G. Fred Lee & Associates

27298 E. El Macero Dr.
El Macero, California 95618-1005
Tel. (530) 753-9630 $ Fax (530) 753-9956
e-mail: gfredlee@aol.com
web site: http://www.gfredlee.com

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US EPA Office of Pesticide Programs
Washington DC

Gentlemen,

I wish to submit comments that are pertinent to the US EPA Office of Pesticide Programs (OPP) current reregistration review for the organophosphate pesticide, chlorpyrifos.

Background

I have been involved and provided technical leadership for one of the most comprehensive studies that has been conducted on aquatic life toxicity in urban area/agricultural area stormwater runoff. This study has taken place over the past 3.5 years in the Upper Newport Bay, Orange County, CA watershed. Over 140 toxicity tests using *Ceriodaphnia dubia* and/or *Mysidopsis bahia* have been conducted. Standard US EPA aquatic life toxicity tests have been used. All stormwater runoff to Upper Newport Bay has been found to be toxic to these test organisms. Through the use of ELISA and US EPA GC procedures, it has been found that chlorpyrifos is one of the constituents in the stormwater runoff responsible for this toxicity.

Attached in Adobe pdf format is part of a report "Results of Aquatic Life Toxicity Studies Conducted During 1997-99 in the Upper Newport Bay Watershed and Review of Existing Water Quality Characteristics of Upper Newport Bay, Orange County CA and its Watershed." The overall report is approximately 500 pages including appendices. It was completed in October, 1999. It has been through technical review and is currently under general public review as part of an Orange County Public Facilities and Resources Department watershed based program governing Upper Newport Bay water quality management. The public review period closes in February, 2000.

The attached part of the overall report contains the results and discussion for the aquatic life toxicity part of this US EPA sponsored 205(j) project. This part of the overall report represents about 200 pages of the 500 page report. Omitted from the attached report are the appendices which include background information on sample collection, hydrology of the stormwater runoff events sampled, a report by Dr. Jeff Miller of AQUA-Science, Davis, CA, "Summary of Toxicity Identification Evaluation to Identify the Cause of Toxicity of San Diego Creek Waters to *Ceriodaphnia dubia*," an overview review of evaluation monitoring, a tabulation of the amounts of pesticides used during 1995, 96, and 97 by commercial applicators in Orange County, CA, aquatic life toxicity information provided by the US EPA OPP ecological toxicity database for the pesticides

found in Orange County stormwater runoff during this study, a report, ALTI Report Newport Bay Stratification@ and a review of the water quality characteristics of Upper Newport Bay and its tributaries. A copy of any of these appendices is available upon request.

Overall Findings

From an overall perspective, chlorpyrifos which is extensively used in Orange County, CA for structural pest control on residential properties is a significant contributor to *Ceriodaphnia* and *Mysidopsis* aquatic life toxicity. Typically the concentrations found in stormwater runoff kill all test organisms in 24 hours. Over 70,000 pounds of chlorpyrifos were used in Orange County, CA during 1997 by commercial applicators, an additional estimated equal amount was used by the public during that year. Approximately 95% of all use was for residential structural lawn and garden purposes. Some use was by agricultural activities and commercial nurseries.

Diazinon was also found to be a significant contributor to aquatic life toxicity in Upper Newport Bay watershed stormwater runoff. Its toxicity was found to be additive with that of chlorpyrifos. Typically, the total toxicity found in the stormwater runoff samples was between 10 to 20 TUa with about half of it due to diazinon and chlorpyrifos. The other half of the toxicity in the stormwater runoff is due to unknown causes. It was not possible through comprehensive toxicity identification evaluations (TIEs) to identify the cause of the unknown caused toxicity. From the information available it appears that the cause of the unknown caused toxicity is not heavy metals or other OP or carbamate pesticides that are normally measured in US EPA standard GC scans (US EPA 8321A and EPA 8141). Further work is being done under a US EPA 319(h) project to determine the specific uses of chlorpyrifos, diazinon and sources of unknown caused toxicity within the Upper Newport Bay watershed.

Water Quality Significance

The water quality significance of the *Ceriodaphnia* and *Mysidopsis* aquatic life toxicity found in Upper Newport Bay stormwater runoff is discussed in detail in the attached report. It is also discussed in a paper AEvaluation of the Water Quality Significance of OP Pesticide Toxicity in Tributaries of Upper Newport Bay, Orange County, CA,@ that was presented at Ninth Symposium on Environmental Toxicology and Risk Assessment: Recent Achievements in Environmental Fate and Transport, ASTM STP 1381 (1999) in press. A preprint of this paper is being submitted electronically as a supplement to these comments.

As discussed in the attached report and the paper, the water quality/ecological significance of the OP pesticide including chlorpyrifos caused aquatic life toxicity is unknown. While there is appreciable acute lethal toxicity to *Ceriodaphnia* and *Mysidopsis*, the impact of this toxicity on the beneficial uses of the tributaries of Upper Newport Bay as well as the bay-s, aquatic life is uncertain. The limited period of time of aquatic life exposure to toxic conditions during a runoff event within Upper Newport Bay tributaries coupled with the limited number of types of organisms that are apparently impacted by this toxicity raises significant questions about whether the laboratory based toxicity test results reliably assess water quality/ecological impacts of this toxicity to aquatic life in

Upper Newport Bay tributaries. This toxicity appears to be restricted to certain zooplankton and possibly certain amphipods. No toxicity was found to fish larvae or algae.

A comprehensive field study of the fate and potential impacts of Mysidopsis toxicity in Upper Newport Bay was conducted in January, 1999. This study showed that there was a thin fresh water sea water lens which was toxic to Mysidopsis for a day or so in the upper part of Upper Newport Bay. Modeling of the mixing of the fresh water stormwater runoff to the Bay with the marine bay waters showed that certain runoff events could lead to toxic conditions in the fresh water sea water lens in the upper bay that could last for several days.

It is concluded that if there are marine zooplankton that migrate from the marine waters of the bay into the fresh water sea water lens associated with a runoff event, that part of the bay has sufficient toxicity to *Mysidopsis* to be adverse to the marine organisms with a similar sensitivity to chlorpyrifos that stay within the lens for one to two days. However, for this situation to be significant to the beneficial uses of Upper Newport Bay, it is necessary that the marine zooplankton that are killed represent an essential non-replaceable food source for bay aquatic life that are of importance to the public.

Relationship of Results to Other Studies

The author is familiar with other OP pesticide (diazinon and chlorpyrifos) caused aquatic life toxicity in urban stormwater runoff. The situation found in the Upper Newport Bay watershed are similar to those being found in other areas with the exception that the level of aquatic life toxicity to *Ceriodaphnia* in other areas such as San Francisco Bay, San Diego, Los Angeles, Sacramento, and Stockton, CA, are less than those found in the Upper Newport Bay watershed. Further, it appears that in the other areas, chlorpyrifos plays a lesser role in causing aquatic life toxicity than diazinon. Also, the other areas where studies have been conducted do not have the large amount of unknown caused toxicity that is found in the Upper Newport Bay watershed. The same issues of the water quality significance of the chlorpyrifos caused toxicity in urban stormwater runoff in the San Francisco Bay area, San Diego, Los Angeles, Sacramento and Stockton, as discussed in the attached report and paper apply to these other areas as well.

The urban stormwater runoff results being found in California are similar to those recently reported by the USGS in other parts of the country. Larson et al. APesticides in Streams of the United States B Initial Results from the National Water-Quality Assessment Program,@ US Geological Survey, Water-Resources Investigations Report 98-4222, Sacramento, CA (1999) found chlorpyrifos at sufficient concentrations in urban streams and several areas of the US to be potentially toxic to *Ceriodaphnia*. It is therefore concluded that urban stormwater runoff aquatic life toxicity due to OP pesticides, chlorpyrifos and diazinon is a national problem that occurs in several areas of the US.

Importance of Appropriate Regulatory Action

At this time several waterbodies in California are on the US EPA 303(d) list of Aimpaired@ waterbodies due to chlorpyrifos and diazinon as a cause of aquatic life toxicity. Regulatory agencies and other stakeholders are in the process of developing TMDLs to control this aquatic life toxicity

in the 303(d) listed waterbodies. There are however significant questions about appropriate goals for the TMDL program in light of Clean Water Act and US OPP regulatory requirements. These issues are discussed in the attached report and paper.

An important aspect of the OP pesticide caused aquatic life toxicity regulatory situation that should be understood is that exceeding the US EPA chlorpyrifos water quality criteria published in 1986 in urban stormwater runoff should not be interpreted to mean that this exceedance represents a significant impairment of the beneficial uses of the waterbody in which the exceedance occurs. The approach used by the US EPA in developing its worst case based water quality criteria tends to significantly overestimate the water quality impairment associated with stormwater runoff associated constituents. It is possible that concentrations well above the chlorpyrifos criterion and those that are found in urban stormwater runoff can occur without being significantly adverse to the beneficial uses of ambient waters.

There is an urgent need for the US EPA OPP and Office of Water to develop methodology that can be used to determine the water quality/ecological significance of the chlorpyrifos, diazinon and other causes of aquatic life toxicity associated with urban and agricultural stormwater runoff and irrigation return flows. The Giesy et al. AChlorpyrifos: Ecological Risk Assessment in North America Aquatic Environments,@ Rev Environ Contam Toxicol 160: 1-129 (1999) is a start to assessing the water quality/ecological significance of chlorpyrifos caused aquatic life toxicity. However, as discussed by Lee and Jones-Lee AThe Single Chemical Probabilistic Risk Assessment Approach Is Inadequate for OP Pesticide Aquatic Life Toxicity,@ Learned Discourses, SETAC News19(6):20-21 November (1999), the single chemical species approach coupled with the limited data base available requires that a much more comprehensive data set coupled with highly directed studies to assess altered aquatic organism assemblages that are associated with chlorpyrifos caused toxicity need to be undertaken to determine that this toxicity is significant to aquatic life related beneficial uses of waterbodies. Of particular significance is the need for fate/persistence and toxicity information associated with urban stormwater runoff.

Further, there is need to better understand the water quality/ecological role of OP pesticide sensitive zooplankton in impacting a waterbodies beneficial uses. It is inappropriate to assume as is being done (SETAC, AAquatic Risk Assessment and Mitigation Dialogue Workgroup, Final Report@ SETAC Foundation for Environmental Education, Inc., Pensacola, FL. 1994) that 10% of the species can be killed 10% of the time without adverse impacts on ecosystems and water quality - beneficial uses without having a better understanding of the ecological role of the killed species in the waterbodies of concern.

The author has recently presented a paper, AOrganophosphate Pesticides as Pollutants of Urban Lakes and Streams@ at the North American Lake Management Association national meeting held in Reno, NV, December, 1999, which summarizes the issues associated with regulating OP pesticide caused aquatic life toxicity. A copy of the extended outline of the slides used in this presentation is being submitted as a supplement to these comments. This material summarizes the

key issues that need to be addressed in appropriately regulating OP pesticide caused aquatic life toxicity in urban stormwater runoff.

The author has published extensively on OP pesticide aquatic life toxicity issues. His papers and reports are available from his website, www.gfredlee.com. Also available on the website is information on his academic background, professional experience and expertise. Additional information is available upon request.

If there are questions about these comments or the materials that are being submitted as attachments, please contact me.

Sincerely yours,

G. Fred Lee

G. Fred Lee, PhD, PE, DEE

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Attachment