

**OP & Pyrethroid Pesticide-Caused Aquatic Life Toxicity:  
Inadequate Regulation of Urban Use**

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During the mid to late 1990's, in cooperation with the Santa Ana Regional Water Quality Control Board, the Orange County Public Facilities and Resources Department (Orange County stormwater management agency) and with support by the US EPA Region IX, Scott Taylor of RBF Inc. of Irvine, CA and I conducted an approximately \$ 0.5-million, 3-year study of the aquatic life toxicity in streams receiving urban and agricultural stormwater runoff in the Upper Newport Bay watershed in Orange County, California. Dr. Jeff Miller of AquaScience, Dr. Scott Ogle of Pacific Eco-Risk of Fairfield, CA and Linda Deanovic of the University of California Davis Aquatic Toxicology Laboratory provided significant technical assistance. That study was motivated by the need for data to guide the development of BMPs to control potential pollution by the Eastern Transportation Corridor (ETC) stormwater runoff. At that time the ETC was a new 22-mile toll road. There was concern about the stormwater runoff from the highway because receiving waters in the area contained sufficient concentrations of heavy metals, including copper and zinc, to violate water quality objectives and therefore potentially cause toxicity to aquatic life. Highway and street runoff is known to contain elevated concentrations of these heavy metals. In order to address the potential for the heavy metals in urban street and highway stormwater runoff, we undertook an aquatic life toxicity monitoring program of about 10 sub-watersheds in the Upper Newport Bay watershed. The Evaluation Monitoring approach described by Jones-Lee and Lee (1998) was used to focus on water quality impacts of potential pollutants.

The laboratory acute toxicity to *Ceriodaphnia* and *Mysidopsis bahia* of many of the samples of stormwater runoff to tributaries of Upper Newport Bay was found to be from 1 to 10 TUa. Using dual column GC and ELISA analysis and TIEs we found that about half of the toxicity was due to the OP pesticides, diazinon and chlorpyrifos. TIEs involving serial dilutions and PBO additions revealed that a substantial part of the remaining toxicity was attributable to pyrethroid-type pesticides. According to the California Department of Pesticide Regulation (DPR) Pesticide Use Reports during the late 1990s about 25,000 lbs (ai)/year of pyrethroid-based pesticides were used in Orange County. Using TIEs it was determined that the heavy metals in the runoff samples, while in exceedance of objectives, were not in toxic forms.

Nurseries in the Upper Newport Bay watershed were, at times, responsible for up to 50 TUa of diazinon toxicity in streams just downstream of the nurseries. DPR was also using a pyrethroid-based pesticide to address a fire ant infestation, although that use was not in the DPR pesticide use reporting mentioned above.

The aquatic life toxicity in urban stormwater runoff in the Upper Newport Bay watershed was, in the mid- to late 1990s, and remains, the highest of any reported in California. By contrast, CVRWQCB monitoring of city of Stockton stormwater runoff during the early to mid-1990s showed OP pesticide (diazinon) toxicity to *Ceriodaphnia* of about 1 to 2 TUa. There was no

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unidentified acute toxicity in that runoff. There is need to conduct comprehensive stormwater runoff monitoring in the Upper Newport Bay watershed to assess the current situation.

In the early 2000s when pyrethroid-based pesticides started to appear in urban pesticides products as replacement for OP pesticides for sale to the public for urban residential use, we predicted that pyrethroid-based pesticides would cause aquatic life toxicity in the water column of receiving waters for urban stormwater runoff. We discussed those concerns in:

Lee, G. F., "The Urban Pesticide Problem: How Do We Know the Substitutes Aren't Worse Than the Ones They're Replacing?" Feature Article, *Journal Stormwater* 2(1):68-71, Forrester Press, January/February (2001).

<http://www.gfredlee.com/Runoff/UrbanPestStormwater1.pdf>

Since then we have advocated for the monitoring of urban stormwater runoff and receiving waters for pyrethroid toxicity to water column aquatic life. In the summer of 2009, Dr. D. Weston of UC Berkeley presented results of his studies that showed that pyrethroid-based pesticides being used in urban areas are causing toxicity to aquatic life in the water column of receiving waters for urban stormwater runoff.

As we had predicted, the replacement of organophosphorus-based pesticides by pyrethroid-based pesticides for urban residential use has resulted in aquatic life toxicity caused by the pyrethroid-based pesticides in both the water column and sediments that receive stormwater runoff from treated areas. This situation, in which one problem pesticide is replaced with another, exemplifies deficiencies in the US EPA Office of Pesticide Programs' (OPP) evaluation and registration processes for pesticides used in outdoor urban residential applications, and underscores problems caused by the different approaches used in regulating pesticide-associated toxicity by the OPP and the US EPA Office of Water in its implementation of the Clean Water Act (CWA). Until these deficiencies and discrepancies are corrected, CWA water quality management agencies should adopt a pro-active approach for evaluating aquatic life toxicity implications of proposed replacement pesticides. Elements of such a pro-active approach, discussed herein, should require comprehensive evaluation of the actual use of proposed pesticides by registrants to more reliably assess short-term and long-term implications of a proposed replacement pesticide's use, and provide for adequate supervision by CWA regulatory agencies. The use of pesticides in urban areas in a manner in which they can cause aquatic life toxicity via stormwater runoff and fugitive water releases from residential and commercial properties should be restricted.

### **Background References**

Lee, G. F., Jones-Lee, A. and Taylor, S. "Evaluation of the Water Quality Significance of OP Pesticide Toxicity in Tributaries of Upper Newport Bay, Orange County, CA," IN: Ninth Symposium on Environmental Toxicology and Risk Assessment: Recent Achievements in Environmental Fate and Transport, ASTM STP 1381, pp 35-51 (2000).

[http://www.gfredlee.com/Watersheds/oppesticide\\_unb.pdf](http://www.gfredlee.com/Watersheds/oppesticide_unb.pdf)

Lee, G. F. and Taylor, S., "Results of Aquatic Toxicity Testing Conducted During 1997-2000 within the Upper Newport Bay Orange County, CA Watershed," Report of G. Fred Lee & Associates, El Macero, CA (2001).

<http://www.gfredlee.com/Watersheds/295-319-tox-paper.pdf>

Lee, G. F. and Taylor, S., "Results of Heavy Metal Analysis Conducted During 2000 in the Upper Newport Bay Orange County, CA Watershed," Report of G. Fred Lee & Associates, El Macero, CA (2001).

<http://www.gfredlee.com/Watersheds/Heavy-metals-319h.pdf>

Jones-Lee, A. and Lee, G.F., "Evaluation Monitoring as an Alternative to Conventional Water Quality Monitoring for Water Quality Characterization/Management," Proc. NWQMC National Conference Monitoring: Critical Foundations to Protect Our Waters, US Environmental Protection Agency, Washington, D.C., pp. 499-512 (1998).

[http://www.gfredlee.com/Runoff/wqchar\\_man.html](http://www.gfredlee.com/Runoff/wqchar_man.html)

Lee, G. F. and Jones-Lee, A., "Review of the City of Stockton Urban Stormwater Runoff Aquatic Life Toxicity Studies Conducted by the CVRWQCB, DeltaKeeper and the University of California, Davis, Aquatic Toxicology Laboratory between 1994 and 2000," report to the Central Valley Regional Water Quality Control Board and the DeltaKeeper, submitted by G. Fred Lee & Associates El Macero, CA, November (2001).

[http://www.gfredlee.com/Runoff/stockton-txt\\_0401.pdf](http://www.gfredlee.com/Runoff/stockton-txt_0401.pdf)

Jones-Lee, A., and lee, G.F., "Proactive Approach for Managing Pesticide-Caused Aquatic Life Toxicity," Report of G. Fred Lee & Associates, El Macero, CA, October (2000). [http://www.gfredlee.com/Runoff/proactivepest\\_1000.pdf](http://www.gfredlee.com/Runoff/proactivepest_1000.pdf)

Our work on urban pesticides water quality impacts is summarized in our Stormwater Runoff Water Quality Newsletter (issues: NL-1-1, 2-1, 3-5, 3-6, 6-3, 6-4, 7-6/7, 8-1/2, 9-3, 9-4, 9-6, 9-7, 9-8, 10-3, 10-8, 10-12, 11-4, 11-7/8, 12-4, 12-7/8, and 13-1 which are available on our website at <http://www.gfredlee.com/newsindex.htm>). The Volume 12 Number 4 (August 14, 2009) issue addresses the following topics: pyrethroid-based pesticides in urban stormwater runoff & domestic wastewaters as a cause of aquatic life toxicity; potential environmental impacts of the pesticide, Imidacloprid, & nanomaterials; availability of new book on environmental modeling of pollutants. The Stormwater Runoff Water Quality Newsletter, now in its 13<sup>th</sup> year of publication, is an email-based newsletter distributed at about monthly intervals, at no cost, to more than 10,400 subscribers. Anyone interested in receiving this newsletter should contact G. Fred Lee at [gfredlee@aol.com](mailto:gfredlee@aol.com).

Dr. Lee's work on the occurrence, transport, fate, and water quality impacts of pesticide began in the 1960s while he was Professor of Water Chemistry at the University of Wisconsin, Madison. Many of his more recent papers and reports are available on Dr. Anne Jones-Lee's and his website [[www.gfredlee.com](http://www.gfredlee.com)] in the "Surface Water Quality" section, "Pesticides Toxicity" subsection at <http://www.gfredlee.com/pswqual2.htm#pesticide>. Questions on our work on aquatic life toxicity due to pesticides associated with urban stormwater runoff should be directed to [gfredlee@aol.com](mailto:gfredlee@aol.com).