



## MEMORANDUM

DATE: December 4, 2014

TO: Tessa Fojut, California Regional Water  
Quality Control Board, Central Valley  
Region

COPY TO: Pamela Creedon, Executive Officer,  
California Regional Water Quality Control  
Board, Central Valley Region

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SUBJECT: **Comments on the October 2014 Preliminary Draft for Discussion Pyrethroid Basin Plan Amendment Language**

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The Sacramento Valley Water Quality Coalition (SVWQC) appreciates the opportunity to provide comments on the proposed Pyrethroid Basin Plan Amendment (BPA) language (October 2014 Preliminary Draft, updated November 10, 2014). SVWQC has concerns about the proposed BPA and potential adverse consequences for agriculture and other regulated stakeholders in the Central Valley. We are also taking this opportunity to recommend specific questions for the peer review of the Regional Water Board's draft staff report supporting the proposed BPA.

SVWQC's primary concerns are: (1) the methodology and assumptions used to develop the proposed water quality objectives for individual pyrethroids; (2) the lack of information supporting the proposed use of an additive toxicity formula; and (3) lack of clarity regarding the considerations of outstanding technical concerns by the peer review panel.

### **METHODOLOGY AND ASSUMPTIONS USED TO DERIVE THE PROPOSED WATER QUALITY OBJECTIVES FOR PYRETHROIDS**

The Central Valley Regional Water Quality Control Board (Regional Water Board) proposes to use the water quality threshold values developed by the University of California, Davis (UCD) for bifenthrin (UCD, 2010), cyfluthrin (UCD, 2010), lambda-cyhalothrin (UCD, 2010), cypermethrin (UCD 2011), permethrin (UCD, 2011), and esfenvalerate (UCD, draft 2014), as individual water quality objectives for pyrethroids in the BPA. These water quality threshold

values (identified as “criteria” by UCD and the Regional Water Board) were derived using a methodology developed by UCD (TenBrook, 2009) that differs from the established United States Environmental Protection Agency (USEPA) national ambient water quality criteria development methodology (USEPA, 1985). Two significant deviations of the UCD methodology are (1) allowing development of criteria using toxicity data for three fewer taxa than USEPA methodology and (2) allowing development of chronic criteria using a default acute-chronic ratio (ACR) developed for organochlorine and organophosphorus pesticides in the Great Lakes (USEPA, 2003).

The decision to abandon the well-established USEPA national criteria development methodology in favor of a new and relatively untested UCD methodology and several assumptions and other aspects of the proposed BPA are not adequately supported. The assumptions of greatest concern that are used to derive the proposed water quality objectives include:

- Rationale for abandonment of USEPA criteria development methodology
- Lack of sufficient toxicity data
- Use of excessively conservative protection levels
- Use of default ACRs
- Cumulative effects of conservative assumptions in the additive criterion equation
- Bioavailability is not explicitly addressed

### **Rationale for Abandonment of USEPA Criteria Development Methodology**

The Regional Water Board has not provided adequate information to support the use of the UCD methodology instead the established USEPA national criteria development methodology. USEPA developed the national methodology for deriving water quality criteria to provide a consistent level of protection across the nation. The USEPA methodology is based on consideration of toxicity test results over a cross-section of at least eight taxa, while the UCD method allows a “short-cut” method for deriving water quality “criteria” based on consideration of only five taxa. To compensate for the lack of applicable data, UCD’s water quality “criteria” were derived using ever-increasing conservative assumptions (discussed in the following sections) that cascade through each step and result in proposed water quality objectives in the proposed BPA that are overly stringent.

### **Insufficient Toxicity Data to Develop Reliable Criteria**

The water quality “criteria” reports produced by UCD acknowledge “major limitation[s]” in the lack of available applicable toxicity data in developing the water quality criteria. The lack of adequate toxicity data is especially problematic for chronic water quality “criteria” for pyrethroids. Insufficient chronic toxicity tests are available to develop individual water quality criteria using either the USEPA or UCD full taxa cross-section methodologies. The UCD

"criteria" documents attempt to compensate for the lack of data with multiple layers of assumptions and subjective conservative adjustments to derive the water quality "criteria" and proposed water quality objectives. Additionally, the water quality "criteria" for individual pyrethroids are combined into a single criterion based on an unvalidated assumption of additive toxicity at concentrations that are below reported toxic effects in the UCD-derived water quality threshold data sets. The cumulative effect of these assumptions and subjective adjustments is an overly stringent combined criterion with significant implementation implications. Additional toxicity data and research are needed to develop technically- and scientifically-sound water quality objectives for pyrethroids.

### **Excessively Conservative Protection Levels**

The 1985 USEPA national ambient water quality criteria development method establishes the fifth percentile of the distribution of genus-mean  $EC_{50}$  concentrations as the basis of protection to derive acute and chronic water quality criteria. This fifth percentile Genus Mean Acute Value (GMAV) is then divided by two to derive a final acute water quality criterion concentration that is not expected to cause toxicity to sensitive species. USEPA criteria method also provides for an adjustment to ensure that important species more sensitive than the fifth percentile are protected. The UCD acute water quality "criteria" for bifenthrin, lambda-cyhalothrin, permethrin, and esfenvalerate are equal to half of the fifth percentile of species-mean  $EC_{50}$  values to develop individual acute water quality "criteria" approximately equivalent to the USEPA established level of protection. However, UCD adjusted the level of protection to the first percentile level to develop the water quality "criteria" for cyfluthrin and cypermethrin that are protective of *Hyalella*. This adjustment to a first percentile basis results in an acute cyfluthrin "criteria" that is 6.7x lower than the species-mean  $EC_{50}$  for the most sensitive species in the UCD data set (*Hyalella*, 2.3 ng/L). Use of the first percentile basis results in an acute cypermethrin "criteria" that is 2.7x lower than the species-mean  $EC_{50}$  for the most sensitive species in the UCD data set (*Hyalella*, 2.7 ng/L). Automatic use of the first percentile of species-mean  $EC_{50}$  concentrations by UCD fails to consider alternative adjustments that achieve the goal of protecting sensitive species goal without unnecessary conservatism (e.g., by using the *Hyalella* species-mean  $EC_{50}$  divided by two, consistent with USEPA criteria methodology).

Additionally, because the adjusted final acute values are also used to calculate the chronic water quality "criteria", the first percentile adjustment also directly results in excessively conservative chronic water quality "criteria" for cypermethrin and cyfluthrin. The impacts of the more stringent protection level adjustments are further compounded in the additive toxicity equation proposed for the BPA (see additional comments below).

### **Use of Default ACRs**

The UCD methodology for developing chronic water quality threshold values allows use of "default" ACRs when there are insufficient paired acute and chronic toxicity test data to develop a chronic criterion for a specific chemical using the ACR method. This method is allowed even though UCD's Phase I report found that "...*there is no evidence that default*

*ACR values are appropriate for pesticides in general*" (TenBrook, 2006; TenBrook, 2009). The "default ACR" used by UCD was developed for the Great Lakes (Host, 1995) and is based on data for organochlorine and organophosphorus pesticides (chlordane, chlorpyrifos, diazinon, dieldrin, endosulfan, endrin, lindane, and parathion) that do not have a mode of action in common with pyrethroids. The upper 80<sup>th</sup> percentile (12.4) of the ACRs for these pesticides (ranging from 2.2 to 25) was selected as the "default ACR." Fojut et al. (2014) updated the ACR data set developed by Host et al. by adding ACRs for cyfluthrin and lambda-cyhalothrin, and calculated a revised default ACR of 11.4.

Pyrethroid, organochlorine, and organophosphorus pesticides do not have similar toxic modes of action, and there is no scientific research establishing a basis for a common default ACR for pesticides with different modes of toxicity. Nonetheless, UCD developed chronic water quality "criteria" using a default ACR for pyrethroid pesticides with no toxicity test-based ACRs (e.g., bifenthrin, cypermethrin) or to compensate for an inadequate set of toxicity test-based ACRs (e.g., for permethrin and esfenvalerate). The available ACRs based on actual acute and chronic toxicity data for lambda-cyhalothrin and cyfluthrin indicate that the default ACR of 11.4 may be up to 2.5 times higher than observed ACRs for some pyrethroids (e.g., lambda-cyhalothrin ACR = 4.73). For cyfluthrin and cypermethrin, the inflated default ACR is compounded with a protection level based on the first percentile estimate of species mean EC<sub>50</sub> concentrations that result in water quality threshold values that are overly stringent for the protection of the aquatic community.

Even if the default ACR approach was scientifically justified, an 80<sup>th</sup> percentile default ACR is unnecessarily conservative, especially when the final ACR is biased by multiple default ACRs. This is not recognized in the UCD approach, and also contributes to the impact of cumulative conservative assumptions.

Use of default ACRs in developing chronic water quality objectives is not scientifically justified and should not be allowed. Instead, the Regional Water Board should follow USEPA's example and simply not calculate chronic criteria until there are sufficient data to support a more rigorous and robust criterion development methodology.

### **Proposed Use of Additive Toxicity-based Criterion Equation**

The Regional Water Board proposes to determine compliance with water quality objectives for pyrethroids based on equations that assume additive toxicity for the six pyrethroids at proposed acute and chronic water quality objective concentrations. The criterion equations are based on the sum of the measured concentration of each pyrethroid divided by the proposed water quality objective for that pyrethroid. A water quality sample is determined to be in compliance with the additive criterion equation if the sum of these ratios for all six pyrethroids is less than or equal to one.

The scientific literature and studies that have investigated mixtures of pyrethroids and their combined effects on aquatic species is limited. Based on three studies cited in the draft esfenvalerate water quality "criteria" report, it was concluded that there were additive effects

of pyrethroids on the test organisms. Two studies (Barata et al. [2006] and Brander et al. [2009]) identified antagonism between pyrethroid mixtures tested in competing for binding sites. The third study (Trimble et al. [2009]) was conducted on sediment samples. These studies did not evaluate additive toxicity at the concentrations approaching the proposed water quality objectives, and Brander et al. (2009) evaluated mixtures of cyfluthrin and permethrin at concentrations several orders of magnitude higher than the proposed water quality objectives. These studies are not adequate to validate the assumption that concentrations of pyrethroid pesticides below the criterion concentrations are additive and that the proposed additive criterion equation is an appropriate and reasonable indicator of compliance.

The Regional Water Board has not provided references to additional scientific studies evaluating the effect of mixtures of pyrethroids proposed in the BPA at concentrations relevant to the proposed water quality objectives, and the assumptions underlying the proposed additive criteria equations have not been validated. Additional research needs to be conducted to validate the proposed additive toxicity equations at concentrations relevant to assessing compliance.

Additionally, if the Regional Water Board's assumption of additivity based on a common mode of action is reasonable, toxicity data for all six pyrethroids should be combined to develop a more robust basis for the additive criteria equations. This would have the benefit of overcoming much of the limitations of the toxicity data sets, particularly for chronic toxicity and ACRs used to establish a chronic criterion.

The proposed additive criterion equation is based on an unvalidated assumption of additive toxicity at concentrations below the proposed water quality objectives. Due to the cumulative effects of adjusted protection levels for some individual pyrethroids and the use of the inflated default ACR values, the additive criterion equation is unnecessarily over-protective. Including some individual criteria developed at the first percentile level of protection essentially extends this level of protection to all pyrethroids considered in the equation. This can be addressed by using the criteria values based on the established fifth percentile protection level for individual pesticides in the equation, even if an adjusted level of protection is required for protective criteria for some individual pyrethroid pesticides. Additionally, the proposed additive criterion equation does not make the best use of available toxicity data and greatly over-estimates the quality of chronic criteria for individual pyrethroid pesticides (see previous comments).

The basis for the proposed additive criterion equations has not been sufficiently evaluated to warrant the considerable compliance implications and implementation complications that it will cause. This can be expected to result in unwarranted 303(d) listings for surface waters and unnecessary and costly management requirements for agriculture and other stakeholders. While this is true for individual pyrethroid pesticides, it is more severe for the additive criterion equations.

## **Bioavailability is Not Explicitly Addressed in the BPA Language**

The pyrethroid “criteria” reports specify that the objectives for individual pyrethroid pesticides should be implemented based on the dissolved fraction in water samples. Although Table III-2A specifies that the objectives apply to “aqueous concentrations”, it is not clearly stated anywhere in the draft BPA language that the objectives are applied to dissolved concentrations. This must be explicitly and clearly stated to avoid inconsistent implementation and interpretation of the objectives.

## **QUESTIONS FOR INDEPENDENT PEER REVIEWERS**

In the most recent BPA workshop (November 7, 2014), Regional Water Board staff indicated that the proposed BPA, draft Regional Water Board Staff Report, water quality “criteria” reports, and other associated documents will be sent for technical peer review in January 2015. Regional Water Board staff invited stakeholders to submit questions for consideration in the charge to peer reviewers. The following technical questions should be submitted to peer reviewers as part of their charge in reviewing the technical basis for the proposed BPA:

- Do the available toxicity data adequately support the development of the proposed chronic water quality objectives? What additional data are necessary to meet the USEPA criteria development guidelines and remove the uncertainty of the proposed default ACR values.
- Is the use of a default ACR based on the 80<sup>th</sup> percentile ACR for organochlorine and organophosphorus pesticides scientifically justifiable for pyrethroids that have a different mode of toxicity? Should pyrethroid criteria be based only on ACRs available for pyrethroid pesticides?
- Does the available research support the assumption of additive toxicity of the six pyrethroids at concentrations near the proposed water quality objectives? If not, is it feasible to conduct toxicity tests verify the assumption of additive toxicity near the proposed water quality objectives?
- Do the cumulative effects of multiple conservative assumptions in developing individual criteria result in a combined additive criteria equation that is more stringent than intended (i.e., lower than necessary to achieve the established 5<sup>th</sup> percentile protection basis for the objectives)?

Because of the statewide and national significance of the proposed BPA and associated water quality objectives, we strongly recommend that the peer review panel include individuals with expertise in the derivation of water quality criteria for pesticides.

## **Conclusion**

We believe that additional study is needed to develop appropriate water quality objectives for pyrethroids and are concerned with the likely impacts on agriculture and other regulated

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stakeholders in the Central Valley. The individual criteria and the BPA as written have numerous technical shortcomings that need to be addressed before robust and scientifically rigorous Basin Plan objectives can be developed and implemented for these pesticides.

We appreciate the opportunity to provide advance technical comments on the proposed Pyrethroid BPA during this informal review process. Thank you for your consideration of our comments and concerns. Please contact me if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read 'Claus Suverkropp', with a long horizontal flourish extending to the right.

Claus Suverkropp  
Larry Walker Associates