

## Why Urban Pesticides Matter

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Current Sources, Water Quality Impacts, and the Role of Water Quality Professionals

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# Acknowledgements

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- Funding
  - State Water Resources Control Board Grant
- Project management
  - San Francisco Estuary Project



# Overview

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- Pesticides background
- Regulatory context
- Pesticides of concern
- Latest news
  - Toxicity from pyrethroids
  - Regulatory action
- Recommendations for water quality professionals

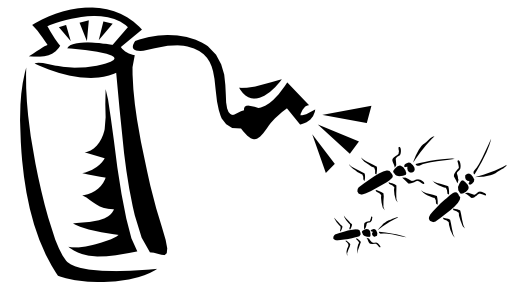


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# Pesticides Background

# Many Products Are Pesticides

- Insect killers
- Herbicides
- Algaecides
- Biocides (cooling water, swimming pool)
- Disinfectants (soap, bleach)



# Urban Pesticide Facts

- >900 registered pesticide active ingredients
- >11,000 registered pesticide products
- At least half of California pesticide use is in urban areas



# Urban Runoff Carries Pesticides to Creeks

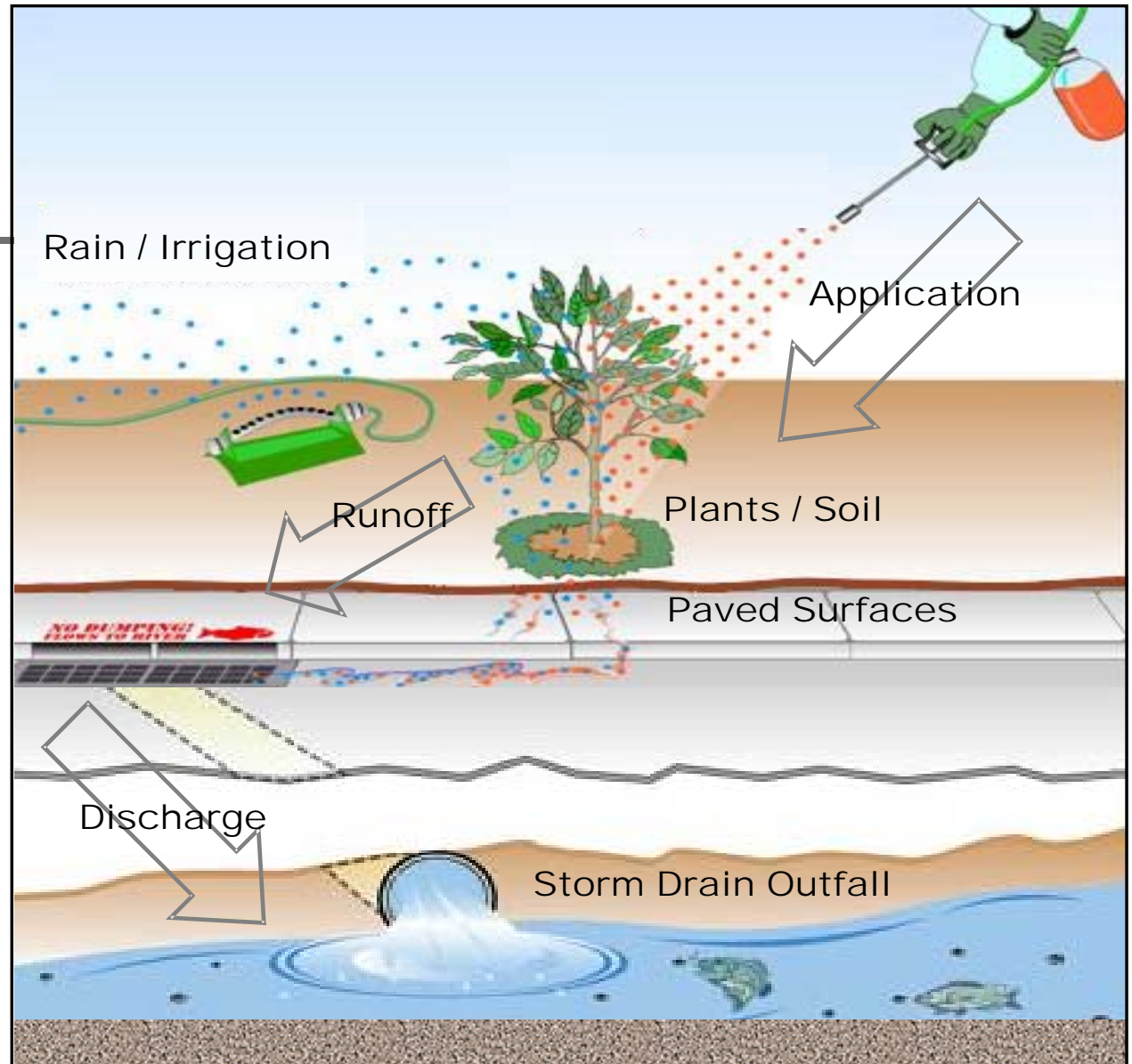


Figure courtesy SF Bay Regional Water Board, based on U.C. IPM Project drawing

# Wastewater Carries Pesticides to Treatment, Sludge, & Surface Water

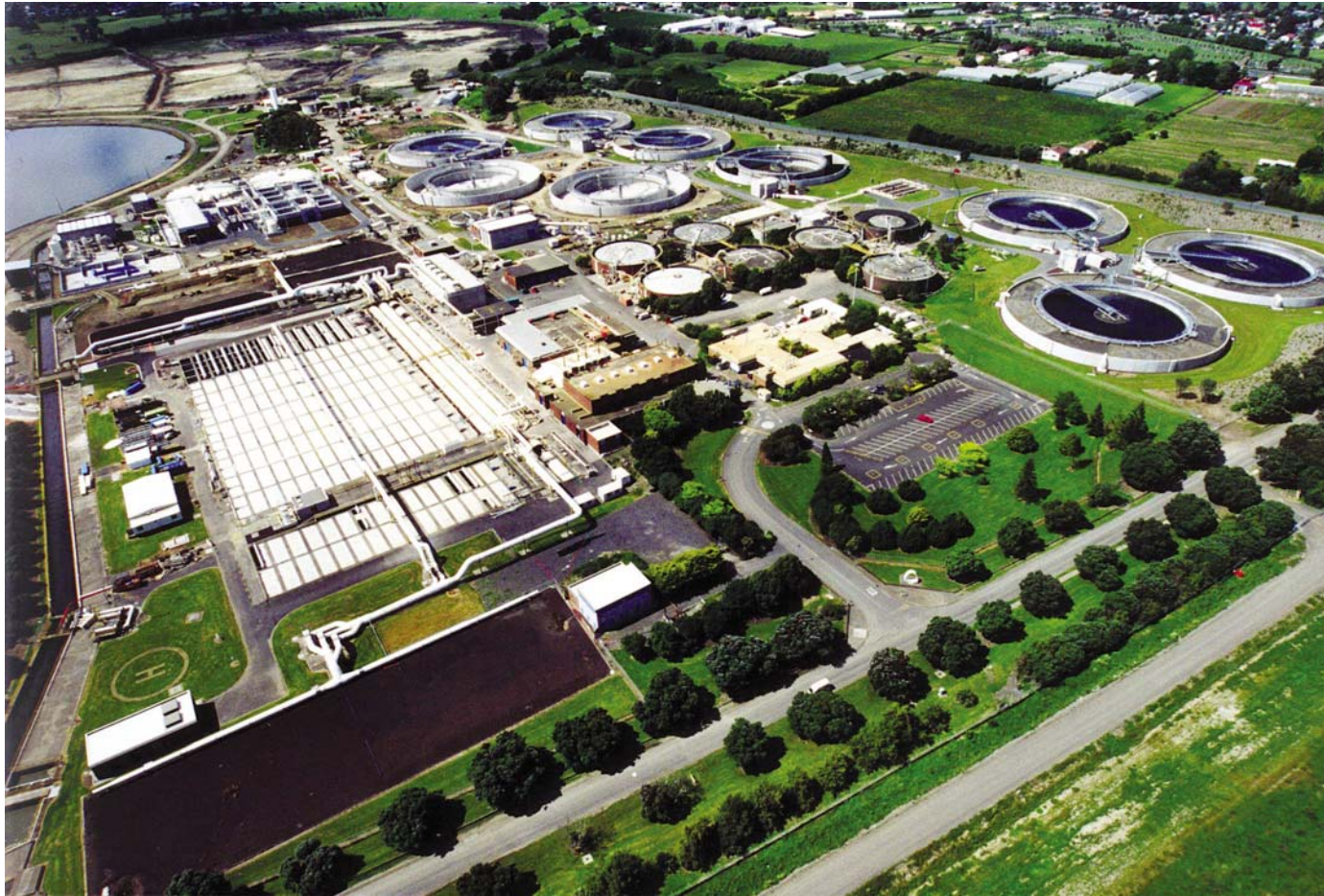


Photo courtesy WaterCare Services, Ltd.

# Urban Pesticide Water Quality Compliance Problems

- Copper-based root killers
- Tributyltin cooling water additives
- Lindane lice and scabies treatments
- Dursban (chlorpyrifos) pet shampoos
- DDT/Chlordane runoff
- Diazinon runoff
- Pyrethroids in runoff





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# Regulatory Context

Why Every Water Quality Professional Should  
Worry About Pesticides

# Pesticide/Water Quality Regulatory Gaps

- Clean Water Act and pesticide registration not coordinated
  - Pesticides registered for uses that will cause Clean Water Act violations & municipal compliance problems
  - Pesticide registration rarely considers urban surface water releases



# Pesticide/Water Quality Regulatory Gaps

- No process to prevent replacing one problem with another
- No process to screen for and address newly identified water quality impacts



# Clean Water Act Sets Tough Requirements for Municipalities

- NPDES permits give municipalities full responsibility for:
  - Everything that flows to a sewer
  - Everything that flows through a storm drain
- California mandatory minimum penalties
- Citizen lawsuits





# Pesticide Compliance Driven by Toxicity, TMDLs

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- Toxicity is the compliance key for most pesticides
  - Numerical water quality standards exist for only about 20 of the 900 pesticides
- Total Maximum Daily Loads (TMDLs) are setting tough standards
  - Many in progress for pesticides or toxicity
  - Allocations assigned to municipalities—not manufacturers, sellers, or users

Ability to comply controlled by pesticide regulators & market—not by municipalities

# Municipalities Have Little Control Over Pesticides

- Cannot regulate sales or use
- Can regulate discharge
  - But is this practical?
- Can use voluntary programs
  - Great to set the stage for stronger controls
  - Even expensive programs usually can't obtain reductions needed for compliance





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# Pesticides of Concern for Urban Surface Water Quality

# Urban Runoff

## Pesticides of Concern - 2006

- Pyrethroids
  - Primary replacements for Diazinon & Chlorpyrifos
- Carbaryl & Malathion
  - Old insecticides



# Urban Runoff

## Watch List - 2006

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- Fipronil
  - New alternative for ant control around buildings
- Polyhexamethylene biguanadine (PHMB)
  - Swimming pool and spa biocide
  - No commercial lab method



# Wastewater

## Pesticides of Concern - 2006

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- Metam sodium root killers
  - Contain NDMA
- Copper-based root killers



# Wastewater

## Watch List - 2006

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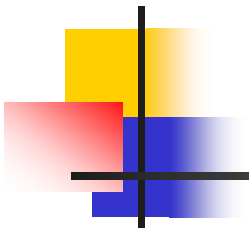
- Pyrethroids
  - Impregnated fabric
  - Wash-off treatments (lice, fleas)
- Silver biocides
  - Impregnated clothing
  - In devices like washing machines
- Tributyltin
  - Carpet & fabric treatments
  - ★ No more cooling water additives in CA



# Other Pesticides of Concern - 2006

- Copper
  - Algaecides
  - Marine antifouling paints





# Pyrethroids

# Pyrethroids Are Causing Toxicity in California Waters

- Main problem—toxicity in sediments
- Widespread toxicity found in California rivers and streams
  - Urban >> Agricultural areas
  - Standard aquatic toxicity test methods
  - Test organism resides in California



*Hyalella azteca* (amphipod)

# Pyrethroid Toxicity in Urban Creeks is Severe

- $\approx$ 20 creeks tested (all Northern CA)
- Pyrethroids detected in 100% of samples
- Multiple pyrethroids contribute to toxicity
  - Bifenthrin, cyfluthrin & cypermethrin biggest
- 80% of tested creeks had toxicity
- Direct connection to urban runoff shown
- # Toxic units (TUs) varies (<1 to 22 TU found)
  - Many samples >10 TU
  - Some areas less (East Bay Creeks 1-2 TU)





# Still Many Questions

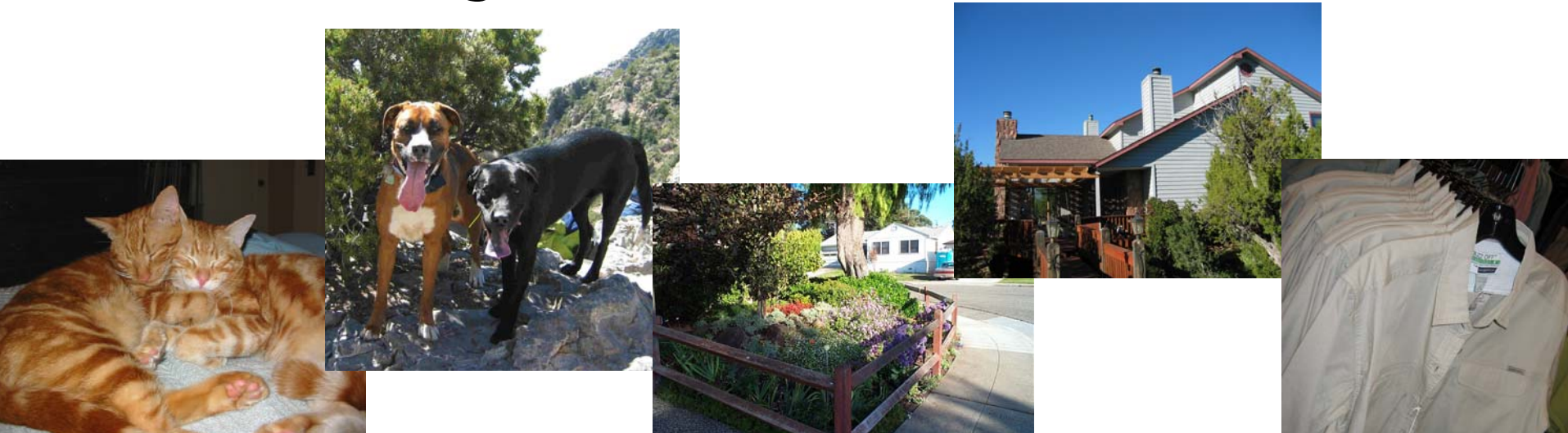
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- Breadth of problem (So. CA, salt water)?
- Is there more toxicity in creeks than in the lab? (Toxicity  $\uparrow$  as T  $\downarrow$ )
- What about sublethal toxicity?
- Municipal wastewater compliance risks?
- Limit reuse of sewage sludge?



# Pyrethroids Have Many Uses

- Keeping insects out of buildings
- Underground termites
- Lawn/garden insects
- Pet fleas
- Clothing





# Priority Pyrethroids for Water Quality (Based on Use Patterns)

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- Bifenthrin
- Cyfluthrin and Beta-Cyfluthrin
- Cypermethrin
- Deltamethrin
- Esfenvalerate
- Lambda-Cyhalothrin
- Permethrin
- Tralomethrin



# All Pyrethroids Are Not Equal

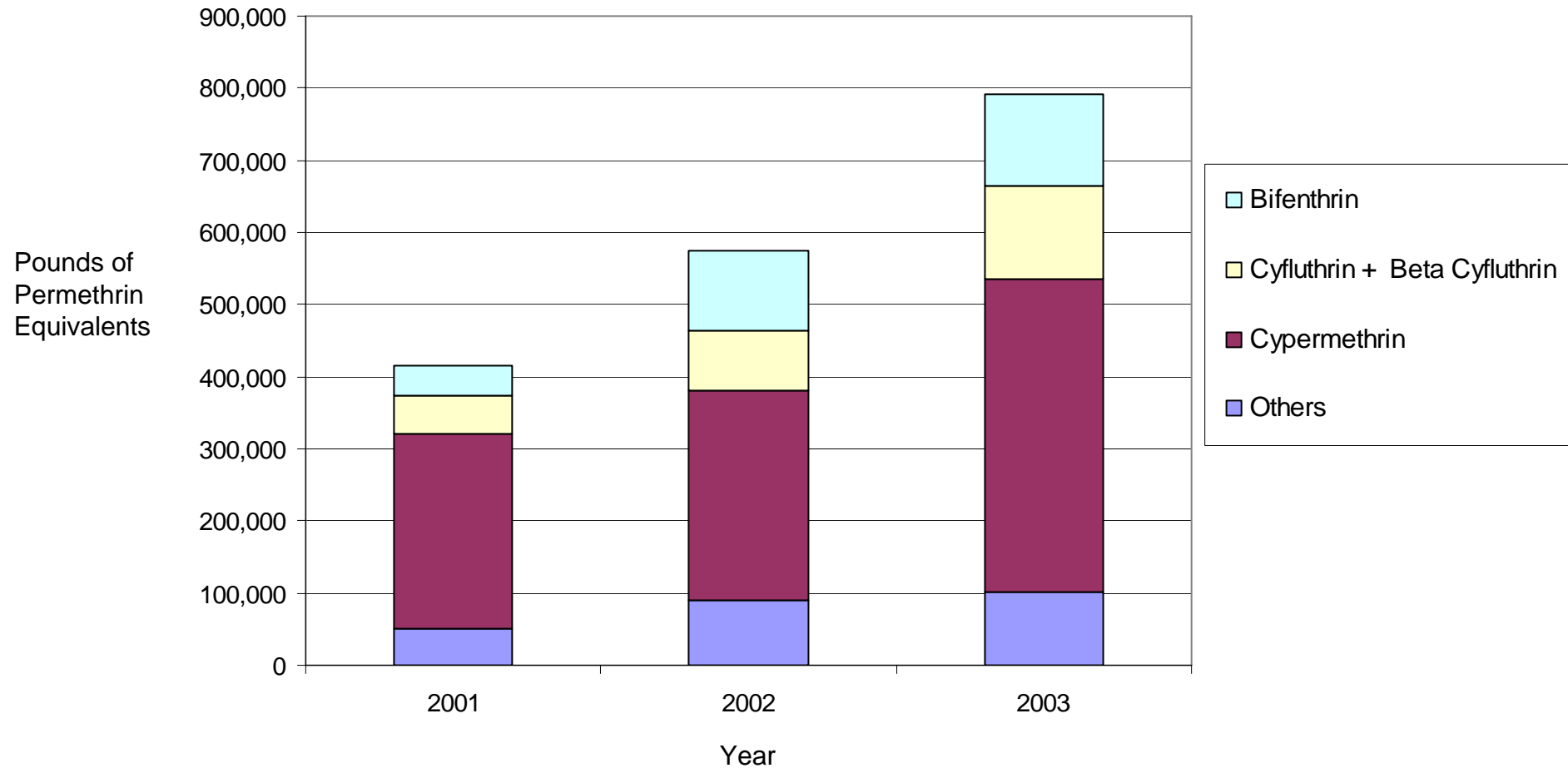
## Pyrethroid Toxicity to *Hyalella azteca*

Pyrethroid	Number of Times More Toxic than Permethrin
Bifenthrin	21
Cyfluthrin	10
Beta-Cyfluthrin	10
Cypermethrin	29
Deltamethrin	14
Esfenvalerate	7
Lambda-Cyhalothrin	24
Permethrin	1
Tralomethrin	Assume ~1

Source: Ratio of each compound's 10-Day LC50 ( $\mu\text{g/g}$  organic carbon) for sediment toxicity to *Hyalella azteca* to permethrin's LC50 (Amweg et al. 2005; Maund et al. 2002)

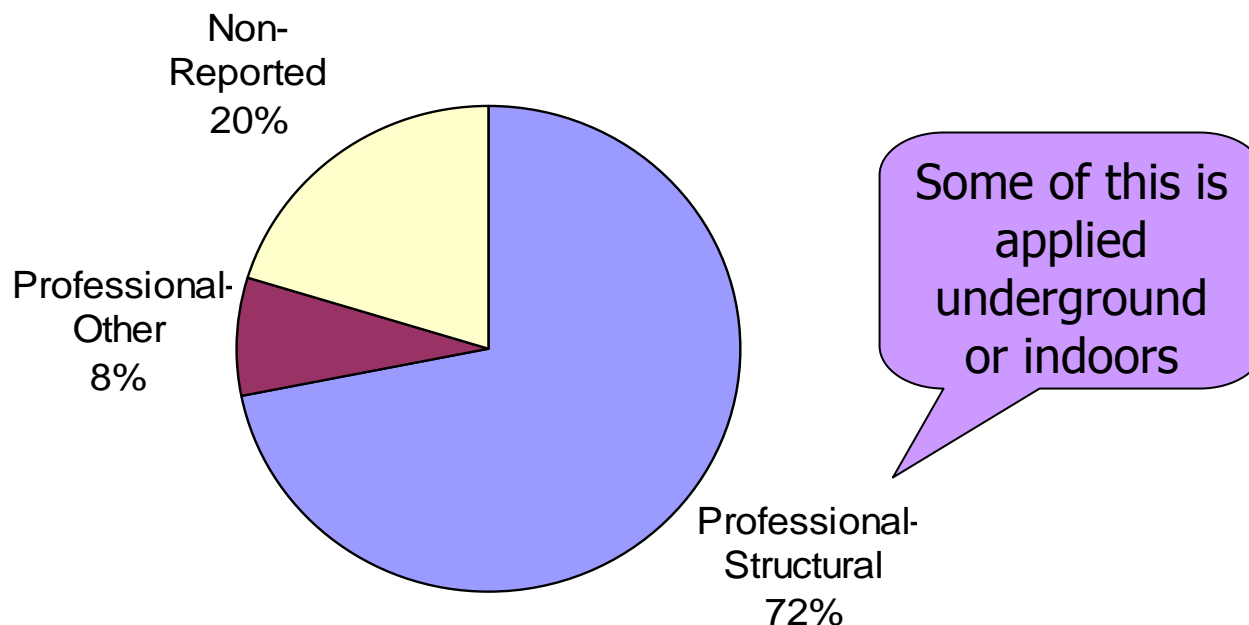
# Three Pyrethroids Account for Most of the Toxic Equivalents Applied—and Most of the Toxicity in Urban Creeks

San Francisco Bay Area Pyrethroids Urban Use



# Most Urban Pyrethroid Toxicity Is Applied by Professionals for Structural Pest Control

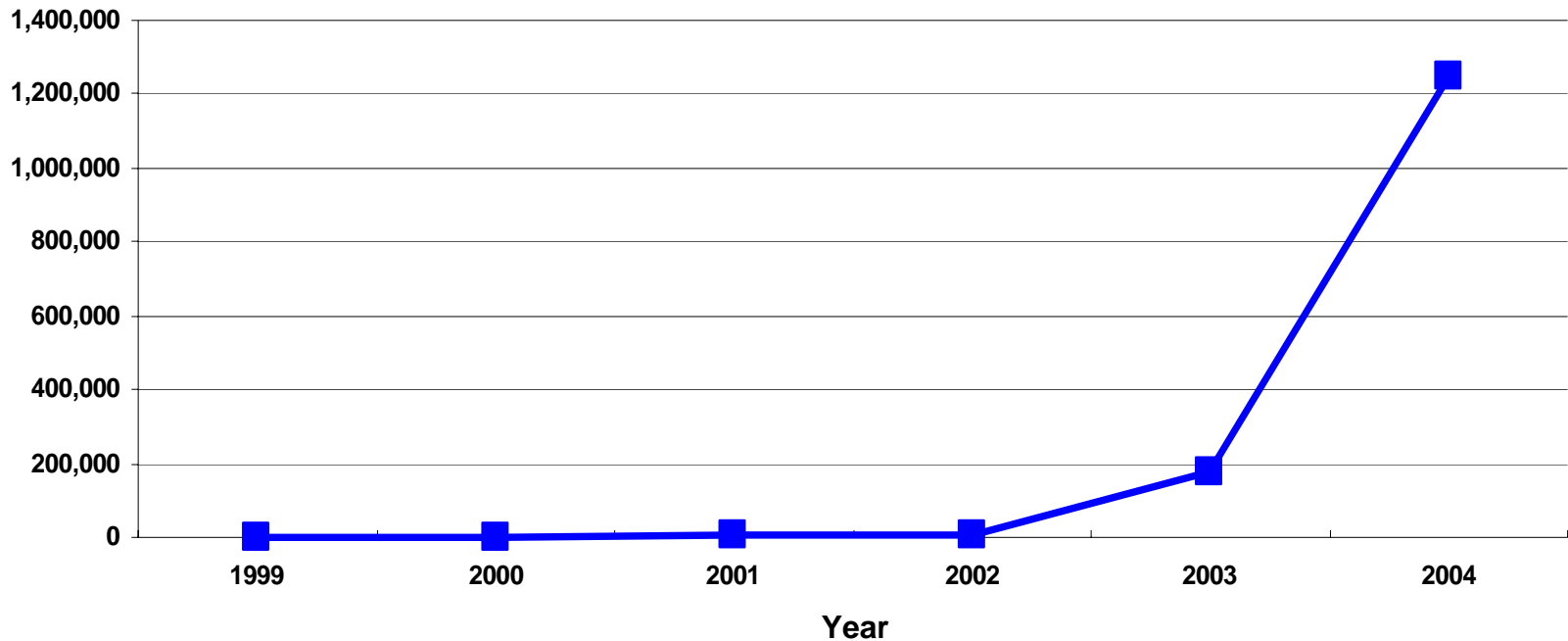
San Francisco Bay Area Study List Pyrethroids  
Urban Uses, 2003 (Permethrin Equivalents)



Lots of uncertainty in these data. Non-reported probably underestimated.

# What's Next? Fipronil

Fipronil Sales 1999-2004



Highly toxic to aquatic organisms

Approved for keeping ants out of buildings in late 2002



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# Regulatory Reactions

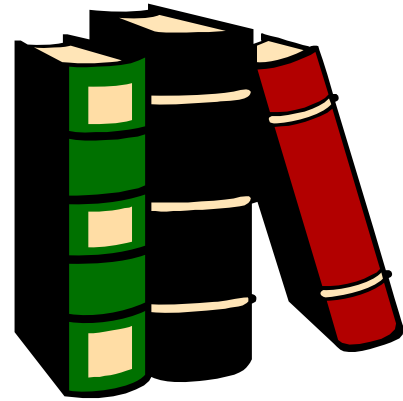


# 303(d) Listings Are Coming

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- A few pyrethroids on upcoming list
- Most listings will be added in 2008

★ *Toxicity TMDLs are in process now in some locations*

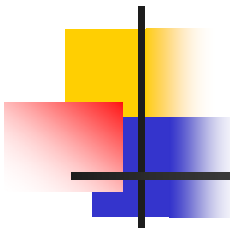




# Water Quality Agencies Team Up to Address Pesticide Regulation

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- Stormwater—CASQA Pesticides Subcommittee
- Wastewater—TriTAC Water Subcommittee
- Water Boards
  - SF Bay leader on urban pesticides
  - Other regions involved
  - State Water Board becoming engaged
- DPR Surface Water Protection Program
- EPA Region 9 Pesticides Liaison



# Organized Effort to Encourage Proactive Pesticide Regulation

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- Why? Cost effective—Preventing problems much cheaper than responding to them
- Approach
  - Coordinate with existing regulatory processes
  - Request special action to address current problems
  - UP3 Project scientific & regulatory support
- Communications
  - >130 Letters to U.S. EPA, teleconference meetings
  - ≈10 Letters to and >10 meetings with DPR



# DPR Is Changing

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- Current problems—regulatory action is coming
  - Pyrethroids re-evaluation
  - Marine antifouling paint re-evaluation
- Preventing future problems—registration needs improvement
  - Currently do not do sewer discharge or urban runoff assessments
  - ★ *Recent agreement to register impregnated fabric*



# U.S. EPA Is Aware

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- Current problems—No action so far
- Preventing future problems—Some change
  - Changes made
    - Sewer discharge modeling
    - Use all data (not just data from mfgrs.)
    - Look at degradates
  - Changes in consideration
    - Most important—Urban runoff modeling



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# Action Plan: What Water Quality Professionals Can Do



# Priority Actions

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Shift from reacting to problems to proactively preventing pesticide-related toxicity and compliance problems

## 1) Monitoring

- Get information & share it with others

## 2) Regulatory

- Encourage U.S. EPA and DPR to protect water

## 3) Outreach/Education

- Promote least toxic pest control methods

# Pyrethroid Monitoring

- Low detection limits needed
  - Water—as close to 0.001 ppb as available
  - Sediment—1 ng/g (dry weight)
  - Few labs can achieve
    - Research: DFG & Southern Illinois University
    - Commercial: CRG Marine Laboratories, Torrance; Caltest Analytical Laboratory, Napa
- Sediments more important than water
  - Measure OC concentrations



# Regulatory Action Probably Necessary to Ensure Compliance

- Agencies can
  - Participate in Urban Pesticides Committee meetings via teleconference
    - See [www.up3project.org/up3\\_upc.shtml](http://www.up3project.org/up3_upc.shtml)
  - Join CASQA Pesticides Subcommittee
  - Work with TriTAC Water Subcommittee



# Outreach & Education

- Target outdoor use of pyrethroids
  - Structural applications are the priority
  - Municipal, business & residential
  - Lawn & garden a lower priority



# Change the Way Ants Are Kept Out of Buildings

- Use IPM methods—baits and exclusion
  - Switching pesticides may create new problems (we need to learn from history)
- Top target audience—PCO customers
  - Building managers
  - Condo associations
  - Landlords
  - Homeowners



For more information:

[www.UP3Project.org](http://www.UP3Project.org)