Stormwater Runoff Water Quality Newsletter
Devoted to Urban/Rural Stormwater Runoff
Water Quality Management Issues

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Editor: Anne Jones-Lee, PhD
Contributor to this Issue:
G. Fred Lee, PhD, PE, DEE

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This issue of the Newsletter presents updated information on the **regulation of aquatic life toxicity due to pesticides in stormwater runoff from urban and agricultural areas**. As discussed in Newsletters 1-1, 2-1, 3-5, 3-6, 6-3, 7-6/7, 8-1/2, 9-3, 9-4, 9-6, 9-7, and 9-8, aquatic life toxicity due to pesticides in stormwater runoff from urban areas and some agricultural areas is one of the most significant causes of violations of water quality standards/objectives in many parts of California; it has also been documented in other areas of the country. Past Newsletters are available at, http://www.gfredlee.com/newsindex.htm.

As discussed in these Newsletters, the California Regional Water Quality Control Boards have found that urban and agricultural stormwater runoff and some irrigation tailwater discharges are causing aquatic life toxicity in the state's waters. Dr. C. Foe (1995) of the California Central Valley Regional Water Quality Board (CVRWQCB) found aquatic life toxicity to *Ceriodaphania* (water flea - fish food organism) in agricultural irrigation tailwaters that was due to agricultural use of the organophosphorus (OP) pesticide, diazinon. *Ceriodaphania dubia* is the US EPA standard zooplankton test organism for aquatic life toxicity. Kuivila (of the USGS) and Foe (1995) reported diazinon-caused aquatic life toxicity in the Sacramento River that persisted through the Delta; that toxicity was associated with the use of diazinon in agriculture. A review of diazinon use records shows that aquatic life toxicity due to that pesticide has likely been present, but not measured for, in stormwater runoff from agricultural areas in the Central Valley of California since the mid-1980s. Recent monitoring has shown that this problem still occurs today although its frequency and magnitude are less than previously experienced.

Lee and Jones-Lee (2001) summarized the early-to-mid-1990's studies of Dr. V. Connor of the CVRWQCB who found aquatic life toxicity to *Ceriodaphnia* in the city of Stockton, CA stormwater runoff. That toxicity was found to be due to diazinon used on residential property. Lee and Taylor (2001) reported finding high levels of *Ceriodaphnia* toxicity in tributaries of Upper Newport Bay in Orange County, CA. Diazinon and chlorpyrifos, as well as some unidentified chemicals (likely pyrethroid-based pesticides), were responsible for that toxicity.

The finding of aquatic life toxicity in the state's waters has caused several waterbodies in California to be listed Clean Water Act Section 303 (d) "impaired." This listing has resulted in the Regional Boards' developing Total Maximum Daily Loads (TMDL) of the pesticides responsible for causing that toxicity. The CVRWQCB website, http://www.waterboards.ca.gov/centralvalley/programs/tmdl/index.htm#Projects

presents information on that Board's current pesticide-related TMDLs.

Newsletters 2-1 and 8-1/2 reviews stormwater runoff pesticide-caused aquatic life toxicity issues. As discussed therein, the organophosphorus pesticides, diazinon and chlorpyrifos, have been found to be the primary cause of urban and some agricultural stormwater runoff aquatic life toxicity in the receiving waters for the runoff. With the US EPA's termination of the sale of diazinon for urban residential (lawn & garden) use in 2003, use of pyrethroid-based pesticides has increased as replacements for urban residential pesticide use. This use of pyrethroid-based pesticides has resulted in both water column and sediment aquatic life toxicity problems in receiving waters.

Dr. D. Weston of the University of California, Berkeley has conducted a number of studies on pyrethroid-based pesticide aquatic life toxicity in Central Valley stream sediments. Weston et al. (2005) presented a paper reviewing the studies on *Hyalella azteca* toxicity in city of Roseville, CA urban streams and the presence of pyrethroid-based pesticides in associated sediments. They reported,
"*The abundance of resident H. azteca was correlated with pyrethroid TUs* [toxic units] *(Figure 4b; p<0.05; Spearman rank correlation). Sediments containing more than one TU of pyrethroids had few or no resident H. azteca. Densities were quite variable at sites having less than one TU, presumably due to factors other than pyrethroid concentrations. The distributions of resident H. azteca are consistent with the patterns of sediment pyrethroid concentrations and toxicity test results, but the patterns are confounded by other habitat factors, for example, the low dissolved oxygen concentrations in some regions of the system."*

Recently, G. F. Lee attempted to determine, through the staff of several of the California Regional Water Quality Control Boards and urban stormwater runoff water quality managers, whether the ban on the sale of diazinon and chlorpyrifos for urban residential (lawn & garden) use in the early/mid 2000s has reduced or eliminated the aquatic life toxicity due to those pesticides in urban stormwater runoff. It appears that the type of water quality monitoring programs needed to make this type of evaluation have not been conducted. As discussed in previous Newsletters, the switch from organophosphorus-type pesticides to pyrethroid-based pesticides does not eliminate aquatic life toxicity in stormwater runoff in urban waterbodies. Basically this change has resulted in a change from OP-pesticide-caused water column toxicity to both water column and sediment toxicity caused by the pyrethroids.

The monitoring program that is needed to determine whether the water column aquatic life toxicity is due to OP pesticides and/or pyrethroids is that used by Lee and Taylor (2001) in their Upper Newport Bay watershed stormwater runoff aquatic life toxicity study of the mid-to-late 1990s. That approach was described by Lee (1999). It involves conducting a dilution series of the toxicity testing with and without PBO. This approach dilutes out the OP-caused toxicity and activates the pyrethroid-based toxicity.

On March 20, 2007 the San Francisco Bay Regional Water Quality Control Board's

Urban Pesticide Committee ("UP3 Project") held a committee meeting at which updated information on urban pesticide stormwater runoff water quality issues was reviewed. Information on the materials presented at that meeting is available at, http://www.up3project.org/up3_upc.shtml.

One of the issues reviewed at the Urban Pesticide Committee (UPC) meeting was updated information on water quality criteria for diazinon and chlorpyrifos. The Central Valley Regional Water Quality Control Board is developing TMDLs for diazinon and chlorpyrifos for several urban and agricultural areas. The CVRWQCB regulates pesticide-caused aquatic life toxicity and other pollutants through its Basin Plan. (The CVRWQCB Basin Plan is available at, http://www.swrcb.ca.gov/rwqcb5/available_documents/#anchor616381). The Basin Plan contains the regulatory requirements for pollutants and waterbodies. As part of its effort to regulate pesticides, the CVRWQCB is developing a Basin Plan amendment. Background information and documents related to that project are available on the project website at, http://www.waterboards.ca.gov/centralvalley/programs/tmdl/pest-basinplan-amend/index.html

As part of that effort, the CVRWQCB issued a contract to enable P. L. Tenbrook and Dr. R. S. Tjeerdema of the University of California, Davis to review and update the water quality criteria for pesticides. A summary of the current CVRWQCB updates of diazinon and chlorpyrifos water quality criteria was presented by P. Hann and J. Karkowski of the CVRWQCB staff at the March 20, 2007 UPC meeting. The PowerPoint slides used in that presentation are available at http://www.up3project.org/documents/UPC_WQC%20Method.pdf. Those slides provide information on the need to update the diazinon and chlorpyrifos water quality criteria, the approaches being followed, and the current results.

The current draft report on the updated methodology for deriving pesticide water quality objectives (WQOs) is available at, http://www.waterboards.ca.gov/centralvalley/programs/tmdl/pest-basinplan-amend/index.html#Criteria.

The CVRWQCB is holding a public workshop on this methodology

Location	**Central Valley Regional Water Quality Control Board** 11020 Sun Center Drive Rancho Cordova, CA 95670
Date:	18 April 2007
Time:	9:30 AM to 4:00 PM

According to P. Hann, it has been found that the current US EPA acute water quality criterion for chlorpyrifos of 83 ng/L is not protective of aquatic life. The current CVRWQCB Basin Plan acute WQO is 25 ng/L. The updated methodology will potential lead to a new acute WQO of 11.5 ng/L. The current US EPA chronic water quality criterion for chlorpyrifos of 41 ng/L is also not protective. The current Basin Plan chronic WQO for chlorpyrifos is 15 ng/L with a potentially revised WQO of 10.5 ng/L.

The March 20, 2007 UPC meeting also included a presentation by Dr. K. Moran of TDC on "**UP3 2006 Annual Regulatory Update."** The PowerPoint slides for that presentation are available at,
http://www.up3project.org/documents/UPC_MoranRegReport03-20-07.pdf
Those slides summarize the UP3 activities during the past year in working to improve the regulation of urban pesticide-caused aquatic life toxicity in stormwater runoff.

M. L. Flint presented a discussion of the "Strategic Directions for the University of California Integrated Pest Management Program" at the March 20, 2007 UPC meeting. The PowerPoint slides covering that presentation are at,
http://www.up3project.org/documents/UPC_urban%20strategy2.pdf

Those interested in the UPC activities can participate by attending meetings or via conference calls. To be placed on the email list to receive information on UPC meetings, contact Laura Speare, UP3 Project Manager, Urban Pesticide Pollution Prevention Project, San Francisco Estuary Project/ABAG at LSpeare@waterboards.ca.gov.

US EPA Pesticide Program Update
On March 7, 2007 the US EPA's Office of Pesticide Programs (http://www.epa.gov/pesticides) made available a "Summary of Aquatic Life Benchmarks for Pesticides." That announcement [available at http://www.epa.gov/oppfead1/cb/csb_page/updates/2007/aquatic-life.htm], states,

"*EPA's Office of Pesticide Programs (OPP) has been working with state pesticide and water quality agencies to compile a chart of "benchmarks" that states can use to guide their water quality monitoring efforts. Today, OPP is making available the results of that effort: an online summary of aquatic life benchmarks taken from pesticide specific ecological risk assessments. These benchmarks can be used by states to help them target any water monitoring they may intend to undertake and, in doing so, increase the efficiency of regulatory processes that protect aquatic environments.*

Aquatic life benchmarks are estimates of the concentrations below which pesticides are not expected to have the potential for adverse effects on aquatic life. These benchmarks can be used as indicators of potential hazard to aquatic life, but they are not detailed toxicity and risk assessments. Concentrations of pesticides in streams or groundwater that exceed benchmarks indicate that further work needs to be done to gather more detailed information and to conduct a risk assessment to characterize the likelihood of adverse effects on aquatic life in a given locality. OPP's aquatic life benchmarks are derived from standardized tests that measure the toxicity of an individual pesticide or metabolite to fish, aquatic plants, or aquatic invertebrates. Comparing a measured concentration of a pesticide in water with an aquatic life benchmark provides an initial perspective on the relevance of the pesticide concentration to environmental health and can be used to identify and prioritize sites and pesticides that may require further investigation. Aquatic life benchmarks for 71 pesticides or degradation products can be found at, http://www.epa.gov/oppefed1/ecorisk_ders/aquatic_life_benchmark.htm.

OPP expects to summarize and publish benchmarks for additional pesticides periodically. Users of these benchmarks are encouraged to explore more detailed information on specific studies (referenced on the Web site above) from which these benchmarks were derived. EPA's Office of Water aquatic life criteria, if derived for a pesticide, are available at http://www.epa.gov/waterscience/criteria/.

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EPA distributes its Pesticide Program Updates to external stakeholders and citizens who have expressed an interest in pesticide activities and decisions. This update service is part of EPA's continuing effort to improve public access to Federal pesticide information.

For general questions on pesticides and pesticide poisoning prevention, contact the National Pesticide Information Center (NPIC), toll free, at: 1-800-858-7378, by E-mail at, npic@ace.orst.edu, or by visiting their website at: http://npic.orst.edu/.

To report an environmental violation, visit EPA's website at, http://www.epa.gov/compliance/complaints/index.html

For information about EPA's pesticide program, visit our homepage at: http://www.epa.gov/pesticides/.

You are currently subscribed to epa-pesticide-updates as: Claire Gesalman@epamail.epa.gov.

To unsubscribe, send a blank email to unsubscribe-epa-pesticide-updates@lists.epa.gov OR: Use the listserve's web interface at https://lists.epa.gov/read/ manage your subscription
For problems with this list, contact epa-pesticide-updates.Owner@lists.epa.gov."

CA Department of Pesticide Regulation's (DPR)
Reevaluation of Pyrethroid Pesticides

In January 2007 the California Department of Pesticide Regulation published "FREQUENTLY ASKED QUESTIONS ABOUT **Reevaluation of Certain Pesticide Products Containing Pyrethroids, California Notice 2006-13."** According to that writeup,

"The Department of Pesticide Regulation (DPR) placed certain pesticide products containing pyrethroids into reevaluation on August 31, 2006. The reevaluation is based on monitoring surveys and toxicity studies revealing the widespread presence of pyrethroid residues in the sediment of both agricultural and urban dominated California waterways at levels toxic to Hyalella azteca (H. azteca). Scientists conducted sediment bioassays using H. azteca, a resident species found in some Central Valley water bodies. Scientists commonly use H. azteca, an aquatic crustacean, as an indicator of environmental health and water quality in streams, lakes, and other bodies of water. Significant toxicity was observed at numerous sites. There was a high correlation between concentrations of pyrethroids and observed toxicity. Findings further indicate that the unique physical, chemical, and toxicological properties of the pyrethroid class of chemicals contribute to their propensity to accumulate in sediment at toxic levels."

For further information on the DPR's reevaluation of pyrethroid pesticides with respect to causing aquatic life toxicity go to,
http://www.up3project.org/documents/pyrethroid_faq.pdf.

Monitoring of Agricultural Runoff-Associated Aquatic Life Toxicity

The California Porter Cologne Water Quality Control Act, California Water Code Division 7 - Water Quality
(http://www.swrcb.ca.gov/water_laws/docs/portercologne.pdf) requires that all sources of pollutants that impair the designated beneficial uses of waterbodies (i.e., cause violations of water quality objectives/standards) be controlled. That requirement is also applicable to stormwater runoff and irrigation tailwater discharges from irrigated agriculture. For many years the California Regional Water Quality Control Boards have had the authority

to issue waste discharge requirements (WDRs) to irrigated agricultural interests that would require that all stormwater runoff and tailwater discharges not cause violation of the Board's Basin Plan requirements, including the water quality standards/objectives.

Until a few years ago, the Regional Boards issued waivers from WDRs ("ag waivers") to irrigated agriculture. This meant that the pollutants in agricultural runoff/discharges were unmonitored and unregulated. However, it was found that some major waterbodies such as the San Joaquin River (SJR) had several Clean Water Act Section 303(d) water quality standards violations. As discussed in Newsletter 10-1, the SJR has about a dozen TMDLs; about eight of those are due to agricultural runoff/discharges. This situation caused the state legislature to require that the Regional Boards implement agricultural runoff water quality control programs to control pollution of the state's waters by discharges from irrigated agriculture.

Initially, the Regional Boards adopted an approach of requiring that agricultural interests conduct limited-scope water quality monitoring programs to characterize, to a limited extent, the violations of the WQOs in waterbodies that receive substantial amounts of agricultural runoff/discharges. Agricultural interests formed area-based coalitions to fund monitoring of certain agricultural runoff-dominated waterbodies, including ag drains, in their areas. The initial primary focus of the water quality monitoring program was aquatic life toxicity; a few grab samples of a downstream stream in a predominantly agricultural watershed were collected. If toxicity was found there, the coalition conducted additional studies to try to determine its cause and source. If a particular source of pesticides or other pollutants was found to be causing a WQO violation, such as aquatic life toxicity, then the agricultural interests were required to implement a management program to eliminate the WQO violation.

It was recognized that this initial water quality monitoring was significantly deficient compared with that need to meet Porter Cologne Act requirements for pollutant control. However, the Boards' initial "go-slow" approach to developing a comprehensive ag waiver water quality monitoring program was established in order to reduce the agricultural interests' financial burden associated with water quality monitoring.

Beginning in 2002, Lee and Lee & Jones-Lee have been providing comments on the water quality monitoring program (Monitoring Reporting Program - MRP) that the CVRWQCB should require in order to adequately define the water quality impacts of agricultural runoff/discharges. In March of this year, the CVRWQCB issued a proposed revised MRP to implement the ag waiver water quality monitoring program. While the proposed revised MRP was changed somewhat from the current MRP, it still contains many of the significant deficiencies that Lee and Lee & Jones-Lee had discussed in previous comments.

The proposed revised MRP includes a detailed listing of the objectives of the monitoring program that is to be accomplished by the MRP. A critical review of the monitoring program objectives compared to the data that will be generated by the proposed revised MRP shows that this proposed program will not generate the data needed to accomplish

the monitoring program objectives in the foreseeable future. Lee and Jones-Lee (2007a) "Comments on 'Working Draft - Draft Monitoring and Reporting Program -Order No. R5-2007-__for Coalition Groups under Amended Order No. R5-2006-0053 Coalition Group Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands"
[http://www.members.aol.com/LFandWQ/CommentsWorkingDraftMRP.pdf]
provide a detailed discussion of key deficiencies in the proposed MRP and suggests changes that will be needed to achieve the stated objectives of the MRP.

The recommended MRP approach described by Lee and Jones-Lee (2007a) was based on the Lee and Jones-Lee (2002) report that was developed for the CVRWQCB for developing non-point-source pollution evaluation/control programs. The key issue of concern is the proposed revised MRP's continued requirement of only a single grab sample collected once a month at a downstream monitoring station for an ag drain or other waterbody that receives considerable amounts of agricultural runoff/discharges. Lee and Jones-Lee (2007a) have characterized the proposed revised MRP as a "**hit or miss**" program. This is because it could readily fail to detect significant aquatic life toxicity upstream of the monitoring location (near the point of ag discharge to the state's waters) that is not manifested at the downstream monitoring location. This upstream pesticide-caused aquatic life toxicity near the point of discharge could readily be significantly adverse to aquatic life resources in a waterbody. Lee and Jones-Lee concluded that this MRP will need to be significantly changed to achieve the MRP's stated objectives.

Lee and Jones-Lee (2007a) recommended that the downstream watershed monitoring program set forth in the revised MRP be expanded, and most importantly include a highly **focused edge-of-the-field and nearby waterbody monitoring** component. The edge-of-the field monitoring should be conducted by the coalitions at locations that represent the range of conditions that are likely to impact the runoff/discharge of pollutants (e.g., pesticides, nutrients, TOC, suspended solids) in the coalition's area of responsibility. Such a focused edge-of-the-field monitoring approach is essential to the reliable detection of the range of potential impacts of pesticide runoff/discharges. The edge-of-the-field monitoring will also be needed to provide background data to evaluate the efficacy of management practices that will need to be evaluated to control the runoff/discharge from an irrigated land. Adoption of edge-of-the-field monitoring will likely be ultimately less expensive to agricultural interests than the hit-or-miss program since it will focus the monitoring on the most likely locations for adverse water quality impacts of agricultural runoff/discharges.

As discussed by Lee and Jones-Lee (2007a) the CVRWQCB needs to significantly change the MRP or change the objectives of the MRP to eliminate the current expectation that this MRP will achieve the stated objectives with respect to adequately monitoring pesticide-caused aquatic life toxicity and other adverse impacts of agricultural runoff/discharges.

Groundwater Quality Protection.
Lee and Jones-Lee (2007a) discussed the need to expand the MRP monitoring program to include evaluation of groundwater pollution by irrigated agriculture. There is widespread pollution of groundwaters in some areas of California by some pesticides used by agriculture. Lee and Jones-Lee (2007b) discussed the California Department of Pesticide Regulation's approach for screening new pesticides for their potential to cause groundwater pollution. This is a significant step toward the reduction of new pesticide-caused groundwater pollution in the state.

Lee and Jones-Lee (2007b) also discussed that irrigated agriculture cannot be conducted without at least some groundwater pollution by salts and nitrate. While it is not possible to completely stop groundwater pollution associated with irrigated agriculture, by monitoring the pollution that is occurring by current agricultural practices it will be possible to learn how to minimize groundwater pollution from this source.

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