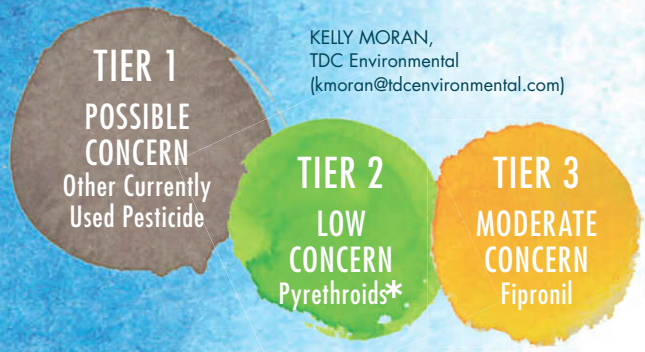
Currently Used Pesticides



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Quick Summary

The term "pesticides" includes all insecticides, herbicides, fungicides, rodenticides, and antimicrobials. Although both the US Environmental Protection Agency (USEPA) and the California Department of Pesticide Regulation (DPR) must approve pesticides prior to their first use, gaps in pesticide review procedures have resulted in pesticide water pollution. Currently used pesticides have been found throughout aquatic environments. Due to the lack of environmental chemical analysis methods for most currently used pesticides and limited availability of aquatic toxicity data, the potential risks are not fully understood.

What Are They?

- Any of more than 1,000 synthetic or natural organic or inorganic chemicals that are toxic to unwanted organisms.
- Some nanoparticles, such as nanosilver, are pesticides.
- Several dozen currently used pesticides are Clean Water Act priority pollutants (e.g., copper, silver, acrolein, and pentachlorophenol).
- Regulatory changes focused on protecting human health have driven a shift in the pesticide market away from pesticides like DDT that are passed up the food chain and into a multiplicity of new chemical families, some of which are highly toxic to aquatic organisms.

What Are They Used For?

- To control unwanted organisms, both indoors and outdoors.
- In agriculture, pesticides are most often used to protect crops from insects, competing weed growth, fungi, and nematodes.
- In urban areas, pesticides have hundreds of diverse uses, such as ant and termite control around buildings, weed and slug control in landscaping and along roads, wood preservatives, fungicides and biocides in building roofing and paints, swimming pool and drinking water biocides, pet flea control products, and antifouling treatments for boat hulls.
- Pesticides (particularly antimicrobials) are commonly incorporated into products that are not traditionally understood to contain pesticides, such as building materials and cleaning products.
- Although California is the nation's leading agricultural state, more than half of all California pesticide use occurs in urban areas.
- California pesticide sales exceeded 280 million kg in 2011 (CDPR 2013).

How Are They Getting Into the Bay?

- Urban and agricultural stormwater runoff, in-Bay applications, and municipal wastewater treatment plant effluent are all pathways to the Bay (PAGE 16).

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Pyrethroids are of low concern in the Bay, but high concern in Bay Area urban creeks

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What Happens to Them in the Bay?

- Pesticides and their degradation products (which are sometimes more toxic and persistent than their parent chemicals) may occur in water, sediments, and biota in the Bay ecosystem.
- Because environmental fate and aquatic toxicity data for estuarine environments are not routinely obtained before pesticides are approved for use, the fate of most currently used pesticides in the Bay is largely unknown.
- For most currently used pesticides, no published, validated environmental chemical analysis methods exist, which has greatly limited the availability of data to characterize patterns of occurrence in the Bay and in other aquatic ecosystems.
- While no trend data are available for the Bay, the general trend in pesticide design is away from chemicals that accumulate in the food web. Some currently used pesticides and their toxic degradation products (e.g., bifenthrin, indoxacarb), degrade slowly and may accumulate in sediment. Pesticides occurring in municipal wastewater discharges can be "virtually persistent" (have a persistent presence in the Bay) even if they degrade quickly because they are continuously discharged.

TABLE 1
Urban Pesticides Pollution Prevention Project Priority Pesticides List.

PESTICIDE	PRIORITY DISCHARGE PATHWAY			POTENTIAL POTW OPERATIONAL INTERFERENCE
	URBAN RUNOFF	POTW	DIRECT TO BAY	
PYRETHROID INSECTICIDES				
Allethrin	X	X		
Bifenthrin	X	X		
Cyfluthrin	X	X		
Cyhalothrin	X	X		
Cypermethrin	X	X		
Cyphenothrin		X		
Deltamethrin/Tralomethrin	X	X		
Esfenvalerate	X	X		
Etofenprox		X		
Permethrin	X	X		
Phenothrin	X	X		
Prallethrin	X	X		
Resmethrin	X	X		
Tetramethrin	X	X		
OTHER INSECTICIDES				
Carbaryl	X			
Fipronil	X	X		
Indoxacarb	X			
Malathion	X	X		
SWIMMING POOL, SPA, AND FOUNTAIN TREATMENTS				
Copper and Copper Compounds	X	X		
PHMB	X	X		
Silver	X	X		
ANTIMICROBIALS				
Copper		X		
Silver (including nanosilver)		X		X
Triclosan		X		
SEWER ROOT CONTROL				
Copper Sulfate		X		
Dichlobenil		X		X
Diquat Dibromide		X		X
Metam Sodium		X		X
WOOD PRESERVATIVES				
Copper and copper compounds	X		X	
Creosote			X	
Pentachlorophenol	X		X	
MARINE ANTIFOULING BIOCIDES				
Copper oxides			X	
Irgarol 1051			X	
Zinc Pyrithione			X	

Source: TDC Environmental 2010, as informally updated in 2011.

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Is There a Risk of Harm in the Bay?

- Due to the lack of environmental chemical analysis methods for most currently used pesticides and the limited availability of aquatic toxicity data, the potential risks are unknown.
- Past pesticide water pollution in the Bay (e.g., diazinon and chlorpyrifos), in effluents (e.g., copper-based root control products), and in creeks, where pesticides have been associated with fish kills (e.g., drinking water and swimming pool biocides), and are posing current challenges (e.g., pyrethroids), indicate that pesticides can harm aquatic ecosystems.
- Among emerging contaminants, pesticides are often ranked as the highest risk class of chemical compounds (e.g., von der Ohe 2011), which is unsurprising since they are specifically designed to kill organisms.
- No comprehensive list of pesticide priorities has ever been developed for the Bay, its urban and agricultural watersheds, or its wastewater discharges.
- The Urban Pesticides Pollution Prevention Project developed a simplified prioritization scheme to identify pesticides used in California urban areas that are most likely to threaten water quality (TABLE 1) (TDC Environmental 2010). Although the prioritization was not comprehensive, the ranking system is unique in its approach, which prioritizes pesticides based on use pattern, toxicity, and presence in the California urban market.
- In 2009, the Central Valley Water Board used DPR pesticide use reporting data and an earlier version of the UP3 Project urban pesticide priority list to develop a list of agricultural and urban pesticides that pose the highest overall relative risk to aquatic life in the Sacramento River, San Joaquin River, and Delta watersheds (TABLE 2).

TABLE 2
Central Valley Water Board List of High Overall Relative Risk Level Pesticides

Abamectin
Bifenthrin
Chlorothalonil
Chlorpyrifos
Cyfluthrin
Cypermethrin
Deltamethrin
Diazinon
Diuron
Esfenvalerate
Fipronil
Lambda-Cyhalothrin
Malathion
Mancozeb
Maneb
(S)-Metolachlor
Oxyfluorfen
Paraquat Dichloride
Pendimethalin
Permethrin
Polyhexamethylene biguanide (PHMB)
Propanil
Propargite
Pyraclostrobin
Simazine
Tralomethrin
Trifluralin
Ziram

Source: Lu and Davis 2009.

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Key Information Gaps

- A robust system for prioritizing pesticides for development of environmental chemical analysis methods.
- Environmental fate and aquatic toxicity data for pesticides and their stable degradation products , particularly in estuarine environments.
- Monitoring data in San Francisco Bay waters and sediments (particularly near discharge and use points, including Bay margins and marinas), urban water and creek sediments, and municipal wastewater effluents.

Management Timeline

2006
The Urban Pesticides Pollution Prevention Project (www.UP3Project.org) develops the first list of pesticides used in urban areas that are most likely to threaten water quality.

2009
Central Valley Water Board examines the relative risk to aquatic life posed by pesticides used in the watersheds draining to San Francisco Bay (Lu and Davis 2009).

2013
DPR develops methods for prioritizing agricultural and urban pesticides for monitoring (Budd et al. 2013; Luo et al. 2013).

2007 2008 2010 2011 2012