

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

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

# Staff

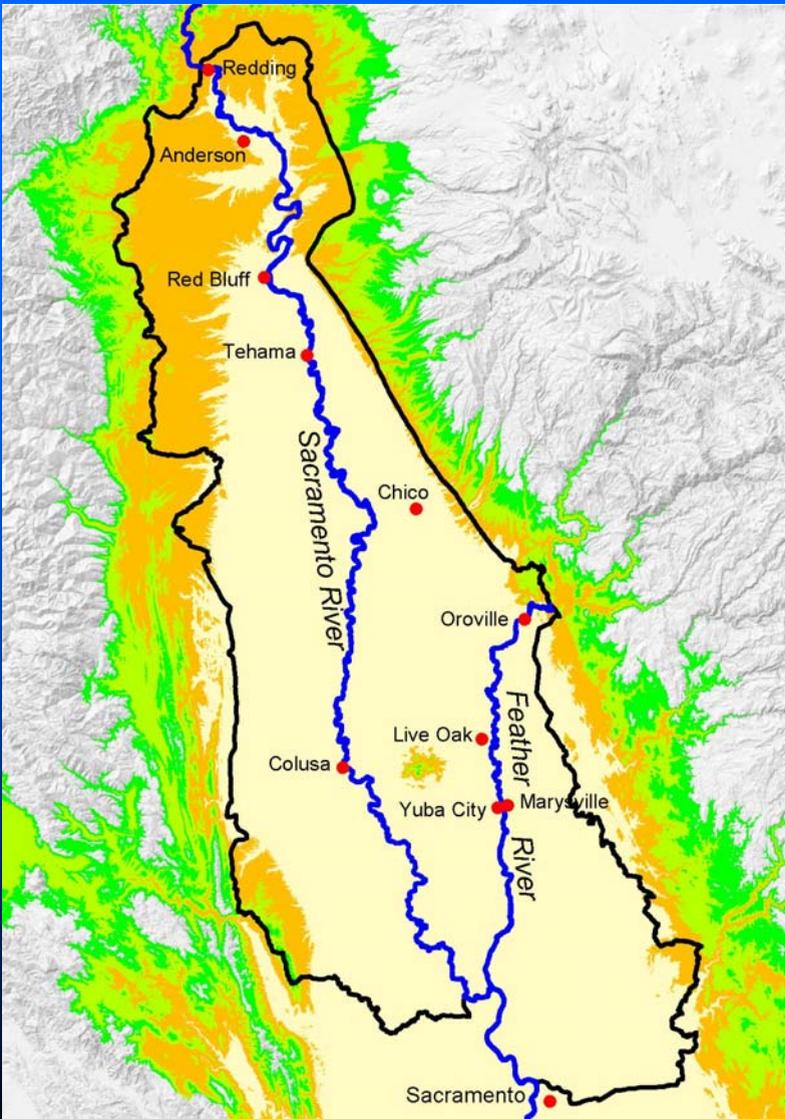
- State Water Board Staff
  - Mitchell Goode
- Office of Chief Counsel
  - Steven Blum
- Central Valley Water Board Staff
  - Paul Hann
  - Danny McClure
  - Jerry Bruns

# 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

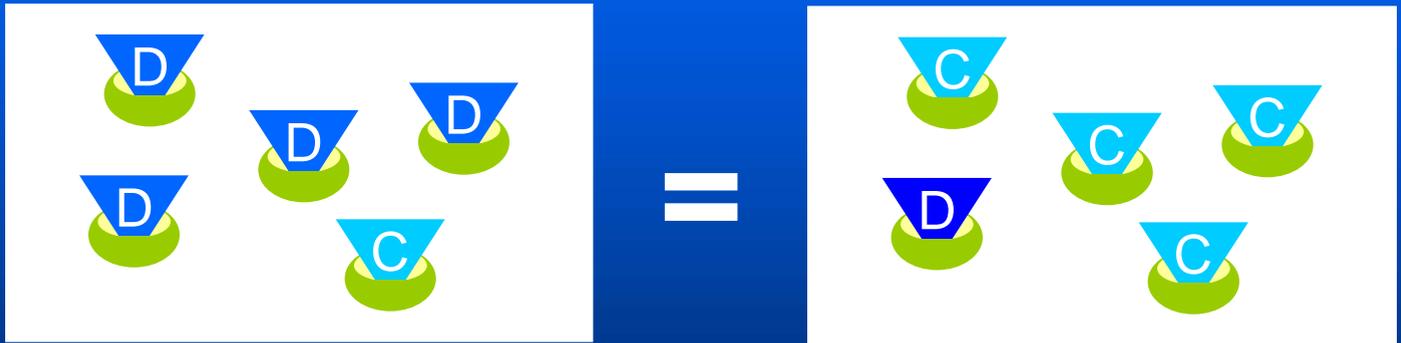
- Pesticides applied to crops, wash offsite after storm events, enter surface water
- Some exceedances of current Diazinon objectives
- Diazinon and Chlorpyrifos have caused exceedances of loading capacity, based on both proposed acute and chronic water quality objectives

# 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?



# Diazinon and Chlorpyrifos

## Mode of Action

- Diazinon and Chlorpyrifos interfere with normal nerve function
  - Release of acetylcholine from one nerve cell activates the neighboring nerve cell
  - Activation stops as acetylcholine is broken down by acetylcholine (AChE) esterase
  - Diazinon and Chlorpyrifos bind to acetylcholine esterase inhibiting breakdown of acetylcholine
  - Excess acetylcholine causes excessive nerve activation – leading ultimately to death
  - **Toxicity is based on the total level of inhibition, not which OP is causing the inhibition. Therefore, any amount of OP can contribute to cumulative effect**

# Additivity Formula

$$S = \frac{C_D}{WQO_D} + \frac{C_C}{WQO_C} \leq 1$$

where:

$C_D$  = diazinon concentration in the waterbody

$C_C$  = chlorpyrifos concentration in the waterbody

$WQO_D$  = acute or chronic diazinon water quality objective

$WQO_C$  = acute or chronic chlorpyrifos water quality objective

# Additivity Formula Example

$$\frac{0.12}{0.16} + \frac{0.012}{0.025} = 1.23$$

Diazinon Measured Concentration is 0.12 µg/L

Diazinon 1-Hour Objective = 0.16 µg/L

Chlorpyrifos Measured Concentration = 0.012 µg/L

Chlorpyrifos 1-Hour Objective = 0.025 µg/L

Sum = 1.23, which exceeds 1.0.

# Public Comments

## ■ Comment

- Do not consider additive toxicity when one pesticide is at low levels

## ■ Response

- Both science and policy requirements support consideration of additive toxicity
- Staff has updated implementation language to allow consideration of the primary pesticide responsible for an exceedance

# Peer Review

- Staff report is based on science that has already been peer reviewed (e.g. 2003 Sacramento and Feather River, 2005 San Joaquin River, 2006 Delta)
- Proposed amendment is a new application of earlier adequately peer reviewed work products
- The proposed alternative doesn't depart from the scientific approach of previous basin plan amendments
- The staff report has fulfilled the requirements of HSC 57004 and does not require additional peer review

# Regulatory Changes

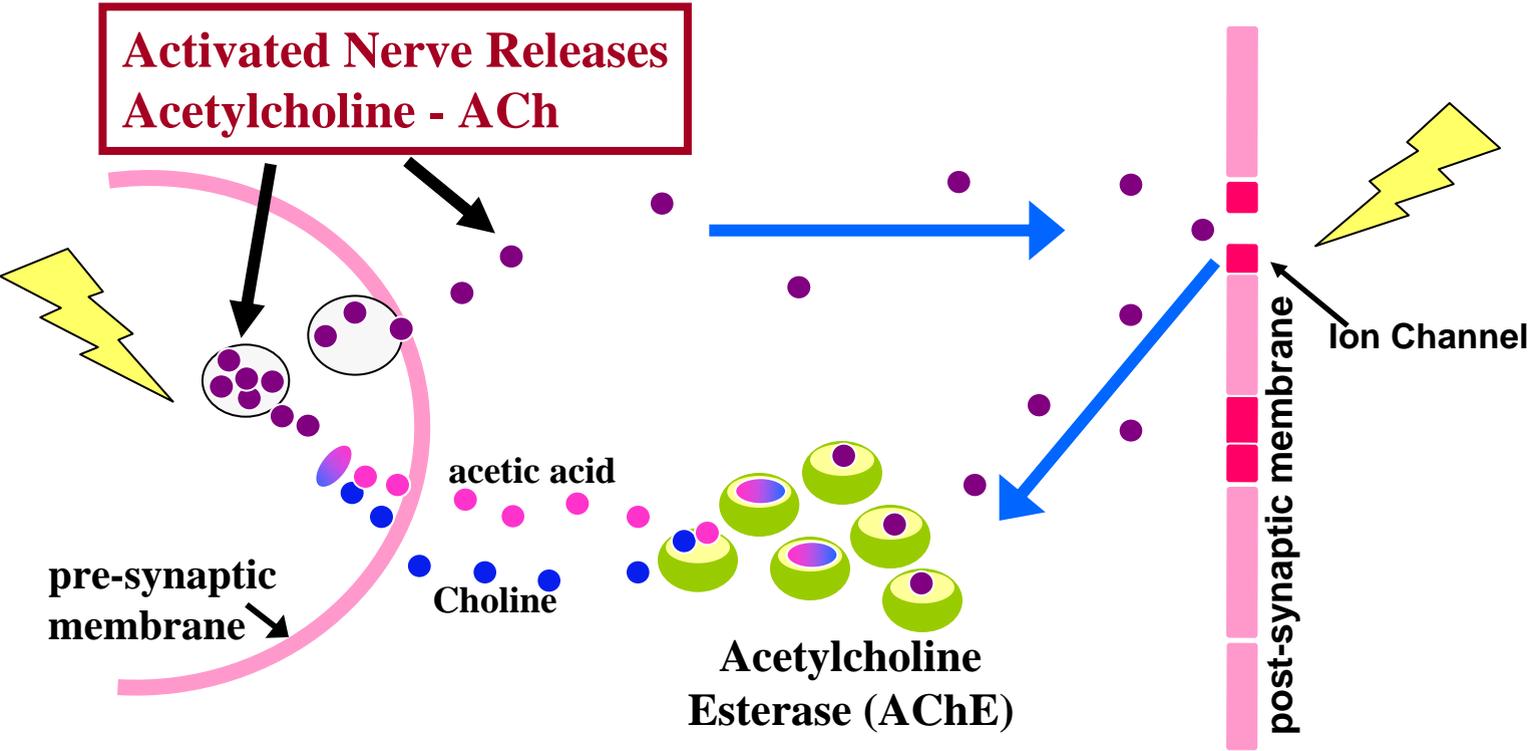
- 2004 Diazinon supplemental label
  - Developed in response to 2003 amendment
  - Approved by USEPA and DPR
- 2006 DPR dormant spray regulations
- Include management practices that should reduce pesticide discharges
- Enforced by County Agricultural Commissioners

# CDFG vs. EPA Diazinon Criteria

	<u>CDFG</u>	<u>EPA</u>
Acute	0.16 µg/L	0.17 µg/L
Chronic	0.10 µg/L	0.17 µg/L

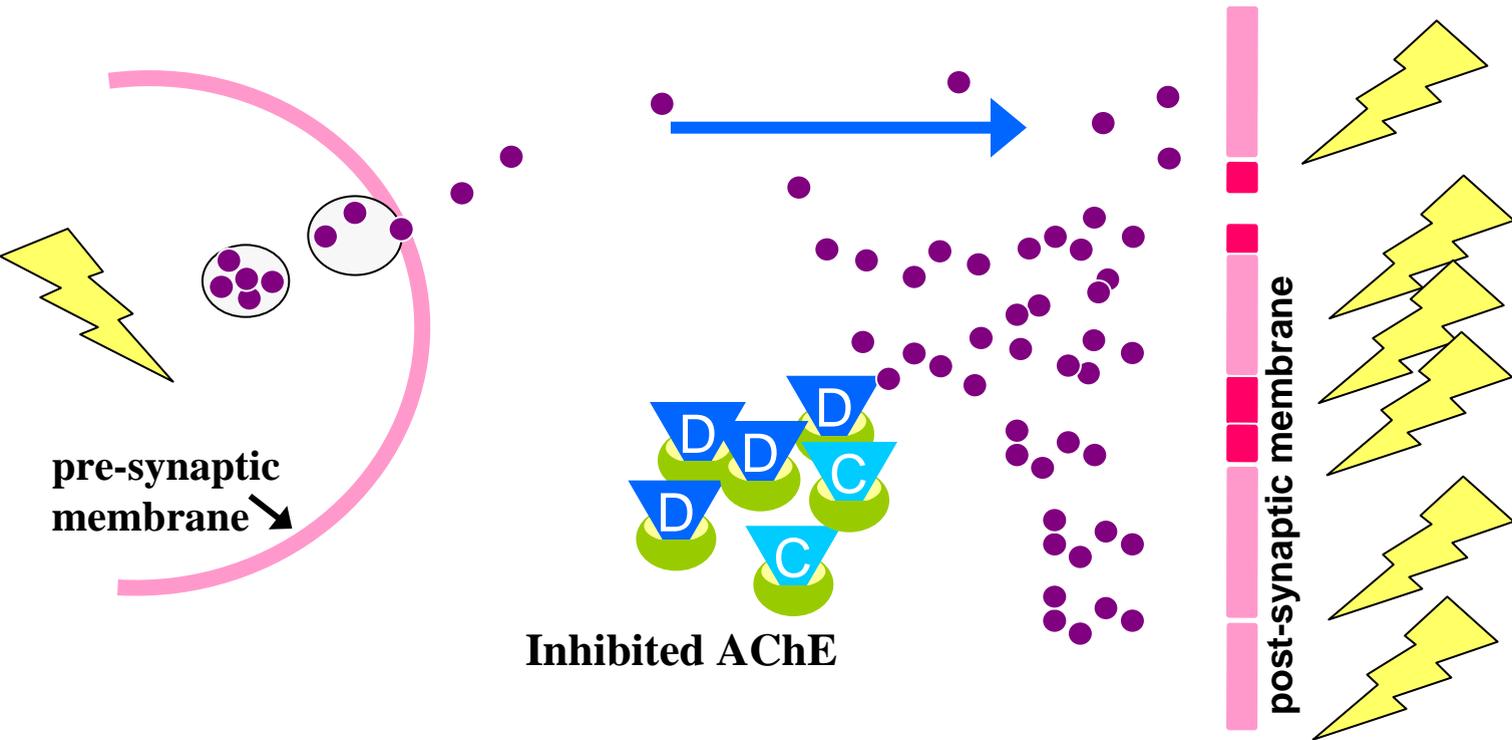
# Normal Nerve Function

**Activated Nerve Releases  
Acetylcholine - ACh**



**Release of Acetylcholine from the pre-synaptic membrane causes activation of the neighboring nerve cell. Activation stops as Acetylcholine is broken down by acetylcholinesterase.**

# Organophosphate Mode of Action



**OP Pesticides Cause Inhibition of AChE, leading to accumulation of Acetylcholine which causes excessive nerve stimulation.**