Stormwater Runoff Water Quality Newsletter
Devoted to Urban/Rural Stormwater Runoff
Water Quality Management Issues
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Volume 13, Number 2 Editor: Anne Jones-Lee, PhD
March 10, 2010 Contributor to This Issue:
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This issue of the Newsletter focuses on urban pesticide-caused aquatic life toxicity. Descriptive information is provided about the upcoming ACS national meeting devoted to these issues. An abstract for, and selected slides from, a review of OP and pyrethroid pesticide-caused aquatic life toxicity in Upper Newport Bay, Orange County, CA, discussion of a pro-active approach for post-pesticide-registration screening of the occurrence of aquatic life toxicity associated with urban pesticide use, and evaluation of the water quality significance of any toxicity found. Information is provided on several Urban Pesticide Committee presentations that discuss current regulatory activities for controlling aquatic life toxicity associated with pesticides in urban runoff. An announcement is included of a San Francisco Bay Conservation and Development Commission–USGS conference on San Francisco Bay sediment issues.

American Chemical Society Meeting Devoted to Urban Pesticide Water Quality Issues
As part of the American Chemical Society National Meeting in San Francisco, CA on March, 21-25, 2010, the Agrochemical Division of ACS will hold a Specialty Conference devoted to **Pesticides and Urban Water Quality: Monitoring, Modeling and Mitigation:** Tuesday March 23 – Wednesday March 24. The agenda as presented in the UPC announcement is as follows,

TUESDAY AFTERNOON
The Moscone Center — Room 3003 West Bldg **1:30 –**

Introductory Remarks

1:35 – 205. Urban runoff as a source of pyrethroid pesticides and their effects on surface water bodies. **D. P. Weston**, M. J. Lydy
1:55 – 206. Urban pesticide monitoring in northern and southern California: A regional look at urban pesticides in surface waters. **M. Ensminger**, K. Kelley, F. Spurlock, K. Goh, L.-M. L. He
2:15 – 207. Pesticide pollution in runoff from northern and southern California neighborhoods. **L. Oki**, D. Haver, S. Bondarenko, J. Gan
2:35 – 208. Fipronil and metabolites in runoff from residential homes. **J. Gan**, S. Bondarenko, K. Lin, L. Oki, D. Haver
2:55 – Intermission
3:15 – 209. Distribution and toxicity of pesticides and other contaminants in stream sediments in relation to urbanization. **L. H. Nowell**, P. W. Moran, N. E. Kemble, C. G. Ingersoll, K. M. Kuivila
3:35 – 210. Pesticide toxicity in urban creeks of Sacramento, California. **I. Werner**, L. Deanovic, L. Oki
3:55 – 211. Potential influence of physical habitat, pyrethroids, and metals on benthic communities in a residential California stream. **L. Hall, Jr**, W. Killen, R. Anderson, R. Alden III

4:15 – 212. Sediment associated contaminants in urban streams: Pyrethroids and other current use pesticides. **M. L. Hladik**, K. M. Kuivila

Tuesday Poster Session - 9:30 AM – 4:00 PM *Authors Present*

9:45 – 10:45 AM and 2:45 – 3:45 PM *The Moscone Center –*

Room 3011 West Bldg

196. Sorption of naphthalene and 1-napthol to turfgrass thatch as influenced by thatch chemical properties. R. M. Leshin, **M. J. Carroll**

197. Survey of replacement pesticides in Ventura County watersheds. **L. I. Delgado-Moreno**, K. Lin, F. Ernst, W. Smith, R. Veiga Nascimento, J. Gan

198. Pyrethroid pesticide analysis in wastewater effluent by NCI GCMS SIM. **P. W. Halpin**, R. L. Heines

WEDNESDAY MORNING

The Moscone Center — Room 3003 West Bldg

9:00 – 236. Approaches to assessing the risk to aquatic organisms from pyrethroids in the urban landscapes of California. **M. Dobbs**, J. Giddings, K. Henry, P. Hendley

9:20 – 237. Potential impacts of pyrethroid pesticides on the marine environment. **B. M. Phillips**, B. S. Anderson, J. W. Hunt, J. P. Voorhees, K. Siegler, R. S. Tjeerdema

9:40 – 238. Effect of sediment organic content and quality on the toxicity of the pyrethroid insecticide cypermethrin. **J. Giddings**, M. Dobbs, K. Henry, G. Mitchell, J. Schupner, D. Tessier, C. Picard

10:00 – 239. Comparison of targeted sediment sampling methods for pyrethroids in urban/residential sediments of a California stream. **L. Hall, Jr**, W. Killen, R. Anderson

10:20 – Intermission

10:35 – 240. Analytical challenges of assessing pyrethroid concentrations in aquatic environments. **D. M. Tessier**

10:55 – 241. Washoff of formulated pyrethroid insecticides from concrete surfaces. **T. M. Young**, B. Jorgenson

11:15 – 242. Offsite transport potential of urban-use insecticides from concrete surfaces. **W. Jiang**, J. Gan, D. Haver, F. Spurlock

11:35 – 243. Comparison of pyrethroid insecticide wash-off from urban surfaces. **B. C. Jorgenson**, T. M. Young

WEDNESDAY AFTERNOON

The Moscone Center – Room 3003 West Bldg

1:30 – 292. Conceptual model for transport of pesticides used in urban areas into surface waters. **K. D. Moran**

1:50 – 293. Transport of insecticides to urban streams in California: A refined conceptual model and problem formulation. **P. Hendley**, J. Giddings, R. Jones, M. Dobbs

2:10 – 294. Advances in modeling urban/residential pesticide runoff. **W. M. Williams**, A. M. Ritter, J. M. Cheplick

2:30 – 295. Urban pesticide use support system. **G. Hoogeweg**, W. M. Williams, A. M. Ritter

2:50 – Intermission

3:05 – 296. Use of a storm water management model for diagnosis of residential exposure issues. **S. H. Jackson**, D. Haver, L. Oki

3:25 – 297. Modeling the effects of landscape best management practices on water quality in urban residential areas. **A. D. Manfree**, A. E. Bale, S. E. Greco, L. Oki, D. L. Haver, J. Gan, S. Bondarenko
3:45 – 298. Pesticide detections in washoff from residential hardscapes generated at defined intervals. **D. L. Haver**, T. J. Majcherek, S. Bondarenko, J. Gan
4:05 – 299. Outreach and training for professional and non-professional pesticide applicators for urban pesticide runoff mitigation. **C. Wilen**, D. Haver, J. Gan, J. Strand, M. L. Flint, M. Rust

Information on this ACS meeting is available at,
http://portal.acs.org/portal/acs/corg/content?_nfpb=true&_pageLabel=PP_TRANSITIONMAIN&node_id=2060&use_sec=false&sec_url_var=region1&__uuid=7511c0b2-2937-4346-a31e-90cb4d960e55

Review of OP and Pyrethroid Pesticide-Caused Aquatic Life Toxicity
On March 9, 2010, Dr. G. Fred Lee presented a seminar at the California Department of Pesticide Regulation devoted to **OP & Pyrethroid Pesticide-Caused Aquatic Life Toxicity: Inadequate Regulation of Urban Use**. Presented below is an abstract of that presentation.

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Abstract
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 G. Fred Lee 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, Lee et al. 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.

Over 375 aquatic life toxicity tests were conducted over the three study period. The laboratory acute toxicity to *Ceriodaphnia dubia* 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. CDFA 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 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, Lee predicted that pyrethroid-based pesticides would cause aquatic life toxicity in the water column of receiving waters for urban stormwater runoff. He 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 Lee and Jones-Lee 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 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

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

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

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

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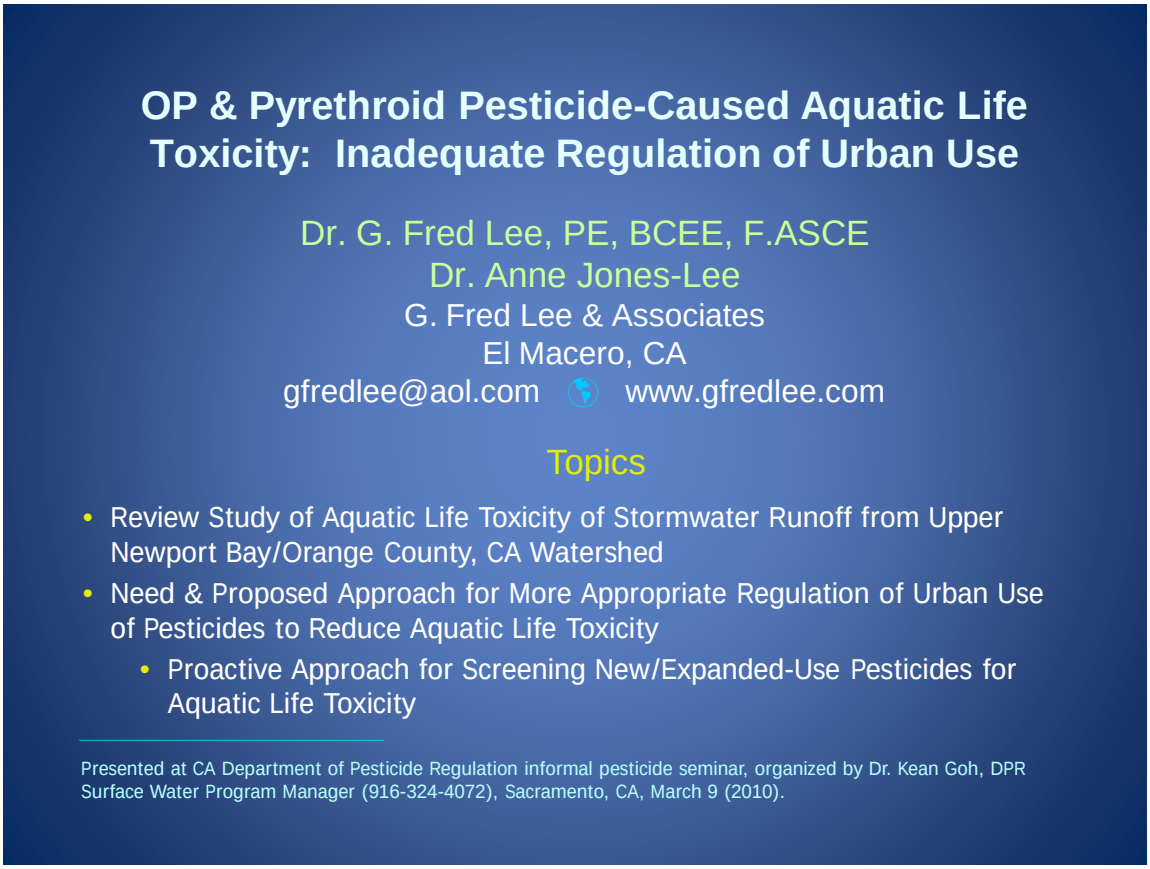
Dr. Lee's work on the occurrence, transport, fate, and water quality impacts of pesticide began in the 1960s while he was Professor of Water Chemistry at the University of Wisconsin, Madison. Many of his more recent papers and reports are available on Dr. Anne Jones-Lee's and his website [www.gfredlee.com] in the "Surface Water Quality" section, "Pesticides Toxicity"

subsection at http://www.gfredlee.com/pswqual2.htm#pesticide. In addition, much of his work on urban pesticides water quality impacts is summarized in previous issues of the Stormwater Runoff Water Quality Newsletter (including 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 addressed 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 13th 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.) Questions on our work on aquatic life toxicity due to pesticides associated with urban stormwater runoff should be directed to gfredlee@aol.com.

Several key PowerPoint slides from Dr. Lee's presentation are provided below. The entire set of 34 slides is available at www.gfredlee.com/SurfaceWQ/DPR_WS_PestToxicityPPt.pdf



Organization of Study

- ~ $0.5-million, 3-yr Study of Aquatic Life Toxicity in Streams That Receive Urban & Ag Stormwater Runoff in Upper Newport Bay Watershed (Orange Co., CA), 375 toxicity tests over 3 years
- Key Professionals Involved in Study:
  - Scott Taylor, RBF, Inc, Irvine, CA
  - Dr. G. Fred Lee, G. Fred Lee & Associates, El Macero, CA
  - Dr. Jeff Miller, AquaScience, Davis, CA
  - Linda Deanovic, University of California, Davis Aquatic Toxicology Laboratory
  - Dr. Scott Ogle Pacific Eco-Risk Fairfield, CA
- Conducted in Cooperation with
  - Santa Ana Regional Water Quality Control Board
  - Orange County Public Facilities & Resources Department (Orange County Stormwater Management Agency)
- Supported by US EPA Region IX Funds

Sources of Pesticides in Watershed

- Usage of Pyrethroid-Based Pesticides in Orange Co., CA during Late 1990s (according to CA DPR Use Reports)
  - ~ 25,000 lbs (ai)/yr
- Nurseries in Upper Newport Bay Watershed
  - At Times, Responsible for up to 50 TUa Diazinon Toxicity in Streams Just Downstream from Nurseries

CDFA Used a Pyrethroid-Based Pesticide to Address Fire Ant Infestation

- That Use Was Not Included in DPR Pesticide Use Report

Summary of Key Results

- *Ceriodaphnia dubia* &*Mysidopsis bahia* Toxicity Tests on Stormwater Runoff to Tributaries of Upper Newport Bay
  - Standard US EPA Procedures - 375 Toxicity Tests
  - Result: 1 – 10 TUa
- Dual Column GC & ELISA Analysis & TIEs
  - Result: About Half Toxicity Due to
    - OP Pesticides
      - Diazinon and Chlorpyrifos
- TIEs Involving Serial Dilutions & PBO Additions
  - Result: Substantial Part of Remaining Toxicity Potentially Attributable to Pyrethroid-Type Pesticides
- TIEs Showed That Heavy Metals in Runoff Not Toxic
  - Despite Exceeding Criteria Concentrations

Illustration of Need for Different Regulatory Approach

- Early 2000s Pyrethroid-Based Pesticides Appeared in Urban Pesticides as Replacement for OP Pesticides
  - Available to Public for Urban Residential Use
  - Predicted Watercolumn Aquatic Life Toxicity in Receiving Waters for Urban Stormwater Runoff

    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
- Continued to Advocate for Monitoring of Urban Stormwater Runoff & Receiving Waters for Pyrethroid Toxicity
- Summer 2009, Dr. D. Weston (UC Berkeley) Presented Results of His Studies
  - Showed Pyrethroid-Based Pesticides Used in Urban Areas Causing Toxicity to Aquatic Life in Watercolumn of Waters Receiving Urban Stormwater Runoff

Need Pro-active Approach

- US EPA OPP & CA DPR Registration of Pesticides Significantly Deficient in Evaluating Potential for Registered Uses to Result in Aquatic Life Toxicity
  - Allow Toxicity in Stormwater Runoff & Irrigation Water Releases
    - Do Not Require Fate/Transport Information or Aquatic Life Impact Information for Stormwater Runoff & Irrigation Water Releases
      - Information Essential for Evaluating Potential Aquatic Life Impacts of All Pesticides That Could Be Mobilized by
        - Rainfall Runoff
        - Fugitive Irrigation Water
        - Irrigation Tailwater (Runoff/Release Waters)

Key Issue

- Is It Possible to Develop a Pesticide That
  - Is Effective against Target Pest
  - Is Cost-Effective
  - Will Not Also Kill Some Zooplankton?
- Insects Are Physiologically Similar to Some Zooplankton & Benthic Invertebrates

Urban Pesticide Committee

The agenda for the January 19, 2010 Urban Pesticide Committee meeting included the following,

10:15 Brief look at bifenthrin Kelly Moran, TDC Environmental

Agency Updates

10:40 State Water Board
303d list status Syed Ali
Aquatic pesticide permit Trinh Pham
Central Valley Water Board Jamie Lu
Basin plan amendment & TMDL
11:00 DPR Nan Singhasemanon
Surface water protection regulation
Pyrethroids reevaluation
Urban pesticide monitoring update
Management Agencies Agreement meeting
11:25 U.S. EPA Patti TenBrook
Public process for new chemicals
Spray drift labeling
Inert ingredients
Harmonization
Registration review (first pyrethroids)
11:50 CASQA Jamison Crosby
12:00 Tri-TAC Preeti Ghuman
12:15 PCOC Update Darren Van Steenwyk/Billy Gaither
12:30 EcoWise Update Ted Shapas
12:45 Science Update Kelly Moran

Presentations on several of these agenda topics,

- **January 19, 2010 UPC Meeting summary**
- **January 19, 2010 UPC Meeting agenda**
  - **Presentation: A Brief Look at Bifenthrin** (Kelly Moran)
  - **EPA Update 1-19-10** (Patti TenBrook)
  - **Presentation: Adulticides Permit Processing in California** (Phil Isorena)
  - Regulatory tracking tables: **State** and **Federal**, by Kelly Moran

are available at http://www.up3project.org/up3_upc.shtml. Many of these presentations provide updated information on the approaches that are being used to work toward controlling the aquatic life toxicity caused by urban use of pesticides. The next meeting of the UPC will be held on March 16, 2010 in Oakland, California. The meeting is open to anyone interested and can be attended by conference call Call-in Number**:** (916) 227-1132 (no passcode. Information on UPC meetings is available at, http://www.up3project.org/up3_upc.shtml.

San Francisco Bay Sediment Workshop

Attached is an announcement for the BCDC/USGS San Francisco Bay Sediment Science Workshop to be held on April 19-20, 2010.

San Francisco Bay Conservation and Development Commission

USGS science for a changing world

San Francisco Bay Sediment Science Workshop: April 19-20, 2010
U.S. Geological Survey Science Center Menlo Park, California

According to the announcement, "*the workshop will include talks by leading Bay Area experts presenting their research on sediment transport and processes, as well as biota and habitat implications. The goals are to present current research, discuss potential research needs and identify key data gaps. The agenda will be sent out shortly and will be available on BCDC's*

website: www.bcdc.ca.gov under special programs: dredging and sediment management. RSVP to Reggie Abad at reggiea@bcdc.ca.gov. Contact Brenda Goeden (brendag@bcdc.ca.gov, 415.352.3623) or Carolynn Box (cbox@bcdc.ca.gov, 415.352.3624) for more information."