directory of resources and publicly available information about health and environmental effects of pesticides; and making school site pesticide reporting forms. School site staff who handle pesticides must also be trained annually.

Protecting Environmental Health

Protecting air and water, and complex ecosystems from drift and non-target toxicity of pesticides has been challenging and requires interdisciplinary scientific expertise. This is reflected in the involvement of numerous federal and state agencies that are charged with monitoring pesticide drift into the environment besides DPR, such as the U.S. Geological Survey, U.S. EPA, the California Air Resources Board, the State Water Resources Control Board, the Department of Fish and Wildlife, and the Department of Public Health.

Scientists conduct studies to provide data that help assess ecological effects of pesticides and pesticide residues. Factors that are of particular interest are the effects of application methods and management practices on the movement of pesticides and the potential of pesticides to contaminate air, surface water, ground water, crops, and non-target ecosystems. Restricted materials permits or site-specific application permits may be issued for pesticides that pose an elevated risk; ultimately, DPR may also cancel a pesticide's registration if deemed too harmful.

Air Quality

Under mandates of the Toxic Air Contaminant Act (Statutes of 1983, Chapter 1047), DPR's Air Program conducts air monitoring, evaluation, and mitigation to reduce

the adverse effects of pesticides in the air. DPR places special emphasis on toxic air contaminants (TACs) and volatile organic compounds (VOCs). DPR evaluates whether a pesticide should be classified as a TAC based on its physical properties, environmental fate, and human health effects. DPR then works with the Air Resources Board to determine the levels of the pesticide in the air in affected communities. If a pesticide is deemed a TAC, measures must be taken to mitigate the risk that compound poses to people and the environment. DPR may request U.S. EPA to change a pesticide label; require additional training for applicators of the TAC pesticide; limit its application or re-classify it as a restricted material; or ban its use.

VOCs are carbon compounds that are released into the atmosphere where they react with other constituents to produce ground-level ozone, a component of smog. While the primary source of VOCs are exhaust gases from fossil-fuel-burning vehicles, pesticides can also release VOCs. To reduce VOC emissions from pesticides, DPR, among other measures, allows only low-emission methods of field fumigations in certain areas of the state, prohibits the use of certain high-VOC products in the San Joaquin Valley (which does not meet air quality standards), and tracks VOC emissions based on pesticide use reporting.

Water Quality

Urban and agricultural stormwater and irrigation run-off can carry pesticides into surface waters, which can contaminate drinking water supplies and be lethal to aquatic organisms. Some examples include the detection of pyrethroids (used for outdoor residential pest control) in urban streams and creeks; contamination of Bay Area creeks with the insecticide diazinon resulting in significant aquatic toxicity; or rice herbicides moving into the Sacramento city drinking water supply from agricultural drains.

To mitigate such contamination events, DPR scientists at the Surface Water Protection Program (SWPP) evaluate pesticides for their potential to contaminate surface water and sediment, study the mechanisms of off-site movement of pesticides to surface water, and make recommendations in pesticide registration decisions. Similar to air contaminants, DPR may take action to limit the use of active ingredients of particular concern to drinking water quality and aquatic environments.

Pesticides can also reach water-bearing aquifers below ground from applications on crop fields, seepage of contaminated surface water, and accidental spills and leaks. Importantly, the effects of pesticide applications may take decades to become apparent in groundwater. Therefore, management decisions for the protection of groundwater quality must consider the lag time between application and arrival and accumulation of pesticides in groundwater. This time lag is generally shorter with shallower water wells or more permeable aquifers. While maximum contaminant limits (MCLs) have been set for some pesticides, many more may be in groundwater without set MCLs.

Protecting Wildlife

Wildlife can be affected by pesticides through direct or indirect application, such as pesticide drift, secondary poisoning, and runoff into water bodies. Just as pesticide exposure to humans can have severe health impacts, wildlife can suffer similar negative biological consequences. Exposure may result in reduced mobility, altered feeding behaviors, impaired navigation, and decreased care for young in non-target organisms.

Of particular concern are honeybees, who are critical pollinators of crops, contributing to over half the value of the U.S. agriculture industry. However, as insects, bees are particularly susceptible to many insecticides. Bees may come into contact with pesticides directly or through pollen or nectar which, when brought back to the hive, expose other individuals and the queen bee. Scientists have identified direct spraying and soil application methods to have the greatest detrimental effects on bees.

Pesticides with endocrine-disrupting effects can also result in reproductive abnormalities in wildlife. This has been demonstrated by UC Berkeley researcher Dr. Tyrone Hayes who showed that the widely used herbicide atrazine can significantly reduce testosterone in male frogs, effectively sterilizing 75% of exposed males and turning 10% into female frogs.

Conclusion

Given the inherent toxicity of pesticides, the state must proactively and aggressively monitor, assess, and regulate these substances to safeguard our communities and natural resources. California has made strides, moving from simple monitoring and evaluation, to increased regulations and restrictions of the most harmful compounds. Much remains to be done, however. Pesticides are ubiquitous and affect every Californian, every day. The science continues to reveal the ill-effects of excessive pesticide use on our communities, our wildlife, and our state's natural resources and ecosystems. Our laws and regulations should evolve along with the research. California must continue to invest in the innovation and advancement of sustainable pest management practices and base decisions on the best-available science and with a long-term outlook.

References and Resources

https://www.cdpr.ca.gov/docs/dept/factshts/what2.pdf
https://www.cdpr.ca.gov/docs/pressrls/dprguide.htm
https://www.cdfa.ca.gov/Statistics/
https://www.cdpr.ca.gov/docs/dept/factshts/what2.pdf
https://www.epa.gov/enforcement/federal-insecticide-fungicide-and-rodenticide-act-fifra-and-federal-facilities
https://www2.ipm.ucanr.edu/What-is-IPM/
https://cerch.berkeley.edu/research-programs/chamacos-study

https://www.cdpr.ca.gov/docs/pestmgt/sustainable_pest_management_workgroup.htm
https://www.pcs.agriculture.gov.ie/aboutus/aboutpesticides/whydoweneedpesticides/
https://pubmed.ncbi.nlm.nih.gov/18226078/
https://pubmed.ncbi.nlm.nih.gov/23184105/
https://www.cdpr.ca.gov/docs/legbills/rulepkgs/16-004/16-004.htm
https://www.cdpr.ca.gov/docs/dept/factshts/protecting_sw.pdf
https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/urbancrksdiazinontmdl.html
https://www.usgs.gov/special-topics/water-science-school/science/pesticides-groundwater
https://pubmed.ncbi.nlm.nih.gov/21419222/
https://www.epa.gov/sciencematters/understanding-how-pesticide-exposure-affects-honey-bee-colonies
https://bees.caes.uga.edu/bees-beekeeping-pollination/pollination/pollination-protecting-pollinators-from-pesticides.html
https://news.berkeley.edu/2010/03/01/frogs/