

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

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This issue of the Newsletter provides updated information on the regulation of the organophosphorus (OP) pesticides, diazinon and chlorpyrifos, in the Central Valley of California. While this information specifically addresses the happenings in the Central Valley of California, it has applicability nation-wide since, as discussed in previous Newsletters cited below, these pesticides are present in waters across the US.

At its February 19, 2008 meeting, the California State Water Resources Control Board (SWRCB) approved the Central Valley Regional Water Quality Control Board's (CVRWQCB) May 3, 2007 Basin Plan amendment for the control of diazinon and chlorpyrifos in runoff to the Sacramento and Feather Rivers. The CVRWQCB has been active in developing information on the aquatic life toxicity caused by diazinon and chlorpyrifos since the early 1990s with the pioneering work of Dr. C. Foe and Dr. V. Connor. Past Newsletters [1-1, 2-1, 3-5, 3-6, 6-3, 7-6/7, 8-1/2, 8-6, 9-4, 10-3, and 10-8 available at <http://www.gfredlee.com/newsindex.htm>] provide information on issues of aquatic life toxicity caused by those pesticides.

The SWRCB resolution described the concern regarding diazinon and chlorpyrifos, stating:

“Diazinon and chlorpyrifos are man-made pesticides used to exterminate destructive pests and insects in urban and agricultural settings. A fraction of urban and agricultural diazinon and chlorpyrifos applications can reach surface water during rainfall or irrigation events and enter the Sacramento or Feather Rivers or their tributaries. Monitoring since the early 1990s by state and federal agencies and other groups has confirmed the presence of diazinon and chlorpyrifos at levels of concern in the Sacramento and Feather Rivers. Diazinon and chlorpyrifos can be acutely toxic to aquatic life, wildlife, and humans. Aquatic invertebrates are the aquatic organisms most sensitive to diazinon and chlorpyrifos exposure. The Sacramento and Feather Rivers are currently listed on the Clean Water Act section 303(d) list for aquatic toxicity due to diazinon and chlorpyrifos. In the near future, agriculture will be the dominant source, since the United States Environmental Protection Agency (USEPA) has banned the sale of all non-agricultural uses of diazinon and most non-agricultural uses of chlorpyrifos.”

The complete resolution is available at:

http://www.waterboards.ca.gov/tmdl/docs/runoff_calif_feather_rivers/agenda_draft.pdf

Additional information on the toxicity and impacts of diazinon and chlorpyrifos is available from Mitchell Goode [(916) 341-5726 (MGoode@waterboards.ca.gov)] of the SWRCB staff, and P. Hann [phann@waterboards.ca.gov] and D. McClure [dmccclure@waterboards.ca.gov] of the CVRWQCB staff.

The set of PowerPoint slides used by M. Goode in his February 19, 2008 presentation of the proposed Basin Plan amendments to the SWRCB are available at, Goode, M., Discussion of Proposed Amendment to the Basin Plan Amendment for the Control of Diazinon and Chlorpyrifos Runoff into the Sacramento and Feather Rivers, PowerPoint slides presented to California Water Resources Control Board, Sacramento, CA, February 19 (2008). <http://www.members.aol.com/GFLEnviroQual/GoodeDiazinonChlorp.pdf>

Comments on several of Goode's slides (appended to this Newsletter) are presented below.

The slide entitled, "**Properties & Additivity**," mentions the consideration of additivity of the OP pesticides when assessing the total potential toxicity of these types of pesticides. According to CVRWQCB Resolution R5-2007-0034,

"the Waste Load Allocations (WLA) for all NPDES-permitted dischargers, Load Allocations (LA) for nonpoint source discharges, and the Loading Capacity of the Sacramento and Feather Rivers shall not exceed the sum (S) of one (1) as defined below.

$$S = (C_D/WQO_D) + (C_C/WQO_C) \leq 1.0$$

where

C_D = diazinon concentration in $\mu\text{g/L}$ of point source discharge for the WLA; nonpoint source discharge for the LA; or the Sacramento or Feather Rivers for the LC (load capacity).

C_C = chlorpyrifos concentration in $\mu\text{g/L}$ of point source discharge for the WLA; nonpoint source discharge for the LA; or the Sacramento or Feather Rivers for the LC.

WQO_D = acute or chronic diazinon water quality objective in $\mu\text{g/L}$.

WQO_C = acute or chronic chlorpyrifos water quality objective in $\mu\text{g/L}$.

Available samples collected within the applicable averaging period for the water quality objective will be used to determine compliance with the allocations and loading capacity. Prior to performing any averaging calculations, only chlorpyrifos and diazinon results from the same sample will be used in calculating the sum (S). For purposes of calculating the sum (S) above, analytical results that are reported as 'nondetectable' concentrations are considered to be zero."

The slide entitled, "**Water Quality Objectives**," presents updated information on the water quality criteria that should be used to determine if the concentrations of diazinon and chlorpyrifos, individually as well as together through additivity, meet the criteria/objectives. These objectives were developed based on the approach used by the US EPA to develop water quality criteria.

The slides entitled, "**Implementation**" and "**Monitoring**" indicate that the compliance with the water quality objectives, individually and summed, is to be achieved through the "Order No. R5-2008-0005 for Coalition Groups under Amended Order No. R5-2006-0053 Coalition Group Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands" "Ag Waiver" available at http://www.swrcb.ca.gov/rwqcb5/adopted_orders/index.html#Waivers.

California's regulations are somewhat unusual in the US since California's Porter-Cologne Water Quality Control Act enables the state regulatory agencies to control all sources of pollutants that cause violations of water quality objectives (standards) including the narrative objective covering toxicity in the water column and sediments. [Porter-Cologne Act available at: http://www.swrcb.ca.gov/water_laws/docs/portercologne.pdf]

Thus, even absent federal numeric criteria for specific individual pesticides discharged, California can regulate any that either exceed their numeric water quality objectives (based on exceedance of the objective by any amount more than once every three years) or cause toxicity in

the state's waters (covered by the narrative objective). The recently adopted CVRWQCB order R5-2008-0005 requires that irrigated agricultural interests in the Central Valley must monitor the waterbodies that receive runoff from irrigated agriculture, for aquatic life toxicity and selected pesticides. If a violation of a water quality objective is found, the source(s) must develop management plans to control the violation.

As indicated in the **"Monitoring"** slide, an evaluation should be made *"To determine the impacts of alternative pesticide use."* The CVRWQCB found it necessary to include that requirement in its Ag Waiver monitoring/management program because the US EPA Office of Pesticide Programs (US EPA OPP) allows the registration/use of pesticides that will obviously be present in stormwater runoff from areas where the pesticides are applied in accord with its label, but that will also be toxic to aquatic life in the receiving waters for the runoff. This paradoxical approach has been, and will continue to be, a significant deficiency in the US EPA OPP regulatory approach and has contributed to a "musical chairs" game in pesticide use. That is, aquatic life toxicity-based restrictions have led to a reduction in use of OP pesticides; reduction in the use of OP pesticides has led to increased use of pyrethroid-based pesticides, which are themselves causing toxicity to aquatic life in the receiving-watercolumn at the time of runoff and in the sediments following the runoff. Thus, the restrictions on the use of diazinon and chlorpyrifos in urban areas have caused a switch from OP pesticide-caused toxicity in urban streams to pyrethroid-based pesticide-caused toxicity in the watercolumn and sediments. Additional information on this issue was provided in Newsletters 8-1/2, 8-6, 9-3, 9-4, 9-6, 9-7, 9-8, 10-3, 10-8, and 10-12, as well as in the following report and presentation discussing a proactive approach for evaluating the potential water quality impacts of new or expanded use pesticides:

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). [available at http://www.gfredlee.com/proactivepest_1000.pdf]

Lee, G. F., "Proactive Approach for Managing Pesticide-Caused Aquatic Life Toxicity," PowerPoint Presentation to the Sacramento River Watershed Program Toxics Subcommittee, Sacramento, CA, September 26 (2001). [available at <http://www.gfredlee.com/ProActivePest.pdf>]

The CVRWQCB is beginning to develop programs that will begin to control the aquatic life toxicity caused by pyrethroid-based pesticides by requiring that agricultural interests that find aquatic life toxicity in waters impacted by irrigated agriculture runoff/discharges, determine the cause of the toxicity and control it at the source.

Goode, M., Discussion of Proposed Amendment to the Basin Plan Amendment for the Control of Diazinon and Chlorpyrifos Runoff into the Sacramento and Feather Rivers, PowerPoint slides presented to California Water Resources Control Board, Sacramento, CA, February 19 (2008).

[made available, with permission, at
<http://www.members.aol.com/GFLEnviroQual/GoodeDiazinonChlorp.pdf>]

**SACRAMENTO AND FEATHER
RIVERS DIAZINON AND
CHLORPYRIFOS TMDL/BASIN
PLAN AMENDMENT**

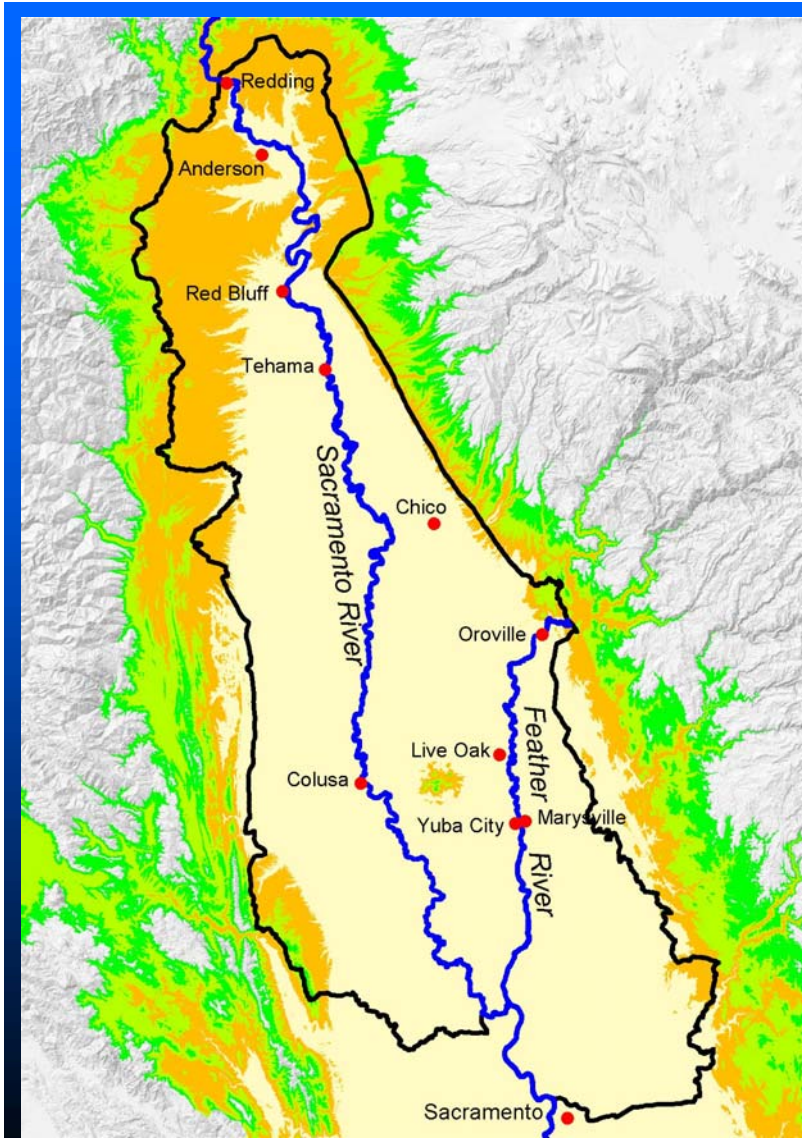
**Agenda Item #7
February 19, 2008**

Staff

- State Water Board Staff
 - Mitchell Goode
- Office of Chief Counsel
 - Steven Blum
- Central Valley Water Board Staff
 - Paul Hann
 - Danny McClure
 - Jerry Bruns

Impetus For Action

- Diazinon Review Required by
 - Basin Plan
 - Sacramento Superior Court Order from the case: *Makhteshim Agan of North America v State Water Resources Control Board; Regional Water Quality Control Board-Central Valley Region, Sac. Cty.*
Sup. Ct. - Case No. 04CS00871
- Chlorpyrifos Program Recommended to Address
 - 2006 Impaired Waters List
 - Current Data



Geographic Scope

- Main stems of the Sacramento and Feather Rivers below the major reservoirs

Diazinon and Chlorpyrifos Use

- Agricultural and urban uses
- Most urban uses stopped by end of 2004
- Diazinon – primarily dormant use on plum, peach, and almond orchards
- Chlorpyrifos – primarily irrigation season use on alfalfa, and walnut and almond orchards
- Both pesticides are applied in significant quantities throughout the spring

Movement of Pesticides & Current Detectable Levels

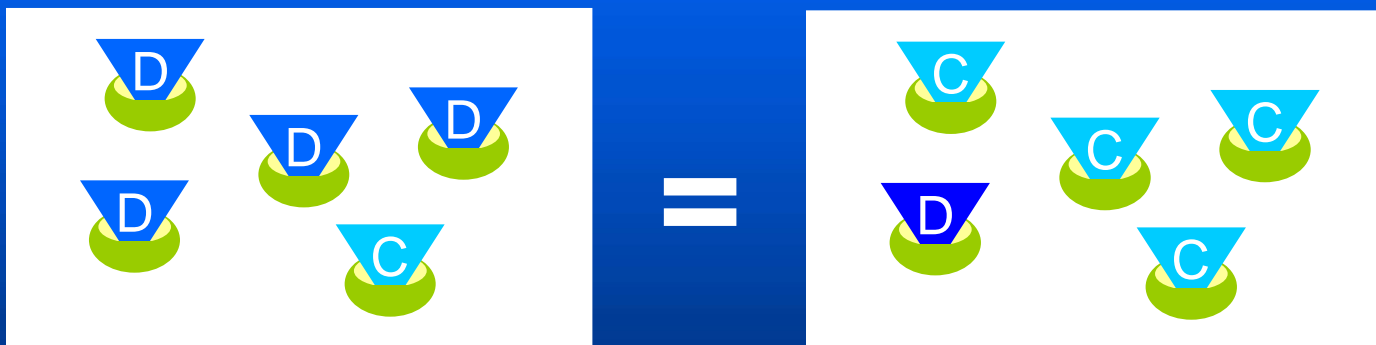
- Pesticides applied to crops, wash offsite after storm events, enter surface water
- Some exceedances of current Diazinon objectives
- Diazinon and Chlorpyrifos have caused exceedances of loading capacity, based on both proposed acute and chronic water quality objectives

Properties & Additivity

- Toxic to aquatic invertebrates at low concentrations
- Additivity Facts
 - Data shows that Diazinon and Chlorpyrifos co-occur
 - Exhibit same mode of toxic action resulting in additive effects
 - Basin Plan requires that the cumulative impact must be considered if more than one pesticide is present
 - Peer reviewers concurred and scientific literature supports
 - Additivity formula was consistently applied in adoption of
 - » Sacramento Urban Creeks Diazinon and Chlorpyrifos Amendment
 - » San Joaquin River Diazinon and Chlorpyrifos Amendment
 - » Delta Diazinon and Chlorpyrifos Amendment

Toxicity of OP Pesticides

Acetylcholine esterase inactivation occurs regardless of which OP molecules are inhibiting the enzyme



Diazinon



Chlorpyrifos



Acetylcholine esterase (inhibited by D or C)

Water Quality Objectives

- Diazinon (revision of existing objectives)
 - 0.16 µg/L Acute (revised from 0.08 µg/L)
 - 0.10 µg/L Chronic (revised from 0.05 µg/L)
- Chlorpyrifos (new objectives)
 - 0.025 µg/L Acute
 - 0.015 µg/L Chronic
- Same as San Joaquin River and Delta Amendments
- USEPA supports objectives

Antidegradation

- Change to proposed Diazinon objective is consistent with antidegradation policies
- Proposed objective corrects calculation error
- Proposed objective maintains full protection for most sensitive species

Loading Capacity and Allocations

- Allocations are set equal to the loading capacity
- Loading capacity requires that all discharges to the Sacramento and Feather Rivers must meet the additivity formula
- Load allocations would need to be met at the point they enter the rivers

Implementation

- Conditional waiver or WDRs are expected method of implementation
- Conditional Prohibition of Discharge provides backstop if no waiver or WDRs
- Submission of management plans
- Management plans must be revised if loading capacity is not met and allocations exceeded
- Implementation language was revised to allow consideration of the primary pesticide responsible for an exceedance
- Consistent with San Joaquin River and Delta Amendments

Monitoring

- To determine compliance with WQOs, load allocations, & loading capacity
- To determine the effectiveness of management practices
- To determine the impacts of alternative pesticide use

Economic Considerations

- No additional costs expected for NPDES sources
- If Chlorpyrifos dischargers aren't causing or contributing to exceedances, no need to change management practices
- Estimated annual Ag costs for all acreage treated in the Delta Watershed
 - Management practice costs \$0-\$6.2M
 - Monitoring planning, evaluation \$0.3-\$1.5M
 - Total costs \$0.3-\$7.7M

Economic Considerations

- Estimates are likely high
 - Growers already implementing practices
 - Requirements for new practices are pending
 - Broadly applicable practices considered – farm specific solutions likely to be less expensive
- State and federal funds available
- Other benefits

Public Comments

Questions?