Pesticides in California's Wastewater - Science Needs

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California Department of Pesticide Regulation

CalEPA
California Environmental Protection Agency

dpr

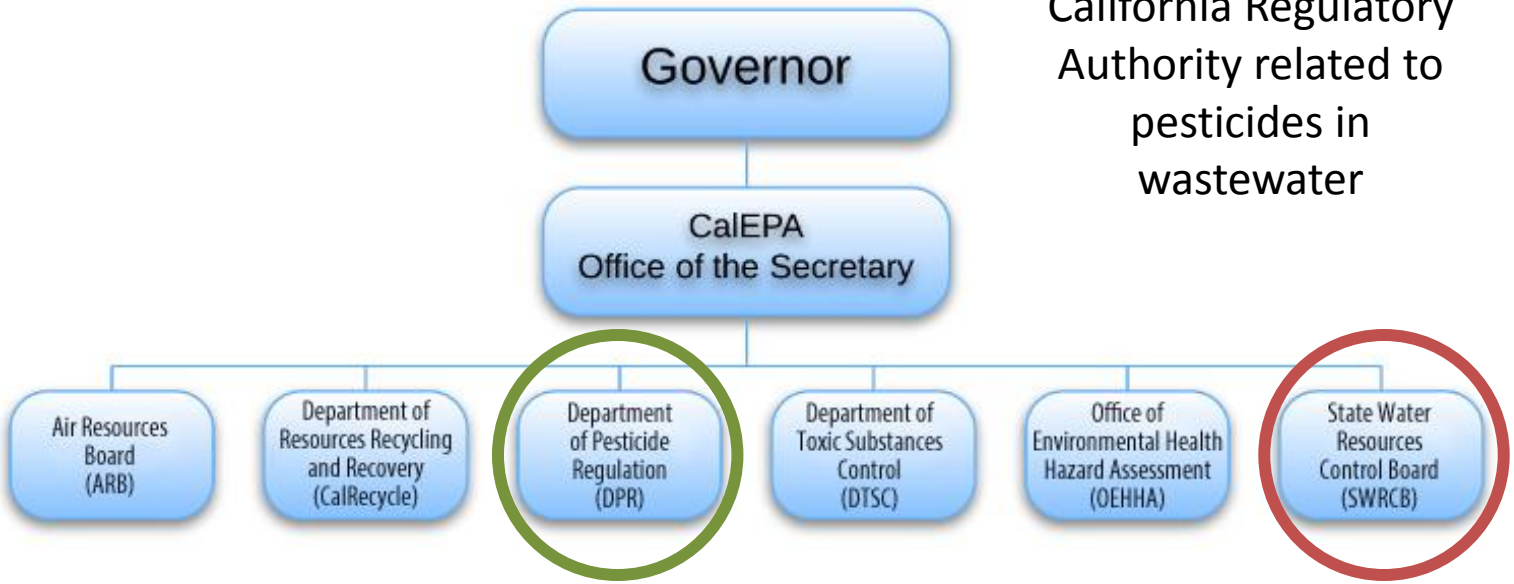
197 Wastewater Treatment Plants in California

Pesticides in Wastewater

- Limited monitoring data available
- Available data show frequent detections in effluent and exceedance of toxicity thresholds

Pesticide	DF	Max Effluent (ng/L)	U.S. EPA Aquatic Benchmark (ng/L)
Bifenthrin*	82	3.9	1.3
Permethrin*	65	17.2	1.4
Fipronil‡	100	44.1	11
Imidacloprid‡	100	306.1	1,050

*Markle et al., 2014
‡Sadaria et al., 2016



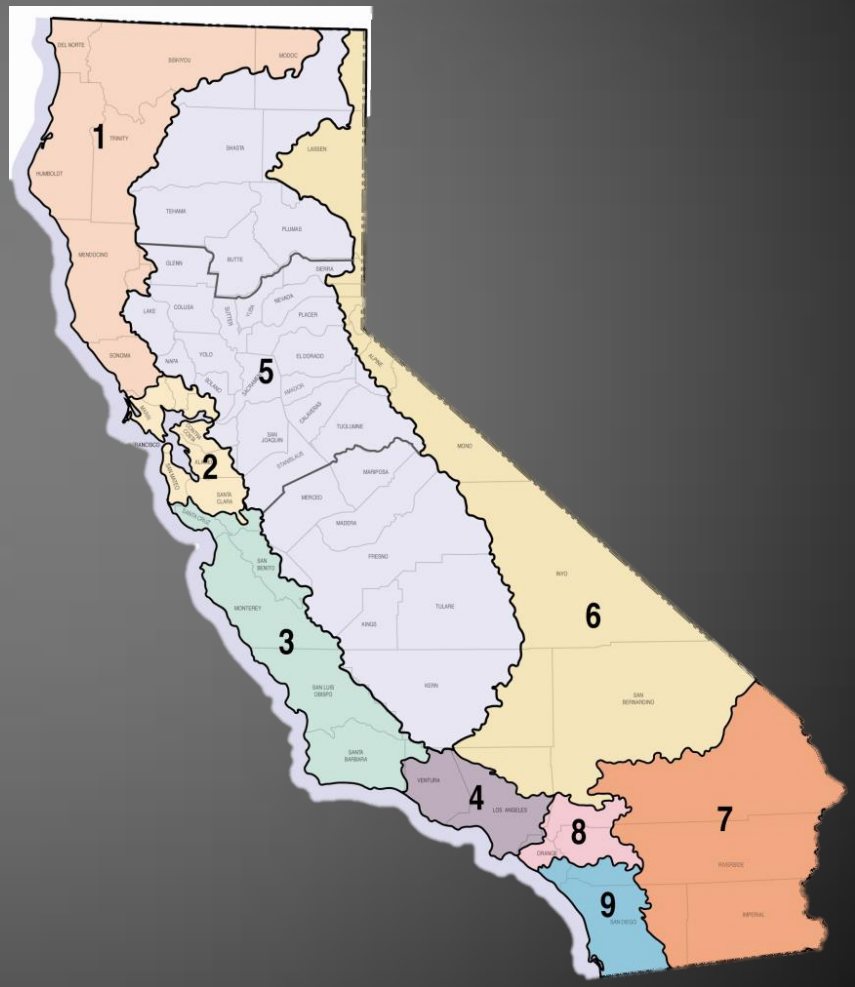
California Regulatory Authority related to pesticides in wastewater

Regulate the sales and use of pesticides

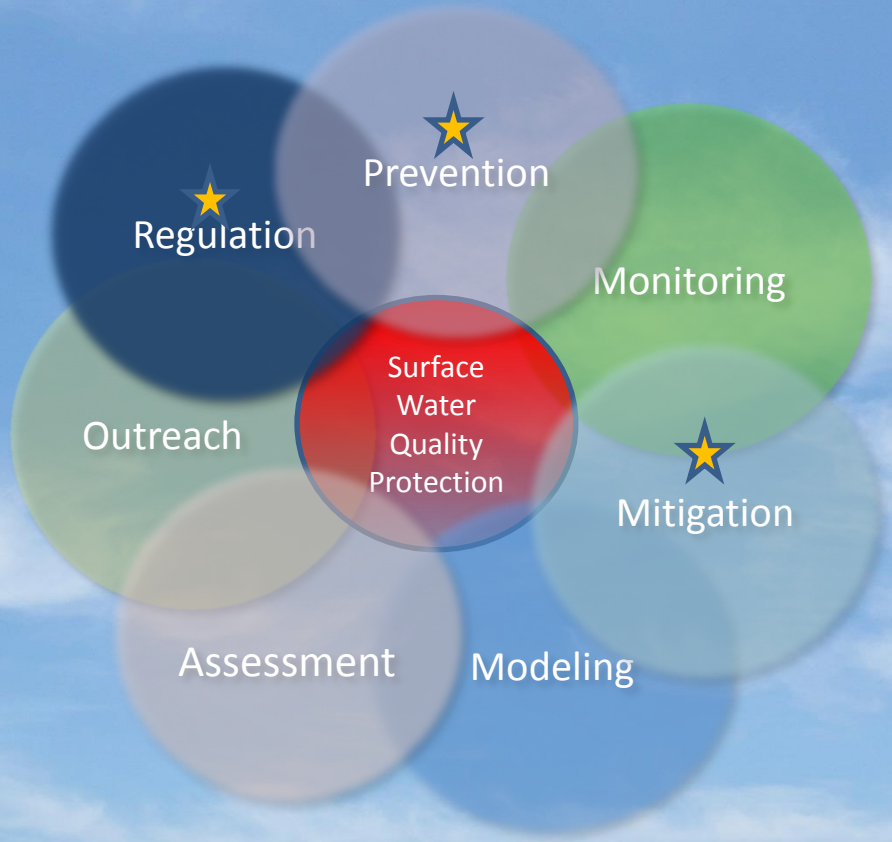
Protect Beneficial Uses of Water

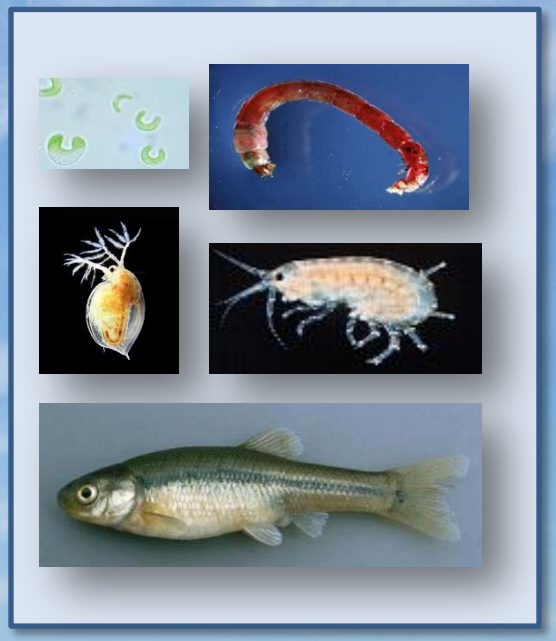
State Water Resources Control Board Nine Regional Water Boards

- Clean Water Act
  - 303d Listing
  - Regulated through NPDES Permits
    - Region 5 – Pyrethroid Basin-wide TMDL



Department of Pesticide Regulation
Surface Water Protection Program





Research & Development

Managing Pesticides in Wastewater

- Prevention – Down-the-Drain model to support registration recommendations
- Continuous Evaluation – Monitoring and source identification

Registration Evaluation

Predictive modeling will provide registration recommendations for pesticide products.

Down-the-Drain module expansion of existing efforts to evaluate pesticides with potential for down-the-drain transport that includes *California Receiving Water* and consideration of *Degradates*.

Product Types

- Pet Products
- Swimming Pools
- Human Products
- Laundry Related
- Indoor Pest Control

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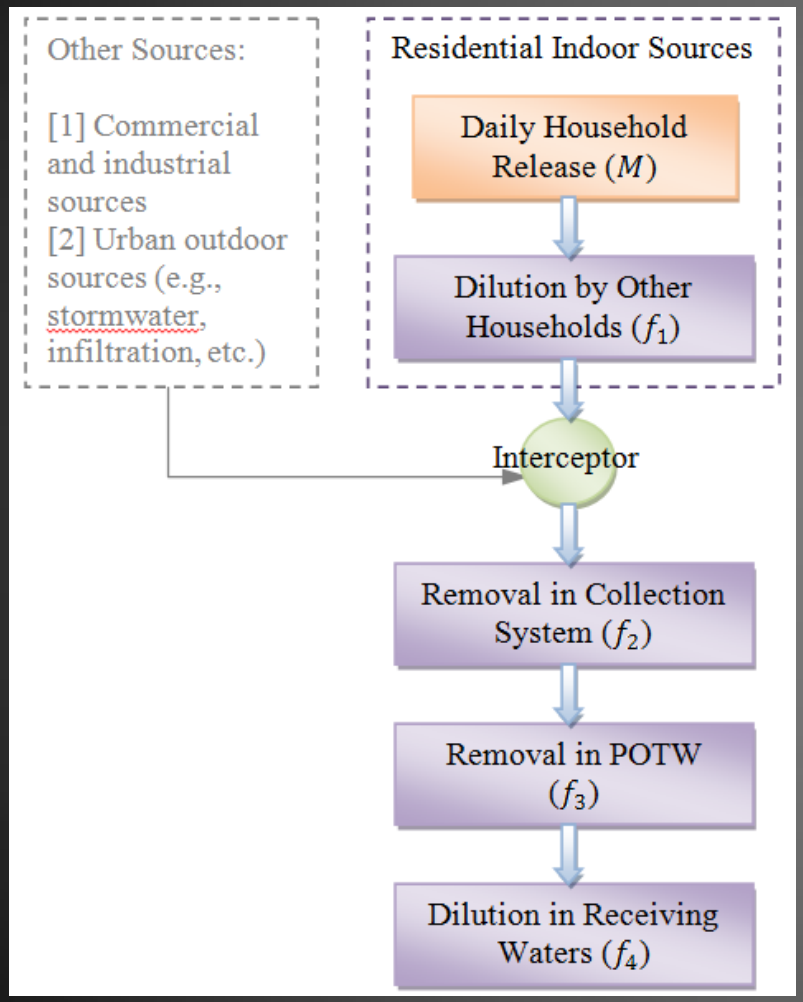
Model Conditions

- 12,500 four-person households
- Worst-case scenario
- Dry season wastewater flow
- Predict concentration in the receiving water body

Down-the-Drain Model



$$C_R = \frac{M}{4 \times 388} \times f_1 \times f_2 \times f_3 \times f_4$$

C_R = Concentration in Receiving Body
M = Maximum daily pesticide release (µg/day)
f_1 = Maximum fraction of households projected to use product
f_2 = Pesticide removal coefficient in collection
f_3 = Pesticide removal coefficient in WWTP
f_4 = Dilution factor in receiving water body

Registrant-submitted data
OR
Estimated based on:
- Sales data of the most popular active ingredient in the product group
- Survey and other sources

Status and Science Needs

- Down-the-Drain Module for Registration Evaluation
  - Currently under development
  - Implemented ~2018
- Science Needs
  - Wastewater treatment removal
    - Pesticide specific
    - Treatment specific

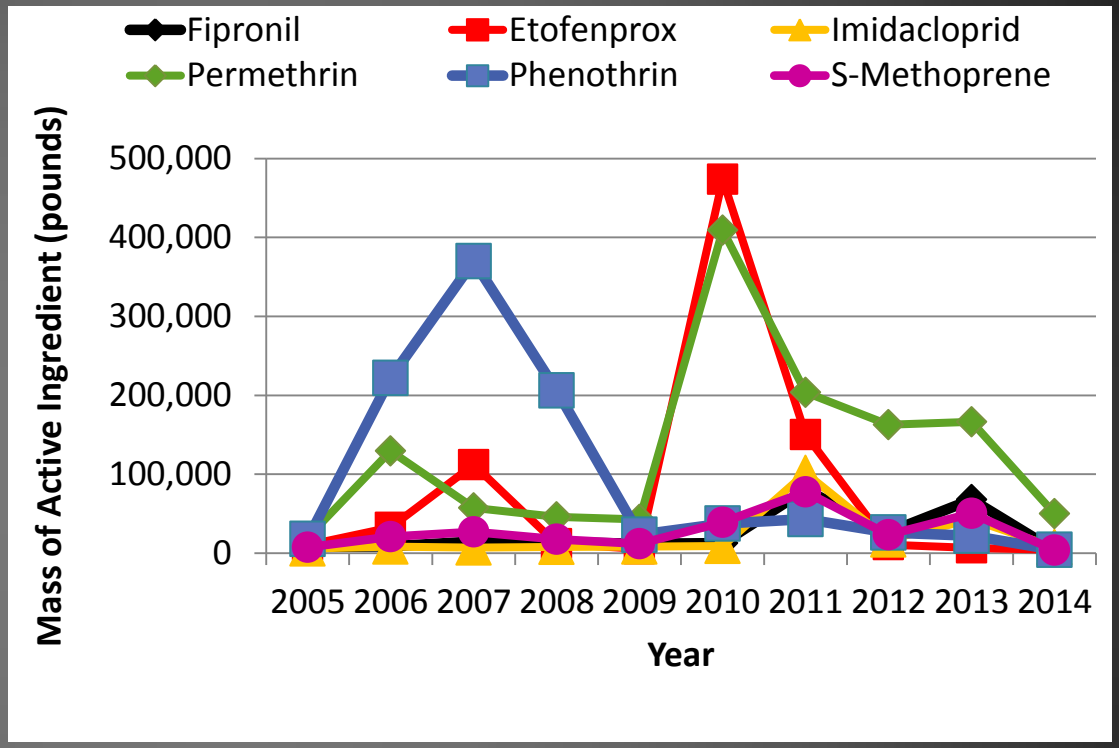
DPR's Current Wastewater Projects

Washoff of Dogs treated with Spot-on Products

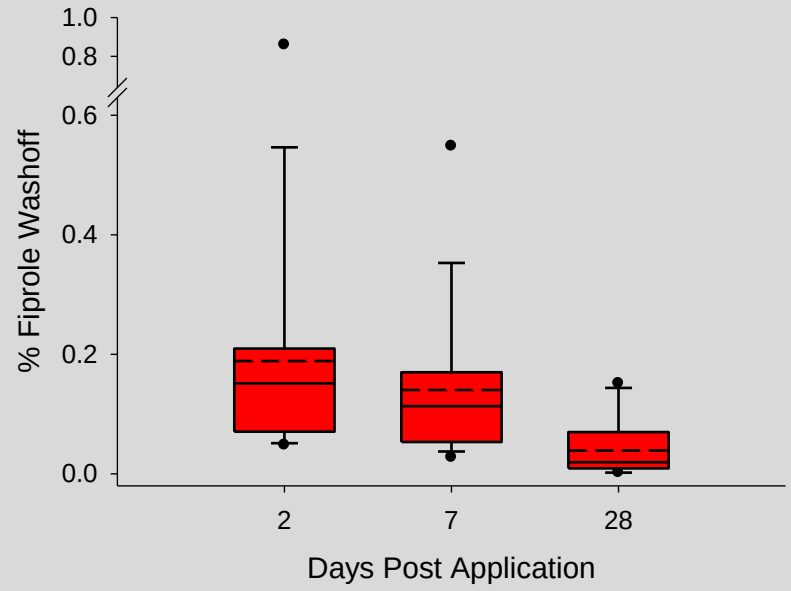
Sewershed Monitoring

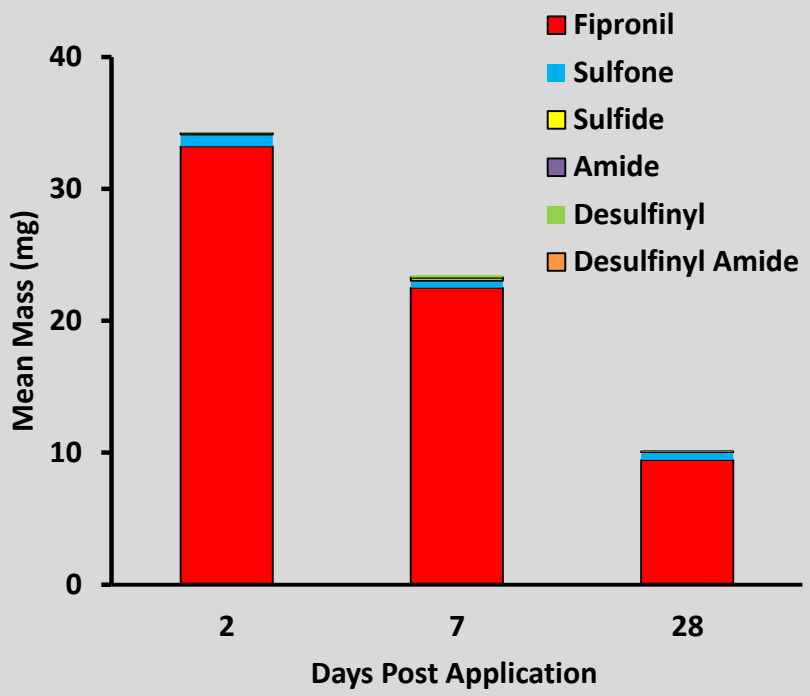
Dog Washoff Study

- 9.1% Fipronil
- Recommended frequency of application 30 days
- Products "waterproof" once dry



Dog Wash-Off Results





- Mass of total fiproles washed off ranged between 0.2–86.0% of total mass applied
- Degradates made up $\leq$ 10% of total mass, and largest fraction was in 28-day samples
- Total mass of fiproles washed off generally decreased with time post-application.

Pesticide Source Identification

- 24-hour Composite Samples
  - Influent
  - Effluent
  - 10 Routine Sewershed Sites
  - 3 Targeted Sites (Limited Samples)
- Monthly (May-December 2016)
- Weekdays and Weekends
- Seasonal Variability

Target and Non-Target Analysis

- Target Analysis
  - 20 pyrethroids
  - Fipronil + degradates
  - Imidacloprid
  - Chlorothalonil
  - Propoxur
  - Pyriproxyfen
  - Indoxacarb
  - Novaluron
  - Tetrachlorvinphos
  - Piperonyl Butoxide
  - (S)-Methoprene

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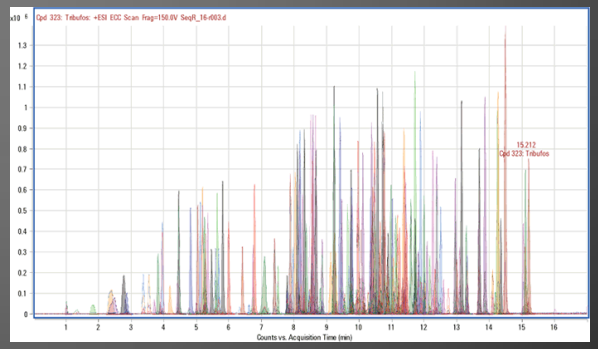
- Non-Target Analysis



Sampling Sites

Commercial

Laundry

Institutional

Residential

- Age of homes
- Density of homes

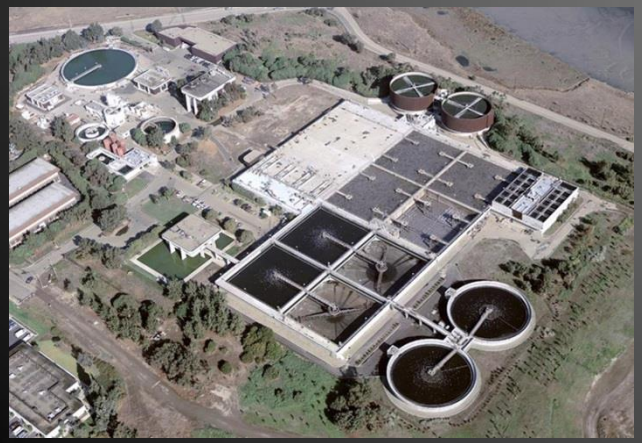
Pest control operators

Hospital

Wastewater treatment plant

- **Influent**
- **Effluent**

Pet grooming



Nursery

University

Just the Beginning

- Relative mass contribution by pesticide use type
- Relative mass contribution of suspected high-use patterns
- Data for model validation
- Identification of non-target pesticides
- Establishing long-term wastewater monitoring program
- Data-driven mitigation solutions

Science Needs!

- Wastewater monitoring data
- Estimates for down-the-drain mass transport by product use (direct and indirect)
- Wastewater treatment range of removal rates
- Confirmation of conceptual pathways (direct and indirect)
- Relative contribution (compared to urban and agricultural)

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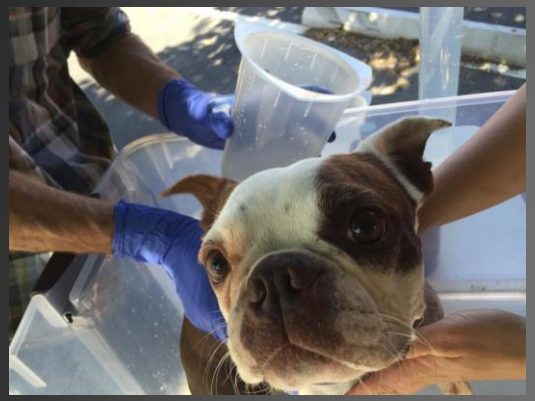
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