

# UP3 Project

## Summary

Pyrethroid insecticides are causing widespread toxicity to sediment dwelling organisms (*Hyalella azteca*) in urban creeks draining to the San Francisco Bay-Delta Estuary. Pyrethroids have many urban uses, including outdoor applications to control insects around buildings, on lawns, and in gardens; indoor sprays and foggers to control nuisance insects; and underground injection to control termites. Rainfall and non-rain urban runoff washes a small portion of the pyrethroids applied to outdoor surfaces into urban creeks. (Urban runoff is the only urban discharge to San Francisco Bay Area and Sacramento area creeks.)

An evaluation of pyrethroid products identified eight pyrethroids as priorities for urban water quality. These pyrethroids differ in their toxicity to *Hyalella azteca*—for example, bifenthrin is 21 times as toxic to *Hyalella* as is permethrin. Since pyrethroid toxicity to aquatic life is cumulative (apparently additive), this analysis looks at “permethrin equivalents” rather than total quantities.

Using California Department of Pesticide Regulation pesticide use reporting, sales, and product label databases, pesticide user surveys, other government reports, and scientific literature, the urban use of pyrethroids in the San Francisco Bay Area was estimated and evaluated to identify the major sources of pyrethroids in urban runoff.

Most Bay Area urban pyrethroid use is by professional applicators (this is true on the basis of total quantity as well as total toxicity-based permethrin equivalents). Most urban professional applications of pyrethroids are for structural pest control. Some professional structural pest control applications involve underground injection; however, these are not separately identified in California pesticide use reporting data. Product label information was analyzed to determine that between 40% to 70% of outdoor applications of permethrin equivalents are structural pest control applications by professional pest control operators.

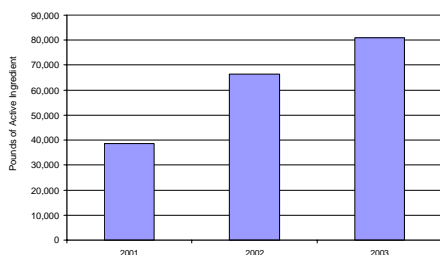
Survey data indicate that the most common outdoor use of insecticides in California is around buildings to control ants. Outdoor structural pest control applications are of particular interest for water quality, as these applications are the ones most likely to involve treatment of outdoor impervious surfaces (e.g., pavement and building surfaces), which have much higher pesticide washoff fractions than pervious surfaces (e.g., lawns and gardens). These applications are most likely to be the major source of pyrethroids in urban creeks.

# Sources of Pyrethroids in Urban Runoff

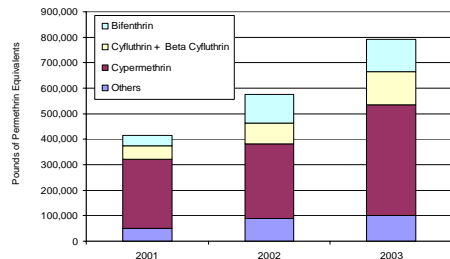
Kelly D. Moran, TDC Environmental, LLC, San Mateo, California

## Bay Area Pyrethroid Use Has Doubled

Bay Area Pyrethroid Use Doubled Between 2001 and 2003



## Three Pyrethroids Account for Most of the Toxic Equivalents Applied



## Pyrethroid Toxicities Differ Greatly—But Application Rates Must Be Considered When Making Comparisons

Pyrethroid	Average Sediment 10-Day <i>Hyalella azteca</i> LC 50 (µg/g organic carbon)	Number of Times More Toxic than Permethrin	Quantity Applied per 1000 sq. ft. for an Outdoor Structural Pest Control Application (g of Permethrin Equivalents)
Bifenthrin	0.52	21	46 to 91
Cyfluthrin	1.08	10	1 to 13
Beta-Cyfluthrin	? (assume same as cyfluthrin)	Assume ~ 10	10 to 20
Cypermethrin	0.37	29	266 to 532
Deltamethrin	0.79	14	12 to 18
Esfenvalerate	1.54	7	2 to 14
Lambda-Cyhalothrin	0.45	24	NC
Permethrin	10.83	1	4 to 74
Tralomethrin	? (assume same as permethrin)	Assume ~ 1	NC

NC – Not calculated. Source: Amweg et al. 2005, Maund et al. 2002

## Urban Runoff Carries Pesticides to Creeks

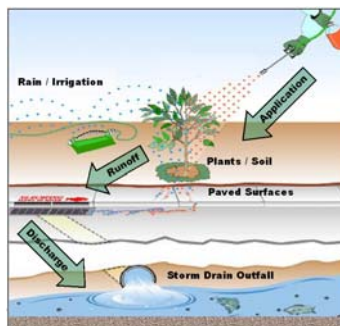


Figure courtesy S.F. Bay Regional Water Board, based on U.C. IPM Project drawing.

## Outdoor Structural Pest Control Is Most Important for Creeks

*Washoff Fractions Are Higher (than Lawn & Garden Applications) Due to Applications on Impervious Surfaces*

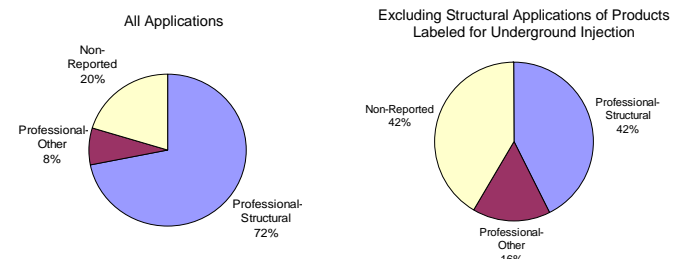
The fraction of pesticide that is washed off of an application site depends, in part, on the characteristics of the application site. Urban surfaces can be broadly categorized into:

- Impervious surfaces**—hard surfaces like roofs, walkways, streets, parking lots, driveways, and buildings.
- Pervious surfaces**—areas where water may infiltrate to some degree, like landscaping and lawns.

For pesticides—like other pollutants—washoff fractions are greatest on impervious surfaces (TDC 2003; Pitt 1987; Pitt 1999; Sartor & Boyd 1972; U.S. EPA 1983).

Pyrethroids applied for structural pest control—particularly for commercial and multi-family residential buildings—are applied to both impervious and pervious surfaces. In contrast, lawn & garden applications are almost exclusively to pervious surfaces. Available data are not sufficient to complete quantitative estimates of washoff.

## Outdoor Structural Pest Control Applications by Professionals Comprise 40% to 70% of Bay Area Outdoor Pyrethroid Applications (Permethrin Equivalents)



## Conclusions/Recommendations for Agencies

### Priority Pyrethroids for Water Quality

Using pesticide use reporting data, pesticide sales data, pesticide product labels, retail product surveys, and an assessment of formulation types for retail products, urban uses of eight pyrethroids were found to have potential to release environmentally meaningful quantities of active ingredient onto outdoor surfaces (TDC 2005). In this poster, pyrethroids refer to:

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

### Priority Actions

**Outdoor structural pest control**—particularly pyrethroid use to keep ants out of buildings—should be the top priority for agencies seeking to eliminate pyrethroid-related toxicity in urban creeks.

**Obtaining data on pyrethroid fate in creeks** is a priority for understanding the relative importance of individual pyrethroids. Because less toxic pyrethroids have higher application rates, substituting different pyrethroids may not reduce toxicity in creeks. If fate in creeks differs significantly, however, substitution could modify toxicity.

## Methods

*Pesticide use reporting and sales data were obtained from the California Department of Pesticide Regulations databases (DPR 2002, 2003 & 2005). (The most recent data available reflect pesticide sales & use in 2003.) Unreported use—primarily residential use—was estimated on a per-capita basis from statewide unreported use (total sales – total reported use). Application rates and allowable pesticide uses were obtained from product labels. Based on product labels and indoor formulations, the analysis assumes that indoor use of the priority pyrethroids comprises a relatively small fraction of their total use.*

## References

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