MEMORANDUM

SUBJECT: Joint Response from OPP’s Environmental Fate and Effects Division and Pesticide Re-evaluation Division to Comments on the Preliminary Risk Assessments for Pyrethroids and Pyrethrins Insecticides

DATE: September 30, 2019

APPROVED BY: Amy Blankinship, Branch Chief
Environmental Risk Branch 2

Justin Housenger, Branch Chief
Environmental Risk Branch 5
Environmental Fate and Effects Division (EFED)

Kevin Costello, Branch Chief
Risk Management and Implementation Branch 2

Cathryn Britton, Branch Chief
Risk Management and Implementation Branch 5
Pesticide Re-evaluation Division (PRD)

FROM: Moana Appleyard, PRD
Melanie Biscoe, PRD
William Eckel, EFED
R. David Jones, PRD
Donna Judkins, EFED
José Melendez, EFED
Khue Nguyen, PRD
Zoe Ruge, EFED
Lauren Weissenborn, PRD
Stephen Wente, EFED
Katrina White, EFED
## Contents

Summary ....................................................................................................................................................... 3

Note on Public Comment Identifier Numbers .......................................................................................... 4

Public Comments and Agency Responses ..................................................................................................... 5

Policy and Technical Comments Applicable Across Pyrethroid Use Patterns Assessed in the Ecological Risk Assessment ........................................................................................................................................ 5

Agricultural Use Pattern Assessment Comments ................................................................................... 20

Urban Outdoor Use Pattern Assessment Comments ............................................................................. 23

Down-the-Drain Use Assessment Comments ......................................................................................... 30

Public Health (Wide-Area Mosquito Control) Use Comments ............................................................... 35

References .................................................................................................................................................. 36

Appendix A: List of Public Commenters on the Pyrethroid Ecological Risk Assessment ...................... 40

Appendix B: Error Corrections .................................................................................................................... 44
Summary

EPA issued a notice in the Federal Register on November 29, 2016 announcing the opening of the public comment period for an ecological risk assessment entitled “Preliminary Comparative Environmental Fate and Ecological Risk Assessment for the Registration Review of Eight Synthetic Pyrethroids and the Pyrethrins,” and a companion document entitled “Ecological Risk Management Rationale for the Pyrethroids,” also called the Rationale Document. The PRA assessed the eight Pyrethroid Working Group (PWG) pyrethroids including bifenthrin, cypermethrin, cyfluthrins, deltamethrin, esfenvalerate, fenpropathrin, cyhalothrins, and permethrin, with the addition of the pyrethrins, and focused on aquatic organisms, which are the risk driver for these chemicals. The Rationale Document was intended to describe EPA’s approach in using the ecological risk assessment to serve as a basis for making risk management, mitigation, and regulatory decisions for all of the pyrethroids currently undergoing registration review. These other chemicals include cyphenothrin, d-phenothrin, etofenprox, flumethrin, imiprothrin, momfluorothrin, prallethrin, tau-fluvalinate, tefluthrin, and tetramethrin, all of which were assessed for new uses in the last ten years. The Rationale Document concluded that quantitatively assessing all the chemicals again in the registration review process would have resulted in similar results as previous assessments, and that aquatic risks in the ecological risk assessment are representative of the risks for the other pyrethroids. The publication of these documents opened a 60-day public comment period beginning on November 29, 2016, which was subsequently extended until July 7, 2017 to allow the public to provide sufficiently comprehensive comments on the agency’s extensive evaluation of the 23 chemicals addressed in pyrethroid registration review case.

During the public comment period, EPA received over 1,400 public comments on the ecological risk assessment for the pyrethroids. Submitters included registrants, state agencies, universities, non-governmental organizations, extension agents, crop and trade organizations, the U.S. Department of Agriculture, individual growers, and Pest Control Operators (PCOs). For a list of commenters, see Appendix A of this document. Comments addressed the technical aspects of the risk assessments, aquatic risk policy considerations for the agency to consider, and the benefits of maintaining the availability of these chemicals. Comments related to the benefits of pyrethroids are addressed in other documents including the following:

- Review of USDA’s Assessment of the Benefits of Pyrethroids, August 2, 2019;
- Biological and Economic Analysis Division (BEAD) Summary of Public Comments Related to Benefits of Pyrethroids Submitted in Response to the Preliminary Comparative Environmental Fate and Ecological Risk Assessment for the Registration Review of Eight Synthetic Pyrethroids and the Pyrethrins; and the

These documents are located in the special pyrethroid docket, EPA-HQ-OPP-2008-0331, available at www.regulations.gov. Comments addressed in this document cover the technical aspects of the risk assessment as well as risk management concerns from stakeholders. Similar comments or those with
common themes were combined and are summarized in this memorandum along with agency responses as appropriate. In addition, discussion of errors in and corrections to the agency’s pyrethroid risk assessment are located in Appendix B of this document.

Note on Public Comment Identifier Numbers

All dockets for pyrethroids undergoing registration review opened for public comment on November 29, 2016. Commenters could submit their comments to any pyrethroid docket or dockets on www.regulations.gov. Because www.regulations.gov assigns a comment identifier number based on the docket in which a comment was received, comments posted to multiple dockets were assigned a unique comment identifier number in each docket to which the comment was submitted. In this memorandum, where it is useful to identify a comment by an identifier number, only one representative comment number is cited. The docket numbers for the pyrethroids and pyrethrins currently undergoing registration review are listed below in Table 1.

Table 1. Pyrethrins and pyrethroid insecticide docket identification

<table>
<thead>
<tr>
<th>Active Ingredient</th>
<th>Docket No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>bifenthrin</td>
<td>EPA-HQ-OPP-2010-0384</td>
</tr>
<tr>
<td>cyfluthrin</td>
<td>EPA-HQ-OPP-2010-0684</td>
</tr>
<tr>
<td>beta-cyfluthrin</td>
<td>EPA-HQ-OPP-2010-0684</td>
</tr>
<tr>
<td>gamma-cyhalothrin</td>
<td>EPA-HQ-OPP-2010-0479</td>
</tr>
<tr>
<td>lambda-cyhalothrin</td>
<td>EPA-HQ-OPP-2010-0480</td>
</tr>
<tr>
<td>cypermethrin</td>
<td>EPA-HQ-OPP-2012-0167</td>
</tr>
<tr>
<td>alpha-cypermethrin</td>
<td>EPA-HQ-OPP-2012-0167</td>
</tr>
<tr>
<td>zeta-cypermethrin</td>
<td>EPA-HQ-OPP-2012-0167</td>
</tr>
<tr>
<td>cyphenothrin</td>
<td>EPA-HQ-OPP-2009-0842</td>
</tr>
<tr>
<td>deltamethrin</td>
<td>EPA-HQ-OPP-2009-0637</td>
</tr>
<tr>
<td>d-phenothrin</td>
<td>EPA-HQ-OPP-2011-0539</td>
</tr>
<tr>
<td>esfenvalerate</td>
<td>EPA-HQ-OPP-2009-0301</td>
</tr>
<tr>
<td>etofenprox¹</td>
<td>EPA-HQ-OPP-2007-0804</td>
</tr>
<tr>
<td>fenpropathrin</td>
<td>EPA-HQ-OPP-2010-0422</td>
</tr>
<tr>
<td>flumethrin</td>
<td>EPA-HQ-OPP-2016-0031</td>
</tr>
<tr>
<td>imiprothrin</td>
<td>EPA-HQ-OPP-2011-0692</td>
</tr>
<tr>
<td>momfluorothrin</td>
<td>EPA-HQ-OPP-2015-0752</td>
</tr>
<tr>
<td>permethrin</td>
<td>EPA-HQ-OPP-2011-0039</td>
</tr>
<tr>
<td>prallethrin</td>
<td>EPA-HQ-OPP-2011-1009</td>
</tr>
<tr>
<td>pyrethrins</td>
<td>EPA-HQ-OPP-2011-0885</td>
</tr>
<tr>
<td>tau-fluvalinate</td>
<td>EPA-HQ-OPP-2010-0915</td>
</tr>
<tr>
<td>tefluthrin</td>
<td>EPA-HQ-OPP-2012-0501</td>
</tr>
<tr>
<td>tetramethrin</td>
<td>EPA-HQ-OPP-2011-0907</td>
</tr>
</tbody>
</table>

¹ Etofenprox is not a pyrethroid but was included due to its structural similarity.
Public Comments and Agency Responses

Policy and Technical Comments Applicable Across Pyrethroid Use Patterns Assessed in the Ecological Risk Assessment

1. **Various Stakeholder Comments on Risks to Pollinators and Wildlife:** There were comments received from various sources concerned with the risks to non-target organisms, including pollinators and other wildlife, from the use of pyrethroids.

   **EPA Response:** EPA acknowledges potential risk to non-target organisms, including aquatic and terrestrial invertebrates, from the use of the pyrethroids and pyrethrins. The agency is proposing risk mitigation measures which are intended to reduce runoff and spray drift. Risk mitigation measures include an increased width for vegetative filter strips and spray drift management labeling.

   The agency has adopted and is using its pollinator risk assessment framework\(^2\) in evaluating risk to bees from use of pesticides as part of the registration and registration review process for registered pesticides. The agency plans to address pollinators on a chemical-by-chemical basis and not as a whole for the 23 chemicals. Therefore, pollinator issues will be addressed in each chemical-specific Proposed Interim Decision (PID).

   The documents in the dockets describe EPA’s rationales for conducting additional risk assessments for the registration review of the 23 chemicals, as well as the agency’s subsequent risk findings and consideration of possible risk mitigation measures. See the *Pyrethroids and Pyrethrins: Ecological Risk Mitigation Proposal For 23 Chemicals* for additional information.

2. **Center for Biological Diversity Comments on Endangered Species Risk Assessment:** The Center for Biological Diversity (CBD) expressed concern about the risks from the use of pyrethroids to the environment and to human health and that their use should be more limited. CBD asserts that the risk assessment underestimates the amount of chemicals entering the environment and that the agency is obligated to provide information on chemical combinations resulting in synergy, and it is the EPA’s duty to consult with the Services on the registration review of all the pyrethroids in accordance with the Endangered Species Act (ESA). The CBD comments mention various aspects of the risk assessments in each of use scenarios and on the risk assessment process, specifically use of modeling and the best available data, including all necessary data and studies, particularly to develop listed species risk assessments, and evaluation of effects on listed species and their designated critical habitat. CBD also expressed concern regarding the rigor of the agency’s preliminary determinations regarding the effects of the pyrethroids and pyrethrins on listed species and their designated critical habitat for the registration review and suggested adoption of spatial data. In addition, CBD expressed concern about effects on pollinators and other beneficial insects,

---

\(^2\) See the agency’s Pollinator Risk Assessment Guidance online: https://www.epa.gov/pollinator-protection/pollinator-risk-assessment-guidance
effects on human health or environmental safety concerning endocrine disruption, and any additive, cumulative or synergistic effects of the use of these pesticides.

**EPA Response:** The EPA used the most current science policies and risk assessment methodologies to prepare the quantitative risk assessment for nine chemicals, in addition to completing a summary of the risks for the other pyrethroid chemicals in support of the registration review. The agency uses conservative exposure estimates to ensure that the risks are not under-estimated. The agency plans to address pollinator, ESA, and endocrine disruption on a chemical by chemical basis and not across this group of chemicals. Therefore, these issues will be addressed in each chemical-specific Proposed Interim Decision (PID). The EPA plans to address many of the concerns regarding listed species as part of the implementation plan for assessing the risks of pesticides to listed species based on the recommendations of the April 2013 National Academy of Sciences (NAS) report. Information on the Endangered Species Assessment will be located in each chemical-specific pyrethroid PID, to provide more information on the agency’s path forward on ESA. Information on the Endocrine Disruptor Screening Program is also described in each chemical specific PID. The EPA is currently developing an agency policy on how to consider claims of synergy being made by registrants in their patents. The EPA intends to release this policy for public comment. After the agency has received and considered public comment on the proposed policy, and once that policy has been finalized, EPA will consider its implications on the EPA’s final decision for each individual pyrethroid chemical.

3. **Comments on Modeling Refinements:** Many commenters suggested refinements and/or alternatives to the Pesticide in Water Calculator (PWC) and the Pesticides in Flooded Agriculture Model (PFAM) modeling conducted in the agency’s pyrethroid risk assessment.

**EPA Response:** Because the EPA’s models are not designed to specifically model pyrethroids, it makes sense that making a series of adjustments to the Pesticide in Water Calculator (PWC) or the Pesticides in Flooded Applications Model (PFAM), or using alternative models, might produce lower or higher pyrethroid exposure estimates, sometimes dramatically. Similar arguments could be made for different adjustments or different models for other pesticides.

The EPA agrees that many of the assumptions used in modeling could result in high-end estimates of potential exposure. Agency models and parameter estimation techniques are designed to provide conservative (protective) estimates of pesticide concentrations in water. The EPA understands that it is important to consider how the assumptions in its models might bias exposure estimates either higher or lower. In many instances, the EPA quantitatively assessed how potential refinements would impact exposure estimates as part of its pyrethroid risk assessment. For suggested refinements that were not considered in the pyrethroid risk assessment, the agency considered these qualitatively in its risk management of the pyrethroids. This is reflected in the *Pyrethroids and Pyrethrins: Ecological Risk Mitigation Proposal For 23 Chemicals.* The EPA is continually improving the PWC, PFAM, and other regulatory models, model scenarios, and guidance to improve exposure estimates while still maintaining a degree of conservatism that aligns with the agency’s protection goals, as well as a consistent approach for evaluating all registered pesticides. Some of these improvements are discussed in this response to comments document.
Finally, it is important to note that risk assessments do not always rely exclusively on modeling. In the case of pyrethroids, additional lines of evidence are available that reflect exposure in the real world, including monitoring data and incidents. These lines of evidence allow for a more complete characterization of the exposure and risk that can occur in aquatic systems.

4. **Comments on Use of Higher-Tier Studies:** Multiple stakeholders, most notably the Pyrethroid Working Group (PWG) and California stakeholders, were concerned that credible/higher tier studies were not sufficiently incorporated into agency’s pyrethroid risk assessment, such as sediment degradation studies, wash-off studies, mesocosm studies, bioassessment studies, and monitoring studies.

**EPA Response:** The EPA acknowledges the work of the PWG, California’s Water Boards, the California Department of Pesticide Regulation, and others to generate data to address various gaps in knowledge about the pyrethroids. While these data may not have been used to estimate exposure concentrations for the risk assessment, this work has been considered in the risk management process in order to provide context/characterization for the risk assessment, and to develop mitigation options. The agency’s responses throughout this response to comments document and discussion of these data in the *Pyrethroids and Pyrethrins: Ecological Risk Mitigation Proposal For 23 Chemicals* are a reflection of the importance of these data to the agency’s risk conclusions and risk management of pyrethroids. Note that for many of the submitted studies, a Data Evaluation Record (DER) has been generated and is included in the pyrethroid-specific dockets. These DERs provide a detailed evaluation of a particular study that goes beyond the depth that can be provided in a response to comments document or risk mitigation proposal.

5. **Pyrethroid Working Group (PWG) Risk Assessment Approach:** The PWG, a consortium of pyrethroids registrants, conducted an ecological risk assessment entitled “*Pyrethroid Working Group Response to the EFED Preliminary Risk Assessment (PRA) for Pyrethroids and Pyrethrins*” that was intended to refine the standard methods used for ecological risk assessment for aquatic organisms by the Office of Pesticide Programs. The PWG’s quantitative risk estimates in its assessment used the following:
   - A new aquatic Level of Concern (LOC) to evaluate the presence of risk
   - Species sensitivity distributions to estimate the toxicity threshold
   - Calculations of risk quotients using the 5th percentile of a species sensitivity distribution (rather than the single most-sensitive species)
   - A conceptual model based on National Hydrography Dataset plus (NHD+) catchments (rather than a 10-hectare watershed adjacent to a farm pond)
   - Percent Cropped Area (PCA) refinements across all NHD+ catchments for each crop of interest
   - Percent Crop Treated (PCT) refinements
   - Estimation of the runoff reduction and eroded sediment loading based on label-required 10-foot Vegetated Filter Strips (VFS)
   - Organic-carbon normalized sediment-water distribution coefficients derived using solid-phase microextraction (SPME)
   - On-field soil photolysis as a Pesticide Root Zone Model (PRZM) input
• Mean metabolism half-lives (rather than the upper 90% confidence bound estimates)
• An experimental drift curve from Spray Drift Task Force data set to represent the drift from ground sprays at the label-specified limit of 15 miles per hour (rather than the more generic drift curves estimated with AgDrift³)

The assessment also included a review of mesocosm and monitoring data and an analysis of sources of uncertainty. Based on its assessment, the PWG concluded that risks to aquatic organisms were much lower than the risks reflected in the EPA’s risk assessment.

EPA Response: The PWG’s assessment reflects major changes to the conceptual model of exposure, the toxicity thresholds, and aquatic Levels of Concern (LOC) the agency uses in quantitative risk assessment. The PWG changed the reference watershed from the agency’s 10-hectare watershed to watersheds of varying dimensions based on National Hydrography Dataset Plus (NHD+) catchments, which can be 100 times larger⁴. While the agency uses the most sensitive test species to represent toxicity across all aquatic organisms in that taxonomic group, the PWG selected the less conservative 5th percentile endpoint across aquatic species their Species Sensitivity Distributions (SSDs). The agency uses an aquatic LOC based on a one-in-ten-year exceedance at a vulnerable use site that is representative of the 90th percentile of all sites across the United States where that specific type of application occurs (e.g., a corn field for which 90 percent of all other corn fields are less vulnerable to runoff). In contrast, the PWG pooled the all site years for all uses and used a 90% vulnerability threshold across those site years as the basis for its LOC. The PWG’s risk assessment does not describe why this LOC is used instead of the agency’s LOC. The agency is unable to interpret the meaning and relevancy of the PWG’s aquatic LOC for real-world aquatic risk because it pools site years across all use types. This also makes the direct comparison of LOC exceedances between the PWG’s risk assessment and the agency’s risk assessment inappropriate.

Apart from these fundamental differences in policy and level of protection choices between the PWG and the agency’s risk assessment approaches, the other refinements made and advocated by the PWG reflect known conservatism or limitations in the EPA’s current aquatic modeling. The PWG treated these as precise quantitative “multiplier factors” which they compared with the agency’s risk quotients to determine the magnitude with which the agency overestimated risk. Table 1 below lists the major factors that the PWG believes caused the agency’s risk conclusions to overestimate potential risk to aquatic organisms that it identified in its assessment, as well as a summary of the agency’s perspective on these factors.

In general, the agency agrees that some of the points brought up by the PWG are valid, although more work would be needed to adopt their suggestions for quantitative exposure modeling. Given the complexity of pesticide transport for all conditions nationwide and the policy decisions inherent with choosing scenarios and input values for aquatic exposure models, however, the agency strongly

---

³ AgDrift is a terrestrial model used to assess a variety of spray drift conditions from agricultural applications and off-site deposition of liquid formulation of pesticides.

⁴ Larger watersheds typically include areas where pyrethroids are not used. Runoff from such areas ‘dilute’ pyrethroid concentrations running off the areas where pyrethroids are used. EPA specifically models a small field-scale watershed draining to a farm pond because these are considered to be the most vulnerable waterbodies with 100% of their watershed being treated with the chemical being assessed.
disagrees with the PWG’s contention that they have accurately calculated factors by which the agency overestimated “correct” exposure concentrations. The agency’s more detailed responses on each of the factors listed in Table 1 are addressed in detail in this response to comments document.

**Table 1. Summary of EPA Response to PWG Multiplier Factors Applicable Across Use Patterns**

<table>
<thead>
<tr>
<th>PWG Factors for “More Appropriate Screening” in Risk Assessment</th>
<th>PWG Multiplier Factor Range</th>
<th>EPA Agreement based on Currently Available Data</th>
<th>EPA Response on Multiplier Factor Range Accuracy</th>
<th>Applicable to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ag Uses</td>
</tr>
<tr>
<td>Anaerobic Aquatic Half-Life</td>
<td>1-12X</td>
<td>Disagrees</td>
<td>N/A</td>
<td>X</td>
</tr>
<tr>
<td>Aerobic Aquatic Half-Life</td>
<td></td>
<td>Disagrees</td>
<td>N/A</td>
<td>X</td>
</tr>
<tr>
<td>Aerobic Soil Half-Life</td>
<td>1.08-24.3X</td>
<td>Disagrees</td>
<td>N/A</td>
<td>X</td>
</tr>
<tr>
<td>Soil Photolysis Half-Life</td>
<td>1.00-7.30X</td>
<td>Useful for Characterization</td>
<td>Would result in minimal impact to RQs</td>
<td>X</td>
</tr>
<tr>
<td>Foliar Degradation Half-Life</td>
<td>1.41-4.75X</td>
<td>Agrees</td>
<td>Would result in minimal impact to RQs</td>
<td>X</td>
</tr>
<tr>
<td>Use of SPME-derived Koc</td>
<td>2.9-80X</td>
<td>Useful for Characterization</td>
<td>N/A</td>
<td>X</td>
</tr>
<tr>
<td>Peak to 24-hour Water Column Time-Weighted Average</td>
<td>3.8-7.4X</td>
<td>Useful for Characterization</td>
<td>N/A</td>
<td>X</td>
</tr>
<tr>
<td>Burial</td>
<td>1.14-3.93X</td>
<td>Useful for Characterization</td>
<td>Would result in minimal impact to RQs</td>
<td>X</td>
</tr>
<tr>
<td>Acute water column endpoint</td>
<td>17.3-1015X</td>
<td>Disagrees</td>
<td>N/A</td>
<td>X</td>
</tr>
<tr>
<td>Chronic water column endpoint</td>
<td>8.11-374X</td>
<td>Disagrees</td>
<td>N/A</td>
<td>X</td>
</tr>
<tr>
<td>Chronic pore water endpoint</td>
<td>11.6-1140X</td>
<td>Disagrees</td>
<td>N/A</td>
<td>X</td>
</tr>
<tr>
<td>Chronic sediment endpoint</td>
<td>1.11-37X</td>
<td>Disagrees</td>
<td>N/A</td>
<td>X</td>
</tr>
</tbody>
</table>

N/A = Not Applicable
6. **PWG Comment on Metabolism Half-lives:** In its risk assessment, the PWG used mean estimates of metabolism half-lives asserted that the EPA’s aerobic soil, aerobic aquatic, and anaerobic aquatic metabolism half-life inputs based on the upper 90% confidence bound on the mean were highly conservative. For aerobic and anaerobic aquatic metabolism, the PWG stated that the EPA should have used aerobic and anaerobic aquatic metabolism half-lives from Meyer 2012 and Meyer et al. 2013 for its modeling input calculations. The PWG stated that this study compared the aerobic and anaerobic degradation for each of the PWG pyrethroids using the same three sediments and demonstrated that most pyrethroids degrade similarly in aquatic systems. For aerobic soil metabolism, PWG believes that the use of field dissipation study half-lives is more appropriate given the extreme hydrophobic nature of pyrethroids that reduces the potential for loss and dilution down the soil profile, as well as the number of field dissipation studies available across the chemical class.

**EPA Response:** The agency does not agree that it used overly conservative approaches to calculate aerobic soil, aerobic aquatic, and anaerobic aquatic metabolism. The agency uses the half-life inputs based on the upper 90% confidence bound on the mean to protect against underestimating the risk due to the large uncertainties in metabolism half-lives resulting from the large background variability (coefficients of variation = 80-100%) and small sample size, usually 1-4 measurements. Using the mean value will generate EECs more likely to be the same as those seen in the environment at sites similar to that being modeled but will underestimate the exposure and consequent risk about half the time, and thus not be protective of wildlife. As a result, the agency’s pyrethroid risk assessment used standard input values that were calculated based on the agency’s Input Parameter Guidance v.2.1\(^5\). The input guidance takes into consideration the number of half-life values available, as well as the standard deviation of those values. The EPA disagrees with the PWG’s proposed refinements for these half-life values for the reasons outlined below.

With regard to aerobic soil half-life values, the EPA does not support the substitution of field dissipation half-lives for half-lives from laboratory studies. In the field, multiple routes of dissipation may occur besides aerobic soil metabolism (e.g., soil photolysis, leaching, runoff, sorption, volatilization, etc.). As a result, various fate and transport routes that are already accounted for in the PWG the would be double-counted by using half-lives from field dissipation studies (e.g., sorption and volatility). Therefore, the EPA believes that it is not appropriate to use field dissipation half-lives in lieu of aerobic soil metabolism half-lives, which are obtained under controlled laboratory conditions (e.g., in the dark, in constant temperature, etc.).

With regard to the aquatic metabolism half-life values, the EPA determined that the comparative aerobic and anaerobic aquatic metabolism study cited by PWG (MRID 48762908) is not suitable for use quantitatively in the risk assessment for several reasons. First, it used cold material instead of radiolabeled material and it could not be determined whether all the pyrethroid test substances were fully extracted or whether there are unextracted residues or degradation products of concern.

---

\(^5\) The Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides is available online: https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/guidance-selecting-input-parameters-modeling
Second, the test material was measured in the sediment and water combined instead of measuring the amount of pyrethroids in the water and in the sediment separately. Third, the runs were conducted for a period of up to 108 days while for many of the pyrethroids, the calculated DT$_{50}$ and/or DT$_{90}$ were well above 100-108 days testing period. Fourth, for two of the aerobic sediment systems, the sediment may not have been aerobic. Finally, for a large number of chemicals, the initial concentrations were relatively low.

7. **PWG Comment on Foliar Dissipation Half-life:** The PWG asserts that the EPA used a highly conservative aquatic exposure modeling approach by using a 35-day foliar degradation half-life. The PWG states that the EPA should have used the foliar dissipation half-life of 5.3 reported by Willis and McDowell (1987) that was subsequently cited in the Pesticide Root Zone Model (PRZM) manual as a value to use for pyrethroids (EPA 2005).

**EPA Response:** The EPA acknowledges that use of a 35-day foliar dissipation input for foliar degradation in the aquatic modeling was a mistake in the pyrethroid risk assessment. PRZM has inputs for foliar degradation, which by default is set to zero in the absence of data, and foliar washoff, which is set to have half the pesticide residues on foliar surfaces with each centimeter of rain (USEPA 2009).

Use of the 35-day foliar dissipation half-life or another foliar dissipation half-life as the foliar degradation input is inappropriate, because it would remove pesticide residues from consideration for further transport. This is because any pesticide dissipation achieved by wash-off from the vegetation to the field soil below is still available for runoff and erosion to aquatic environments. In the risk assessment, the EPA considered whether the foliar dissipation inputs changed substantially when using 0 or 35 days. The risk assessment compared modeling results for two pyrethroids using 0 and 35-day foliar dissipation half-lives, and the resulting estimated exposure concentrations were very similar. As a result, the EPA does not expect the use of the 35-day half-life to change the overall risk conclusions of the assessment. For more details, see the risk assessment.

8. **PWG Comment on Soil Photolysis:** The PWG views soil photolysis (during the periods when crop cover is not present) as a significant route of dissipation in the field between applications and significant erosion events for certain PWG active ingredients. The PWG provided estimates of how this may impact the risk quotients in the risk assessment.

**EPA Response:** The Agency agrees that pyrethroids will be subject to soil photolysis when residues are on the soil surface and sunlight is not intercepted by the crop canopy. However, the PWC model does not allow time-varying application of soil photolysis based upon crop cover and was thus not considered quantitatively. The agency acknowledges that this may have led to an overestimate of residues in surface water in the risk assessment. The PWG found that in most cases, however, soil photolysis did not contribute significantly to the dissipation of the pyrethroids.

While soil photolysis can occasionally be a major route of dissipation, in most cases, it much less important than metabolic degradation. The PWG simulated soil photolysis in the top 2 mm of the soil and turning off photolysis when the canopy closes. While this probably overestimates degradation somewhat (and consequently underestimate residues in surface water), the agency considers this to be a reasonable approach to accounting for soil photolysis.
9. **PWG Comment on Using Solid-Phase Microextraction:** The PWG developed alternative estimates of soil adsorption or partition coefficient ($K_{oc}$), or measures of the mobility of a substance in soil, using solid-phase micro extraction (SPME) instead of liquid-liquid extraction (LLE) to remove the pyrethroid from solution. The PWG noted that its $K_{oc}$-SPME and $K_{DOC}$-SPME coefficients were similar to those reported in the literature by University of California Riverside (Cui and Gan 2013). The PWG asserted that the EPA should use partition coefficients based on solid-phase microextraction (SPME) for more realistic estimates of potential aquatic exposures and interpretation of whole water monitoring data. Despite this assertion, the PWG is pleased that the EPA acknowledged the potential importance and impact of using the SPME data in its risk characterization.

**EPA Response:** The Agency acknowledges that the LLE method removes chemical that adsorbed to dissolved and suspended material in solution, and thus underestimates the partition coefficient. The Agency also agrees that the SPME method avoids extracting the pesticide off the dissolved organic carbon and $K_{oc}$ measurements made using this method are expected to be more accurate. In concept, the EPA agrees that the use of $K_{oc}$-SPME to calculate freely dissolved concentrations is appropriate for quantitative ecological risk assessment. In the case of pyrethroids, however, the $K_{oc}$s measured using the SPME method were measured at only one concentration, rather than at a range of 5 different concentrations. This deficiency drastically reduced the utility of this data, as it was not possible to evaluate the full sorption isotherm. While the data are suitable for demonstration of the superiority of the method, and the data generated can be used to characterize the uncertainty in the assessment, but it is not of sufficient quality to replace the values generated from regular guideline studies. Therefore, the standard $K_{oc}$s used in the risk assessment were not replaced with the $K_{oc}$s derived by the SPME method.

Furthermore, it is not correct to say that the SPME $K_{oc}$s were not considered in the risk assessment. This line of evidence is discussed in some detail in Section 7.2.4: Alternative KOC Values, Use of $K_{oc}$ SPME free in Part II of the draft assessment (also in Section 7.2.5 in Part III). In this section, the risk assessment reports that the SPME $K_{oc}$s measured from the single concentration were about an order of magnitude greater than the standard $K_{oc}$ used in the risk assessment. The effect of this on estimated environmental concentrations was explored through a series of model runs for deltamethrin and esfenvalerate. The resulting EECs were generally at least an order of magnitude lower for acute and chronic exposures in the water column, and for acute exposure in sediment pore water. Based on a higher $K_{oc}$ SPME free value, the chemical was assumed to be redistributed in the standard pond with more pyrethroid moving towards the sediment than to the water (i.e., equilibrium was established based on the set $K_{oc}$ value).

The acute RQs were lower using the $K_{oc}$ SPME free, due to the use of the same endpoint based on a water column acute test; however, the risk conclusions are the same. In order to obtain applicable chronic RQs, the pore water endpoints were recalculated, based on the sediment endpoint and the corresponding $K_{oc}$ (standard LLE or SPME free). For example, the pore water chronic endpoint for deltamethrin for the runs using the standard LLE $K_{oc}$ is 12 μg/kgOC/449,000 L/kgOC = 0.000026 μg/L. Meanwhile, for the runs using the $K_{oc}$ SPME free, the endpoint is 12 μg/kgOC/3,661,709 L/kgOC =
3.19x10-6 μg/L. As a result, the chronic RQs for benthic organisms, calculated using the adjusted endpoints were similar using both KOC values. Pore water RQs ranged from 0.04 to >64 for urban uses and 1.2 to >259 for agricultural uses, whereas respective RQs using regular KOC ranged from 0.06 to 81 for urban uses and from 1.5 to 260 for agricultural uses, resulting in similar risk conclusions. Based on this characterization, the EPA expects that while risk quotients would be reduced, the agency’s risk conclusions for aquatic invertebrates would not change.

While SPME was not used directly to calculate EECs in the pyrethroid risk assessment, it has provided useful additional characterization of the accuracy of the partition coefficients estimated by using the LLE method and the EEC resulting from their use, and indicates that EECs may be overestimated in the water column and less available to aquatic life than modeled in the agency’s risk assessment.

10. **PWG Comment on Spray Drift Estimates:** The PWG advocates for the use of spray drift data specific to wind speeds of 15 miles per hour (mph) and use of the RegDisp spray drift calculator in the agency’s pyrethroid risk assessment.

**EPA Response:** The pyrethroid products registered by the PWG have a 10-mph wind speed limit for aerial sprays and a 15-mph limit for ground sprays. However, the model the Agency uses for ground spray in AgDrift does not consider wind speed explicitly – a curve representing the 90th percentile of all drift curves with a fine to medium spray nozzle is used to represent the higher wind allowed on the label. In its risk assessment, the PWG selected a single trial from the Spray Drift Task Force data that was used to develop the AgDrift ground spray drift curves which was taken during a wind speed of 15 mph (the droplet size spectrum was not identified) and a spray drift calculator called RegDisp. While the Agency agrees that the attempt to account for the higher wind speed is appropriate, the RegDisp tool uses only 4 swaths of 45 feet rather than the 20 swaths which are the default in AgDrift. While the swaths near the edge of the modeled field contribute most of the off-site drift, significant drift still comes from more distant swaths from the interior of the treated area – particularly at higher wind speeds. In addition, there is some significant variance, from spray drift event to spray drift event, that is not accounted for with current regression approaches like that in AgDrift and RegDisp. With a single trial, it cannot be known whether this particular trial resulted in more or less drift than the typical event at this wind speed and droplet size spectrum. In addition, the Agency has not approved the RegDisp tool for use in risk assessments because the supporting QA/QC for the analytical chemistry measurements are not available.

11. **PWG Comment on Use of Peak EECs:** The agency used peak EECs (i.e., instantaneous concentrations) for the risk assessment instead of 24-hour time-weighted averages. The PWG believes that this results in unrealistic EECs, asserting that the use of the peak concentration assumes that all the drift, runoff and erosion predicted for a day arrive at precisely the same instant and are then perfectly and instantly mixed.

**EPA Response:** The use of the peak instead of the 24-hour time-weighted averages for acute aquatic modeling was the standard practice in EPA at the time the pyrethroid ecological risk assessment was issued in 2016. On June 27, 2017, EPA issued new guidance about the use of the alternative
approach for acute exposure estimates, with a justification like the one in the PWG comment. The EPA does not expect that this change in modeling practice, if implemented at the time of the pyrethroid risk assessment, would change the agency’s overarching risk conclusions for aquatic organisms.

12. PWG and CASQA Comments on Use of Aquatic Toxicity Endpoints: The PWG disagreed with the EPA’s toxicity endpoint selection for aquatic organisms in the agency’s pyrethroid risk assessment. The PWG commented that the agency did not acknowledge that some aquatic taxa are much less sensitive to pyrethroids than represented by risk quotients in the agency’s risk assessment (e.g., mollusks are consistently less sensitive than *Hyalella azteca*, and amphibians are less sensitive than fish). As such, the PWG asserted that, given the amount of aquatic toxicity data for pyrethroids as a class and for select active ingredients, the aquatic effects endpoints should be generated via a species sensitivity distribution (SSD) approach rather than relying on endpoints for the most sensitive species. The PWG preferred the use of the 5th percentile of the SSD instead of endpoints from the most sensitive species, which they argue is consistent with water quality criteria in the US and most other countries. This is the approach that the PWG used in its risk assessment, accomplished in this instance by creating an SSD from LC50s for each species and each pyrethroid that were normalized using the *Hyalella azteca* LC50 of the same pyrethroid (i.e., the endpoint for the most sensitive species to all pyrethroids tested). Further details on the PWG’s approach may be found in its risk assessment6.

On the issue of species sensitivity and endpoint selection, comments from the San Francisco Bay Regional Water Quality Control Board contrast greatly with those from the PWG. The Board argued that *Hyalella azteca* are not uniquely sensitive to pyrethroids, citing data suggesting similar sensitivities in amphipods, *Eohaustorius estuarius* and *Austrochiltonia subtenuis*, as well as the mysid shrimp, *Americamysis bahia* (formerly *Mysidopsis bahia*). The comments also highlighted the lack of comparative toxicity information with “published water LC50 data for only four amphipod species within two genera (*Hyalella* and *Gammarus*), while nearly 10,000 species of amphipods have been identified in 1,700 genera, meaning there are published LC50 data for 0.04% of the known species. Given this limited data set, it would be imprudent to presume that *H. azteca* is unique in its pyrethroid sensitivity.”

**EPA Response:** The selection of an endpoint with which to describe the potential risk from exposure to pyrethroids is a matter of science policy. As the PWG indicates, the SSD approach is one way to evaluate the toxicity of a pesticide or family of pesticides and it uses this approach when warranted. However, the agency does not agree that use of a toxicity threshold from an SSD is a more “correct” expression of potential risk to aquatic organisms than use of the most sensitive endpoint for each taxon.

The agency agrees with the PWG that the SSDs for the pyrethroids indicate that some aquatic taxa appear to be less sensitive than others generally. The agency also acknowledges that use of toxicity data from a small subset of organisms to screen for risk to a large, diverse set of organisms brings

---

with inherent uncertainty in making risk conclusions. The agency considers both these issues in its risk management approach for the pyrethroids.

13. PWG Comment on RQ Discrepancies: The PWG noted a discrepancy in the agency’s risk quotient calculations. The agency’s risk assessment stated that application rates for the less-resolved active ingredients (cypermethrin, cyfluthrin, and lambda-cyhalothrin) were used for exposure modeling, and “were assumed to cover the other compounds which usually have lower application rates” (PRA Section II, p. 4). The PWG noted that, in several cases, toxicity data for the refined-isomer active ingredients were selected as endpoints for comparison with EECs in deriving RQs. For example, the gamma-cyhalothrin LC50 for *Hyalella azteca* was used as the acute toxicity endpoint for freshwater invertebrates and compared with EECs for lambda-cyhalothrin (despite an 18x difference), and the beta-cyfluthrin LC50 for rainbow trout was used as the acute toxicity endpoint for freshwater fish and compared with EECs for cyfluthrin. In such cases, it resulted in overestimation of RQs by a factor of ≥2.

**EPA Response:** The EPA acknowledges uncertainty in interpreting the data sets available for pyrethroids with multiple isomeric ratio formulations. For example, if cyfluthrin rainbow trout toxicity data were used (LC50 of 0.209-0.302 µg a.i./L, MRIDs 46426708 and 46426705), rather than the lambda-cyfluthrin endpoint that was used (LC50 of 0.068 µg a.i./L, MRID 45375002), the RQ would be reduced by a factor of 3-4, and some of the agricultural and urban uses would have resulting RQs that fall below the level of concern. Conversely, the 18x suggested difference in aquatic invertebrate acute endpoints for the cyhalothrins, resulting from both the toxicity difference between lambda-cyhalothrin and gamma-cyhalothrin and sensitivity differences among taxa (i.e., use a species-sensitivity distribution versus a single *Hyalella* endpoint), would not change the risk conclusions due to RQs ranging from 24-62,500 for down-the-drain, agricultural, and urban uses.

The agency acknowledges that refinement of isomerization for both toxicity endpoints and exposure estimates for some compounds might make a difference in a limited set of the risk conclusions. However, such refinement would require data sets and modeling tools that demonstrate the persistence of isomeric ratios throughout both the fate and effects study data. Even for the most compelling cases (e.g., the rainbow trout example above), resolution of the uncertainties would not likely reduce risk estimates on an order that would alleviate risk concerns for all aquatic taxa.

14. PWG and Central Valley Regional Water Control Board Comments on Existing Water Monitoring Data: The PWG commented that the pyrethroid monitoring database over-represents higher exposure settings and events (e.g., small streams, storm events, sediment depositional areas). The RQs calculated in the agency’s risk assessment used maximum monitored concentrations, which PWG argued are extreme outliers from highly skewed distributions, often representative of anomalous or worst-case situations such as storm drains during storm events and which do not reflect receiving waters, and liable to be caused by errors in sampling or chemical analysis and reporting. The PWG also argued that freely dissolved concentrations in whole water samples were calculated incorrectly (i.e., not corrected using SPME derived KOC values). The PWG argues that it is inappropriate to compare modeled exposure concentrations to monitored RQs for those reasons.
The Central Valley Water Board has a contrasting view of monitored data in California, expressing concerns regarding pyrethroid detections in monitoring data where recent studies have shown that pyrethroid pesticides “are present in waters at levels that threaten aquatic ecosystems and exceed water quality standards for toxicity. These water quality impairments, and the responses they require under the Clean Water Act, have significant potential to impact aquatic life, and therefore, water supply reliability and significant potential costs for the State and regulated community.”

**EPA Response:** While the agency agrees with the PWG that higher-exposure settings and events are represented within the pyrethroid monitoring database, only a portion of the thousands of samples represent highly vulnerable scenarios, and only a small number of them were taken at any one vulnerable site. As a result, the magnitude of the concentrations detected in the samples at these vulnerable sites do not preclude the possibility or likelihood that greater concentrations actually occur at other sites not represented in the data set. In addition, while some monitoring data are clearly targeted and may capture peak concentrations (i.e., publicly owned treatment works outflows), the majority of monitoring samples in the available monitoring data are non-targeted with infrequent sampling. As such, the majority of the data are not expected to capture the range of potential concentrations that may occur in the environment and likely underpredict exposure (Crawford, 2004; Carpenter et al., 2019; Vecchia, 2018; Mosquin et al., 2018). Regarding calculation of freely dissolved concentrations, the agency disagrees that the SPME-derived KOC values can be used quantitatively at this time to calculate these concentrations. Please see the agency’s responses on this topic earlier in this document.

The agency does not agree with the PWG that it is inappropriate to compare modeled and monitored concentrations, the agency acknowledges that there is uncertainty inherent in such comparisons. In situations where the agency’s conceptual models are more comparable to the circumstances under which sampling occurs (i.e., when the monitoring samples include storm events, effluent releases, and/or frequent enough intervals to capture peak concentrations) there is less uncertainty associated with the direct comparison of modeled and monitored concentrations. In situations where the monitoring samples are taken at infrequent intervals and/or at locations that are less comparable to the agency’s conceptual models, there is more uncertainty in the comparison of modeled and monitored concentrations. The agency also notes that its conceptual models and resulting EECs are intended to be representative of vulnerable sites and circumstances (i.e., conservative), and, as such, would be expected to overestimate exposures observed in less vulnerable situations (e.g., downstream locations, scoured stream beds without sediment, sites with a lower occurrence of storm events).

Ultimately, when considering risk to aquatic invertebrates, the suitability of comparing EECs to monitoring data become less and less relevant when a compound is sufficiently toxic to pose risk at extremely low concentrations that may be found at less vulnerable sites. Even though the EPA’s scenarios may be conservative, and even though there is uncertainty when comparing modeled and monitored concentrations, monitored concentrations still result in risk to aquatic organisms in many instances that would not be considered “worst case.” Concern about these situations is reflected throughout comments received from California stakeholders who are concerned about water quality
impairments, and the responses they require under the Clean Water Act. This is addressed further in the next response.

15. PWG’s Submission of Water Monitoring Data: The PWG conducted a multi-year monitoring study (Goodwin et al., 2015) in the Lower American River in Sacramento, CA that was submitted after the agency’s risk assessment was published. This study demonstrates that, even when pyrethroids are at measurable concentrations following runoff, the residues are extremely spatially variable and decrease very rapidly via mixing and dilution. In dry weather conditions, no pyrethroid residues were present above the reporting limit. When water column residues were present in storm event sampling, the residues tended to be low and occurred above the reporting limit 17% of the time. When they occurred, pyrethroid water column residues were transient and variable across the river width at any given location. Residues were shown to disperse downstream of storm water entry points and the higher residues tended to remain close to the bank near entry points before dispersion. Backscatter flow data indicate that the highly variable local flow velocities in this fast-flowing complex hydrological system contribute to rapid dilution and dispersion. Sediment sample concentrations were low and variable; few sediment samples could be obtained since there is little depositional sediment at most sampling locations due to the fast flow and other local and upstream hydrological factors.

EPA Response: Because of the chemical characteristics of pyrethroids, it is to be expected that they will be transported with sediment and concentrated in depositional zones. As a result, pyrethroid residues might not be expected in areas of flowing water bodies where bed sediment has been removed by scouring. As the depth and flow velocity of rivers change with seasons and storms, the portions of a river bed with deposited sediment can change. Slower flowing streams, lakes, and ponds could have more uniform bed sediment.

The Goodwin et al, 2015 study reinforces that stream beds are not uniform and that the detection of pyrethroid residues near a residential outfall does not mean that pyrethroid concentrations will be found at the same level throughout the water body. Depending on the amount of residues entering a water body, the size of the water body and the rate of flow, it stands to reason that dilution and dispersion could greatly reduce concentrations of pyrethroids below levels of concern. Similarly, benthic invertebrates that rely on that sediment for habitat may not be present in the faster-flowing parts of streams where sediment has been scoured away.

These facts do not reduce the concerns of other commenters for the risk to aquatic organisms and the potential costs that might be incurred from impaired water bodies under the Clean Water Act. Commenters from California have cited studies, such as those by Weston et al., 2013 and others, which sampled sediment where it is present and could be collected. Concentrations of pyrethroids in sediment at levels toxic to the most sensitive aquatic invertebrates tested are sufficient to lead to classification of a water body as impaired, even if it is unlikely that pyrethroid residues could be found throughout the river. Mitigation measures put into place for residential/urban uses of pyrethroids by the agency in coordination with the State of California are designed to reduce potential loading while acknowledging the benefits pyrethroids provide.
16. **PWG and CASQA Comments on Use of Mesocosm Studies:** The PWG commented that many pyrethroid mesocosm studies provide information supporting the expectation of no adverse environmental effects from pyrethroid exposures. They state that, due to processes not accounted for in exposure modeling, mesocosm studies confirm that pyrethroid exposures decrease in water bodies significantly faster than predicted in modeling. They also assert that mesocosm studies demonstrate that laboratory toxicity study endpoints do not translate into ecosystem-scale primary or secondary impacts. Finally, the PWG claims that mesocosm studies show that, after short-term effects, ecosystem-level recovery occurs rapidly even with doses higher than those predicted by screening level modeling.

In contrast to the mesocosm studies cited by the PWG, the California Stormwater Quality Association (CASQA) commented that pyrethroid exposure has also been associated with structural and functional changes in aquatic invertebrate communities (Rogers *et al.*, 2016).

**EPA Response:** Historically, mesocosm data conducted under FIFRA have been difficult for the agency to interpret, and there are multiple confounding factors contributing to uncertainty in the results. Mesocosm studies assess numerous endpoints/attributes with finite resources, such that none are assessed with the level of rigor needed to draw definitive conclusions. More importantly, however, mesocosm studies are not focused in such a way that they can easily relate to risk assessment endpoints and the agency’s risk management objectives. For example, a mesocosm study that shows there is a recovery after a short-term, single-pulse exposure does not address the agency’s objective of reducing aquatic risk as a result of repeated exposures, long-term exposures, and retention of species diversity in the aquatic community, which are all considerations in the agency’s risk management approach to pyrethroids.

With this context in mind, the agency agrees with the PWG that the individual species sensitivity in the mesocosm studies comports with laboratory studies, which is expected. However, because the mesocosm studies indicate that aquatic community structure and function are impacted by pyrethroid exposures, and because the mesocosm studies do not consider the impact of repeated and longer-term exposures, the agency does not agree with the PWG’s assertion that pyrethroids do not result in adverse environmental effects based on the mesocosm study results.

Additionally, while the agency agrees that there are processes present in mesocosm studies (and in the environment) that are not accounted for in exposure modeling and could reduce estimated exposure concentrations, real-world monitoring data indicate that pyrethroids are present in the environment that result in adverse effects to aquatic invertebrates.

While the available mesocosm data provide some valuable characterization about short-term exposures and the potential for individual species recovery, they are generally consistent with the agency’s risk conclusions regarding the individual toxicity endpoints and short-term impacts on aquatic invertebrate communities.

17. **PWG and California Water Boards Comments on Macroinvertebrate Communities:** The PWG commented that thriving populations of macroinvertebrates are found where sediment residues are
present at potentially toxic concentrations in several multi-year bioassessments conducted in California (Hall et al., 2013a; 2016; Hall et al., 2008; 2009a; 2009b; 2012c; 2013b; 2013c; 2013d). Based on these studies, the PWG asserts that benthic macroinvertebrate community status is generally uncorrelated with pyrethroid residues but responds more to other stressors, especially habitat quality, and that there is recovery potential even in extreme exposure settings as a result of refugia that occur in both static and flowing receiving waters. The PWG also provided data showing that *Hyalella azteca* have developed resistance to pyrethroids in surface waters, asserting that pyrethroid resistance may be a mechanism for greater resiliency in aquatic ecosystems (Weston et al., 2013).

In contrast to the PWG’s comment, the California Water Boards noted that pyrethroids are impacting stream biota, citing an investigation by Phillips et al. (2016) of the relationship between water quality indicators and benthic macroinvertebrate assemblages in California. The Water Boards stated that these studies showed a significant positive correlation between amphipod survival in laboratory toxicity tests and the California Stream Condition Index (CSCI) calculated from bioassessment data.

**EPA Response:** The EPA acknowledges that aquatic invertebrates are subject to multiple stressors in water bodies, that pyrethroid exposures are one of those stressors, and that it is likely not the most important stressor in many situations. In characterizing risk to aquatic organisms, the EPA recognizes that some benthic communities may have higher resiliency due to diverse community structure, ample refugia, adequate population reservoirs for re-colonization, and other ecological attributes, while others may be more vulnerable to effects from pyrethroid exposure, which also may be exacerbated by other stressors.

The agency also acknowledges that resiliency of some aquatic invertebrates is a result of their development of pyrethroid resistance; however, the agency does not consider development of pyrethroid resistance in aquatic invertebrates to be an environmental benefit. Pyrethroid resistance in one aquatic invertebrate species is not an indicator of resistance in all aquatic invertebrate species; as such, the agency expects that there are aquatic species that will still be adversely impacted by pyrethroids because they have not developed pyrethroid resistance. Additionally, development of pyrethroid resistance in certain aquatic species could lead to undesirable changes in aquatic invertebrate community structure and function.

However, the agency received comments citing examples where pyrethroids (as opposed to other stressors) have been indicted in real-world effects (*e.g.*, the decline of important fish species in the Sacramento-San Joaquin Delta Estuary), as well as examples of uncertainties where laboratory results may underestimate risk, such as other sensitive species that have not been evaluated, and other modes of exposure (such as foodborne uptake among aquatic organisms) that have not been fully assessed (see comments from the San Francisco Bay Regional Water Quality Control Board, dated July 6, 2017). Pyrethroid exposure has also been associated with structural and functional changes in aquatic invertebrate communities (California Stormwater Quality Association, CASQA, comments dated July 7, 2017).
Based on the weight of evidence available, the Agency agrees with the California Water Boards that pyrethroids are expected to result in risks to aquatic biota in many situations. EPA has considered water quality issues in developing its ecological risk mitigation proposal for the pyrethroids/pyrethrins.

Agricultural Use Pattern Assessment Comments

18. **US Department of Agriculture (USDA), National Association of State Departments of Agriculture (NASDA), and other stakeholders’ Comments on Risk Mitigation:** There was general concern from many commenters with EPA proposing any mitigation or imposing any restriction to use sites based on the findings in EPA’s risk assessment. In addition, some commenters, including NASDA, were concerned that EPA’s risk assessment does not reflect the risk-benefit balancing required under FIFRA and overstates the potential risks of pyrethroids.

**EPA Response:** As part of the pesticide registration review process, as required under FIFRA, the agency must ensure that the use of the pesticide “will not generally cause unreasonable adverse effects on the environment,” while taking into account the economic, social, and environmental costs and benefits. After the agency completes a risk assessment, it considers the risks and benefits of that pesticide in the *Pyrethroids and Pyrethrins: Ecological Risk Mitigation Proposal For 23 Chemicals* which includes a section on the benefits of the pesticide. The agency balances the risk and benefits in the development of proposed mitigation in this document.

19. **PWG Comments on the Use of Vegetated Filter Strips in Modeling:** The PWG commented that the EPA’s pyrethroid risk assessment modeling should include the impact of the mandated 10-foot-wide maintained vegetative filter strip (VFS) on reducing sediment and pyrethroid loading into receiving waters should be considered in the screening PRA. The PWG asserted that VFS would be more effective for reducing pyrethroid transport than for other agrochemicals which may have larger fractions of the transported chemical in the more-difficult-to-control runoff phase. Since the ability of VFS to trap sediment is known with greater certainty than any other aspect of VFS performance and was used for calibrating the VFSMOD model, uncertainties regarding the prediction of pyrethroid removal by VFS will be lower than for other active ingredients. The PWG requests consideration for the impact of incorporating these mandatory vegetative filter strips in risk assessments.

**EPA Response:** Multiple stakeholders across the public and private sectors, including the EPA, agree that well-maintained VFS have been shown to be effective in reducing runoff of soil-bound pesticides to water bodies. EPA also agrees that the technology and supporting data exist to quantify the extent to which pesticide runoff is mitigated as a result of VFS.

Although the agency does not currently have an approvedmodel to quantitatively evaluate VFS efficacy, the Office of Pesticide Programs has met with stakeholders through the Center of Excellence for Regulatory Science in Agriculture (CERSA) conference, as well as with VFSMOD (Vegetative Filter Strip Modeling System) model developers and the PWG on this issue. As a result, the EPA has concluded that VFS and other erosion control measures would be particularly effective.
in agricultural settings for reducing pyrethroid runoff into water bodies. The EPA agrees that this type of mitigation approach is particularly appropriate for pyrethroids given their extreme hydrophobic nature. VFS and erosion control is therefore a key component of the EPA’s risk management proposal for pyrethroids. Moving forward, the EPA is working to improve its ability to quantitatively account for VFS effectiveness in its risk assessments.

20. PWG Comments on Burial of Residues via Sedimentation: The PWG stated that the agency’s pyrethroid risk assessment did not consider the impact of burial of pyrethroid residues by subsequent sedimentation in the water body. PWG indicated that incorporation of burial in PWC modeling would reduce water column EECs to some degree, and substantially decrease pore water and sediment EECs. The PWG suggests use of other models which could better simulate pesticide transport in residential areas and burial of residues by sedimentation.

EPA Response: The agency included an analysis of the potential effect of burial in the PRA in addition to the RQs calculated without accounting for potential burial of pyrethroid residues. The agency agrees that burial is a potential sink for pyrethroid residues in scenarios like the pond scenario used in the PRA, and that burial could reduce the mass of pyrethroid residues to which non-target organisms might be exposed in certain circumstances. Burial processes are much less likely in flowing water bodies in which scouring of sediment from depositional areas could occur during periods of greater flow. The agency believes that in these scenarios, the rate of degradation of pyrethroid residues is a more important removal process than the less likely and slower process of burial.

21. PWG Comments on Use of PCAs and PCTs: The PWG believes that Percent Cropped Area (PCA) and Percent Crop Treated (PCT) data should be used to refine estimated aquatic exposure concentrations for pyrethroids.

EPA Response: The EPA applies PCA and PCT data to its human health drinking water assessments for surface water sources in large geographic areas, as these larger watersheds are not typically comprised of 100% cropped area, and the cropped area is not typically 100% treated with the pesticide being assessed. The EPA does not apply PCA or PCT data to ecological assessments for pesticides because ecological exposure estimates are based on field-scale scenarios (e.g., the 10-hectare farm pond scenario using PRZM-EXAMs), and PCT and PCA are not valid concepts for single fields. Applying PCA and PCT to the 10-hectare field simulated in aquatic modeling would likely underestimate exposure in many aquatic systems, because it is likely that a 10-hectare field would have 100% crop coverage and also be treated in its entirety in one day.

22. PWG Comments on Land Conservation Requirements: The PWG expressed concern that the USDA’s Highly Erodible Land (HEL) conservation requirements were not considered in the agency’s aquatic modeling. The PWG asserted that, of the 72 simulated crop scenarios in the PRA, 18 crop scenarios have 30-year annual average soil loss > 5 tons/acre which would be considered unsustainable by USDA and would have to be managed as Highly Erodible Land (HEL). The PWG notes that these scenarios are frequently among those generating the highest EECs for individual active ingredients.
**EPA Response**: The EPA acknowledges that some of the PWC scenarios produce high erosion losses and, to the extent that growers would take measures to avoid unsustainable soil loss, EECs for those specific scenarios could be overestimated. While the EPA has not modified its model scenarios to account for the reduction in soil loss specifically as a result of these requirements, the EPA has been working on other updates to PWC that address potential overestimation of pesticides that bind to soil particles: enforcing a sediment mass balance and equilibrating erosion solids with the water column prior to sedimentation.

23. **PWG Comments on the Incidents Database**: The EFED states that the incident database supports their conclusions of widespread risk to aquatic ecosystems. However, given the long-term extensive agricultural use of pyrethroids that has increased over time, and the predictions of high risk to fish made in the EFED PRA, many more reported fish incidents would have been predicted than were observed nationally, especially since 2010.

**EPA Response**: The incident database is not designed to be a biological monitoring program that captures ecosystem effects from pesticide use in a structured way that links amounts of applied pesticides to in-field effects measurements for non-target species, communities or ecosystems. Because incident data are not reported or collected systematically, a lack of reported incidents cannot be used as evidence that incidents could not or do not exist from registered uses of the chemicals being considered. As an example, aquatic invertebrate risks are still expected to occur, particularly in vulnerable areas, even though aquatic invertebrate incidents have not been reported to the agency—invertebrate incidents are not highly visible or likely to be reported. Although incidents are a valuable line of evidence of real-world effects, they can be of limited utility in supporting a safety finding due to the lack of targeted monitoring for vulnerable taxa. Regardless of the aquatic incidents reported for pyrethroids, the agency acknowledges that risk conclusions for fish are less certain than they are for aquatic invertebrates. This conclusion is not based on incident data, but rather because of the greater measured sensitivity of invertebrates to pyrethroids and corresponding risk identified for numerous scenarios in the agency’s quantitative modeling.

Additionally, prior to 1998, registrants were required to submit information on all ecological incidents of which they were aware, and which involved one of their chemicals. Since 1998, registrants are only required to provide information on incidents considered “major”? (USEPA, 2011). Therefore, even if it were appropriate to compare incident reports on a temporal scale, there would be a bias toward the agency receiving fewer incident reports after 1998.

---

7 Definition of “Major” Incident: Fish or wildlife: Involves any incident caused by a pesticide currently in Formal Review for ecological concerns.
Fish or wildlife: Involves effects to, or illegal pesticide treatment (misuse) of a substantial tract of habitat (greater than or equal to 10 acres, terrestrial or aquatic).
Fish: Affected 1,000 or more individuals of a schooling species or 50 or more individuals of a non-schooling species.
Birds: Affected 200 or more individuals of a flocking species, or 50 or more individuals of a songbird species, or 5 or more individuals of a predatory species.
Mammals, reptiles, amphibians: Affected 50 or more individuals of a relatively common or herding species or 5 or more individuals of a rare or solitary species.
Plants: The effect is alleged to have occurred on more than 45 percent of the acreage exposed to the pesticide.
Urban Outdoor Use Pattern Assessment Comments

24. PWG Comments on Modeling Approach for Urban Outdoor Uses: Instead of the EPA’s modeling approach for urban outdoor uses, the PWG advocated that the agency use a model calibrated to a specific vulnerable watershed for which pyrethroid monitoring data are available, and generate estimated aquatic exposure concentrations for different regions of the country and the different climatic conditions of those regions.

**EPA Response:** The agency does not consider the calibration of a model to a specific watershed with one year of monitoring data to be equivalent to validation of an exposure model with predictive capability. The agency lacks confidence that the calibration of such a model would be appropriate for the other six scenarios for which similar data were not available for calibration. The PWG’s proposed approach illustrates the difficulty of predicting possible environmental concentrations on a national scale, which is one of the reasons that the agency uses conservative assumptions to account for the possible range of exposure concentrations that could occur nationwide.

25. PWG and NPMA Comments on Factoring Existing Risk Mitigation Measures in Risk Assessment: The PWG and the National Pest Management Association (NPMA) commented that the EPA’s pyrethroid risk assessment’s exposure and risk estimates for aquatic organisms did not take into account the numerous restrictions (i.e., mitigation measures) already required on pyrethroid labels to reduce exposures from residential and commercial uses. These restrictions are described in the following paragraphs.

In January 2013, after concerns expressed by end-users, the EPA requested modification of language on pyrethroid labels to allow use of these products to control aggregating, overwintering pests (USEPA 2013). The following are key mitigation-related aspects of the EPA-approved label language:

“Do not water the treated area to the point of run off. Do not make applications during rain. All outdoor applications if permitted elsewhere on this label must be limited to spot or crack-and-crevice treatments only, except for the following permitted uses:

1. Applications to soil or vegetation, as listed on this label, around structures;
2. Applications to lawns, turf, and other vegetation, as listed on this label;
3. Applications to the side of a building, up to a maximum height of 3 ft above grade;
4. Applications to underside of eaves, soffits, doors or windows permanently protected from rainfall by a covering, overhang, awning or other structure;
5. Applications around potential pest entry points into buildings, when limited to a surface band not to exceed one inch in width;
6. Applications made through the use of a coarse, low pressure spray to only those portions of surfaces that are directly above bare soil, lawn, turf, mulch or other vegetation, as listed on this label, and not over an impervious surface, drainage or other condition that could result in runoff into storm drains, drainage ditches, gutters or surface waters, in order to control occasional invaders or aggregating pests.
Application is prohibited directly into sewers or drains, or to any area like a gutter where drainage to sewers, storm drains, water bodies, or aquatic habitat can occur. Do not allow the product to enter any drain during or after application.”

Prior to the EPA’s efforts, and in part as an outcome of the successful PWG “Pathway ID” study, the California Department of Pesticide Regulation (CDPR) instituted related regulations that went into force in 2012 (Davidson et al. in MRID 49137401; and Davidson et al. 2014). Key distinctions in the California regulations are that they only allow application to vertical surfaces up to 2 ft instead of 3 ft, and that broadcast applications cannot be applied within 2 ft of an impervious horizontal surface, with the following exceptions:

“(a) Except when prohibited in (e), applications to the soil surface, mulch, gravel, lawn, turf, or groundcover must be made using only the methods described below:
   (1) Spot treatment
   (2) Pin stream treatment of one-inch wide or less
   (3) Perimeter band treatment of three ft wide or less from the base of a building outward
   (4) Broadcast treatment but not within two ft from any horizontal impervious surface. Pin stream treatment of one-inch wide or less may be made within the two-ft area.
   (5) For broadcast treatment of termiticides to preconstruction sites, prior to precipitation, the treatment site must be covered with a waterproof covering, such as a polyethylene sheet, or a concrete slab must be poured over the treated soil.

(b) Except when prohibited in (e), applications to windows and doors, and horizontal impervious surfaces must be made using only the methods described below:
   (1) Spot treatment
   (2) Crack and crevice treatment
   (3) Pin stream treatment of one-inch wide or less

(c) Except when prohibited in (e), applications to vertical structural surfaces, such as walls, foundations, and fencing, must be made using only the methods described below:
   (1) Spot treatment
   (2) Crack and crevice treatment
   (3) Pin stream treatment of one-inch wide or less
   (4) Perimeter band treatment to a maximum height of two ft above the grade level.”

The bifenthrin producer companies also agreed a Memorandum of Agreement (MOA) which instituted some special additional specifications for bifenthrin product labels (CDPR 2012) that apply nationally; the major focus of these was to further restrict applications to impervious surfaces.

EPA Response: The agency agrees that its modeling of aquatic exposures resulting from urban outdoor uses is conservative. Urban areas are complex systems that are very difficult to simulate on a national scale due to the extensive variability of urban landscapes, building materials and construction, pest pressures, and environmental conditions across the country. In conducting a national-level assessment, the agency approached its modeling to account for this nationwide

---

8 [https://www.cdpr.ca.gov/docs/pressrls/2012/120718.htm](https://www.cdpr.ca.gov/docs/pressrls/2012/120718.htm)
variability, and as such included situations where urban aquatic ecosystems are more vulnerable as a result of the urban landscape, building materials and construction, pest pressures, and environmental conditions. For example, the agency did not use the Pathway ID study quantitatively because the study only included stucco house fronts and California-specific weather, which is not representative of urban areas nationwide.

Although the agency’s modeling approach was conservative (for example, by assuming that all lots in the watershed would be treated at the same time with the pyrethroid), the agency attempted to reduce the overall conservativeness of its approach by assessing only one pyrethroid application per year. This one-application-per-year assumption is not conservative, as multiple applications on the same property are allowed on the label and occur in the real world.

The agency acknowledges that there are situations where its modeled exposure concentrations are overestimates. However, model estimates are not the only line of evidence indicating that pyrethroid residues are present in urban surface waters. Available monitoring data indicate that there are pyrethroid residues in urban streams that exceed the agency’s levels of concern. In California in particular, stakeholders have commented that a reduction in pyrethroid residues has not consistently been observed in urban streams despite previous label changes intended to address aquatic exposure in urban areas. Based on the monitoring data available in urban areas that support the Agency’s conclusions based on modeling, the agency is confident that there are situations in vulnerable urban environments where risk to aquatic invertebrates is occurring.

26. PWG Comments on the Pathway ID Study: The PWG expressed concern that the “Pathway ID” study was not sufficiently considered and utilized in the agency’s pyrethroid risk assessment (Davidson et al. in MRID 49137401; and Davidson et al. 2014). The PWG discussed how this study, corroborated by other lines of evidence, showed pyrethroid transport from lawns to be relatively low under normal rainfall and irrigation conditions, and asserted that the general consensus among stakeholders is that most significant contributions to pyrethroid off-site transport following residential and urban use comes from treated impervious surfaces with a direct connection to the storm water system (especially garage door entry-ways and the upper driveway).

The PWG discussed the findings of the Pathway ID study, primarily that greater than 99% of the pyrethroid losses from the house lot were from the driveway and garage wall, and that after the label changes to reduce applications to impervious surfaces were implemented, total pyrethroid losses from a house lot were reduced by 40X, with losses from impervious surfaces still accounting for 74% of the total.

The comparison showed that the EPA’s modeling misrepresented the sources of pyrethroid residues, and that the modeling significantly over-predicted the transport rates (wash-off) from the most important of these source areas (driveway/garage door and foundation perimeter). The PWG’s modeling predicted rates much closer to measured, but still conservative, wash-off rates from these same use sites.

EPA Response: The agency agrees with the PWG that the Pathway ID study is an extremely valuable study that has informed mitigation put into place for residential uses of pyrethroids by the EPA.
(2013)\textsuperscript{9} and CDPR (2012)\textsuperscript{10}, as well as the bifenthrin-specific label mitigation that was implemented at a national scale (CDPR 2012)\textsuperscript{9}. The agency also agrees that the Pathway ID study confirms that pyrethroid transport to water is much more likely from impermeable surfaces than from permeable surfaces. Furthermore, the agency agrees with the PWG that restrictions on pyrethroid applications to impermeable surfaces and a reduction of the surface area of perimeter treatments should reduce the mass of pyrethroids that are likely to be transported to surface water bodies, as well as the total load at individual spray locations. Because of the conservative nature of the agency’s conceptual model for urban outdoor pesticide applications, as discussed in response to the previous comment, the agency acknowledges that its estimated aquatic exposure concentrations for these applications are likely to be overestimates in many situations.

The agency notes, however, that soil particles in permeable areas near a home can still be transported during large storm events. This may be one of the reasons why, based on monitoring studies from California, reduction in pyrethroid residues have not consistently been observed in urban streams despite label changes targeting impervious surfaces. While the agency considers reduction in applications to impervious surfaces to be a critical component of reducing pyrethroid exposures in urban streams, it is not the only consideration in the risk management of pyrethroid exposures in urban surface water. Reduction of the area that can be treated at the same application rate represents a load reduction for each pyrethroid treatment, which represents a clear reduction in the amount of pyrethroid material that can be transported from a treated area. Based on the most recent monitoring data available from urban surface waters in California and elsewhere, the agency has concluded that the overall reduction of all pyrethroid residues available for off-site transport needs to be considered in its risk management approach for pyrethroids. This is reflected in the proposed mitigation in \textit{Pyrethroids and Pyrethrins: Ecological Risk Mitigation Proposal For 23 Chemicals}.

Specifically, regarding the PWG’s modeling of aquatic exposures resulting from urban outdoor applications, the agency is not surprised that the PWG’s estimated concentrations for California were closer to those observed in California residential monitoring data, because the California Pathway ID study and a California stormwater outfall were the datasets used to calibrate the wash-off equations in the PWG’s model scenario. Calibration assures that there is close correspondence between the output and the monitoring data. It is less clear how predictive the Texas scenario was of potential EECs in Texas. The calibration factors from California studies resulted in Texas EECs that corresponded fairly well to the California monitoring data.

27. CASQA, California State Water Resources Control Board, and San Francisco Bay Regional Water Board Comments on Water Quality Concerns for Bifenthrin: CASQA and the San Francisco Bay Regional Water Board requested that EPA consider the elimination of bifenthrin registration for all urban ("residential") applications, including professional applications. CASQA stated that bifenthrin exceeds aquatic life benchmarks in California more than any other pyrethroid, that it has greater persistence and toxicity than other pyrethroids, and that recent studies indicate that bifenthrin

\textsuperscript{9} \url{https://www.epa.gov/ingredients-used-pesticide-products/environmental-hazard-and-general-labeling-pyrethroid-and}
\textsuperscript{10} \url{https://www.cdpr.ca.gov/docs/pressrls/2012/120718.htm}
causes endocrine effects in fish (Brander 2012 and 2016). CASQA also asserted that there are alternatives to bifenthrin that could be used for non-agricultural outdoor use sites. The Water Boards expressed similar regarding urban outdoor uses of bifenthrin.

**EPA Response:** The agency acknowledges that bifenthrin has been detected more than other pesticides at concentrations that exceed California’s Aquatic Life Criteria. The agency has supported previous mitigation efforts specific to bifenthrin as described earlier in this document, and bifenthrin would be subject to the additional proposed mitigation for all pyrethroids with outdoor residential and commercial discussed in the *Pyrethroids and Pyrethrins: Ecological Risk Mitigation Proposal For 23 Chemicals*. The agency’s proposal is does not include bifenthrin-specific mitigation or use cancellation based on the risks and benefits of bifenthrin use in outdoor urban areas.

With regard to aquatic risk, bifenthrin is not so unique when compared to other pyrethroids that it warrants additional bifenthrin-specific mitigation. The urban outdoor RQs presented in the agency’s pyrethroid risk assessment and summarized in the risk mitigation proposal illustrate that bifenthrin does not consistently have the highest RQ exceedances for aquatic invertebrates. This is a reflection of the toxicity and persistence of bifenthrin as compared to other pyrethroids.

The agency disagrees with CASQA that bifenthrin is more toxic to aquatic invertebrates than other pyrethroids. All pyrethroids are very highly toxic to aquatic invertebrates. The agency’s pyrethroid risk assessment is based on acute and chronic toxicity data for freshwater and estuarine/marine invertebrates associated with the water column and with bed sediment. Bifenthrin does not have the lowest endpoint for most of these taxa based on the most sensitive species tested and is not a significant outlier for the taxa for which it does have the most sensitive endpoint.

The agency also disagrees with CASQA that bifenthrin is the most persistent pyrethroid. Bifenthrin is persistent in the environment, as are many pyrethroids, but it is not the most persistent. Considering the range of measured values from studies submitted to the agency, as opposed to 90th percentile on the mean values calculated for use in surface-water modeling, bifenthrin is similarly persistent to aerobic soil metabolism as permethrin and less persistent than fenpropathrin. It is also less persistent than fenpropathrin to aerobic aquatic metabolism. Although this is also the case for anaerobic aquatic metabolism, this route of degradation is less relevant for consideration of potential risk to aquatic organisms included in the agency’s protection goals, which do not live in anoxic environments.

With regard to endocrine disruption, a complete evaluation of potential endocrine effects has not been completed for all pyrethroids and was therefore not included as part of the *Pyrethroids and Pyrethrins: Ecological Risk Mitigation Proposal For 23 Chemicals*. This is because the agency has not received, nor assessed, data for all the pyrethroids under the Endocrine Disruptor Screening Program. The EPA notes, however, that a complete a Weight of Evidence (WOE) analysis of potential endocrine effects for bifenthrin in June 2015, and the results are available in [www.regulations.gov](http://www.regulations.gov) under docket EPA-HQ-OPP-2010-0384. While the 2012 Brander study cited by CASQA was considered in the WOE analysis, the 2016 Bander study was published subsequent to completion of the WOE analysis and would be considered in future assessments. Based on a preliminary review of
the 2016 study, the agency has determined that the study is not likely to change the agency’s conclusions on endocrine disruption for bifenthrin, nor would it change the agency’s risk management approach for the pyrethroids.

CASQA also cites California Department of Pesticide Regulation data indicating that bifenthrin has high usage in urban areas in California (comments dated July 7, 2017). The agency’s pyrethroid risk assessment acknowledges that bifenthrin is one of the more widely used pyrethroids in urban areas in California and nationwide. Usage data from proprietary data sources (USEPA 2016), indicate that there are other pyrethroids widely used in urban areas, especially permethrin. All pyrethroids widely used in urban areas are predicted to be present in aquatic environments at levels of concern to EPA.

The EPA is not proposing ecological mitigation for bifenthrin beyond what is outlined for all pyrethroids in the Pyrethroids and Pyrethrins: Ecological Risk Mitigation Proposal For 23 Chemicals due to the benefits of its use (USEPA 2016), and the agency’s expectation that greater detection frequencies and concentrations of alternative insecticides (including other pyrethroids and fipronil) would occur if bifenthrin were removed from the market, because these alternative insecticides would likely take its place in the market.

28. CASQA and San Francisco Bay Regional Water Board (SFBRWB) Comments on Labeling Changes for the Pyrethroids: CASQA and SFBRWB recommend that EPA coordinate with the CDPR, professional applicators, and pyrethroids registrants to revise pyrethroid product labels with the goal of providing additional mitigation to better protect water quality through three specific types of improvements:

A) Reducing overuse of active ingredients
B) Adding a minor label requirement to post signs after pre-construction termiticide applications to warn users of potential Clean Water Act concerns from these types of uses and to maintain plastic cover over the application until the foundation is poured.
C) Enhancing overall readability and enforceability of label language
D) If the EPA does not find it appropriate to make these changes on a nationwide basis, we request that the EPA provide CDPR the ability to work with registrants to establish California-specific instructions on product labels. Since the EPA controls product labels – the most effective means of controlling product usage – the EPA’s explicit approval of state-specific label language is essential.

EPA Response: The EPA agrees that it is important to seek feedback from various stakeholders to develop risk mitigation that is both practical, enforceable, and addresses risk concerns. The EPA’s efforts on this front include the following:

A) The EPA has worked extensively with registrants, such as user groups including National Pest Management Association (NPMA), the National Association of Landscape Professionals (NALP), State FIFRA Issues Research and Evaluation Group (SFIREG), and the Association of American Pesticide Control Officials (AAPCO), to develop proposed mitigation to reflect what is practical while also maintaining the efficacy of these uses. The proposed mitigation is designed to reduce the pathway for these chemicals to get into surface waters and storm
drainage systems. The language also informs consumers on how to prevent pyrethroids products from ending up in wastewater facilities.

B) In following up on the labeling recommendations from CASQA, the EPA consulted with construction experts with specific experience with termiticide applications, regarding the suggestion that a signage requirement on pyrethroid labels could reduce the amount of pesticides running off into the drainage system. The EPA also met with Dave Tamayo, an environmental specialist from CASQA, on February 25, 2019, to discuss these comments and recommendations. The EPA officials also attended the 2019 Termite Tour, organized by the Association of Structural Pest Control Regulatory Officials, which included discussions on pre- and post-construction termite application practices. There wasn’t consensus on the potential effectiveness additional posting and covering of these pre-construction termite applications could be in reducing pesticides in surface water. Therefore, the EPA is not proposing these changes in the ecological risk mitigation proposal. However, the EPA welcomes additional comments on this topic during the public comment period.

C) The EPA has made a significant effort to propose changes to pyrethroid labels to improve consistency and help users find adequate directions.

D) The EPA has worked closely with CDPR in the past on adding state-specific labeling restrictions to many pesticide products, including products containing pyrethroids. The EPA will continue to discuss implementation options with states and stakeholders when geographic-specific restrictions may be needed.

29. CASQA Comment on CDPR’s Urban Runoff Study: CASQA requested the EPA review the result of an urban runoff study from CDPR (DPR Study 303 “Source Identification for Urban Pyrethroid Use in California: Bifenthrin in Placer County”).

EPA Response: This study by CDPR looks at sources and trends over many years of monitoring data, including those before the adoption of California’s pyrethroid regulations for professional applicators. Although it is not yet published, the EPA looks forward to reviewing the new monitoring study when it is available. The agency expects that the proposed mitigation to reduce pyrethroid loads in urban areas as described in the Pyrethroids and Pyrethrins: Ecological Risk Mitigation Proposal For 23 Chemicals would further water protection goals in Placer County and other areas in California.

30. PWG Comments on Modeling for Nursery/Ornamental Uses: The PWG asserted that agency’s modeling of nursery and ornamental uses overestimated aquatic exposures from these uses. They primarily cite the agency’s modeling assumption that pyrethroids are applied to 100% of a 10-hectare nursery. The PWG acknowledges that a level of conservatism in a screening level modeling is expected but believes that the agency’s approach does not reflect how pyrethroids are used in nurseries. The PWG asserts that nurseries are not mono-cultures, and that they typically grow a very wide range of plants in a mix of outdoor containers, greenhouses, hoop houses and field settings. They also discuss how nursery pesticide applications are typically made via spot treatment to individual plants or blocks needing attention on any given day, and how active ingredients are rotated to minimize the development of resistant pests.
EPA Response: The agency acknowledges that pyrethroid application to 100% of a 10-hectare nursery is a conservative assumption in many situations due to the variability inherent in the location, set up, and operation of nurseries. The agency uses conservative inputs because percent-treated data are unavailable at the field scale for nurseries, and to-date a reasonable method is not available to establish a lower percent-treated value for refinement. The 100% treated would, however, account for situations where (as the PWG acknowledges) nursery plants are grown in field settings, which is not representative of all types of nursery settings.

While acknowledging the conservatism of its modeling if only a portion of field is treated, the agency notes that the nursery scenarios used in PRZM were originally developed in response to monitored concentrations in vulnerable watersheds where ornamental applications were the primary contributor to residue loading in surface waters. Therefore, while the agency acknowledges that estimated exposure concentrations are expected to be conservative in many situations, it does not agree that the exposure concentrations will be overestimated in all situations.

Down-the-Drain Use Assessment Comments

31. PWG and Bay Area Clean Water Agencies (BACWA) Comments on Surface Water EECs: The PWG asserted that the agency’s DRA incorporated assumptions into the Exposure and Fate Assessment Screening Tool (E-FAST) model that resulted in highly conservative EECs in surface water. They cite as an example how the agency assumed that all publicly owned treatment works (POTW) discharges were made to dry river beds and concluded that this limited the relevance of its assessment to the few days that a minority of national POTWs are discharging to what would otherwise be dry creeks. As a result, the PWG concluded that the Agency’s approach was not representative for a national scale ecological risk assessment, especially for exposure to estuarine and marine organisms because it requires the assumption of a completely dry estuary or marine location. The PWG concluded that consideration of normal flow conditions would dramatically reduce or eliminate predicted risk for aquatic organisms from POTW discharges.

In contrast to the PWG, BACWA reported that, in some cases, waters receiving POTW discharges (“receiving waters”) may be effluent-dominated, in that there is little to no dilution, either because the receiving water is small or there is a lack of mixing at certain times due to thermal or saline stratification. They assert that even the most sophisticated wastewater treatment plants cannot fully remove these complex chemicals.

EPA Response: The agency agrees that there are some conservative assumptions in the E-FAST analysis and appreciates the additional characterization of potential for exposure from the down-the-drain use patterns provided by the PWG. Many of the uncertainties are already discussed in the agency’s risk assessment. Calculation of EECs with no dilution or low dilution factors is conservative, but such scenarios do occur, as BACWA points out. This important point has practical implications. According to the Main Facility File from the Probabilistic Dilution Model Portion of E-FAST, approximately 20 percent of POTWs in California have no dilution (that is, no significant stream flow...
at least once in 10 years). Throughout the US, about 23 percent of POTWs have a dilution factor of less than 10 at least once every 10 years based on the same source. For more details see page 19 of Preliminary Comparative Environmental Fate and Ecological Risk Assessment for the Registration Review of Eight Synthetic Pyrethroids and Pyrethrins Part I. Assessing Pyrethroid Releases to POTWs.

32. PWG Comments on Modeling Approach for Indoor Uses: The PWG claimed that the agency’s pyrethroid risk assessment assumes 100% of the indoor-applied pyrethroids reach POTWs; more specifically, that the assessment assumed that 100% of the pyrethroids applied to the use sites/pests would be transported down the drain with no degradation, adsorption, or dissipation between the time of use and the time of entering the drain.

EPA Response: In its risk assessment, the agency did not assume that 100% of pyrethroids applied indoors reach POTWs. As described in the risk assessment section, “Overview of Pesticide Uses that Lead to POTW Exposure,” the agency identified a subset of indoor uses that would be most likely to be transported down the drain. To the extent possible, the agency considered only the uses (in terms of application site, application method, and/or target pest, depending on the market sector) with a higher potential for substantive release of pyrethroids into domestic wastewater. However, available usage data by target pest do not allow separation of different indoor uses with sufficient resolution to derive per capita usage values for only those that are most likely to be transported down-the-drain. Therefore, while the agency adjusted the data to account for uses that are less likely to be transported to POTWs, the estimates include additional pyrethroid residues from these uses.

In addition, the Agency did consider the removal by ‘degradation, adsorption and dissipation’ as it used the Sewage Treatment Plant Fugacity Model component of E-FAST to estimate the removal of pyrethroids from the treatment stream before discharge by wastewater treatment processes. In general, the estimates for removal were about 90%. These values were validated against treatment study and monitoring data.

33. PWG and BACWA Comments on Down-the-Drain Exposure: The PWG asserted that the agency’s down-the-drain assessment was overly conservative by including pyrethroid applications that do not lead to down-the-drain exposures (e.g., floor, wall, and spot treatments) because usage data used by the agency was based on target pest, not actual application method. The PWG conducted an analysis of Residential Exposure Joint Venture (REJV) data based on the application type of “applied indoor air/space,” and, as a result, estimated that approximately one half of the indoor-specific application records considered to have “a higher potential to lead to down-the-drain exposure” were made in rooms without a sink, tub, or drain. Based on this analysis, the PWG asserted that the agency overestimated pyrethroid down-the-drain usage by a factor of 2 to 3.

In contrast with the PWG, BACWA had concerns about potential underestimation of pyrethroid exposures as a result of the agency’s POTW modeling methodology. BACWA cited monitoring data for permethrin that was higher than the agency’s modeled exposure estimates, illustrating this potential underestimation. BACWA disagreed with the agency’s conclusion that certain uses did not contribute substantially to down-the-drain exposures and advocated for the agency to include these...
uses in the down-the-drain assessment. These uses include pet spot-ons, collars, and indoor foggers, which BACWA has concluded contribute to POTW discharges. BACWA cited a growing body of data that pet spot-on treatments are discharged to sewer systems through direct transfer (pet washing) and indirect transfer (washing hands, fabric, and surfaces contacted by treated pets, and possibly through human waste) (Teerlink et al. 2017, Davis et al. 2008, Litchfield et al. 2015, Bigelow Dyk et al. 2012, and Sadaria et al. 2017). BACWA also cited scientific evidence connecting pet collars and indoor foggers to POTW discharges. BACWA asserts that these pyrethroids sources – particularly pet spot-ons – appear to be among the largest sources of insecticide discharges to the sewer system. BACWA also supported this claim by citing California Department of Pesticide Regulation (CDPR) studies showing that topical flea control formulations fipronil could result in wastewater residues 2 to 29 days after treatment, as well as fipronil and pyrethroid studies showing that residues on treated pets could be transferred to human hands via petting, and subsequently down the drain from handwashing, weeks after application.

**EPA Response:** The agency acknowledged in its assessment that the down-the-drain exposure assessment using the E-FAST model incorporated many assumptions that could result in an overestimation of EECs for most POTW discharges. However, because the model divides total production of a pesticide on a per capita basis and assumes that these residues go down the drain from indoor use, the agency attempted to limit the input of the model to those uses for which the amount applied is the amount that can be assumed to go down the drain, such as for pet shampoos. The agency notes that this specific assumption that is likely to underestimate, rather than overestimate, exposure. Other uses that are not intended to have a direct pathway down the drain were not included, as their level of degradation, dissipation, and likelihood of contact with water transported down the drain is expected to be a small and currently unquantifiable fraction of the amount applied. As an example, pet spot-ons are not intended to be washed off the pet at the time of application, and some spot-on labels advise pet owners to not wash their pet for some minimum time period after the application. As a result, the actual contribution of a pet spot-on to down-the-drain exposures is expected to be substantially lower than the amount applied. With regard to pet products specifically, the agency is working with the HCPA Pet Care Products Task Force to quantify household exposures from pet product uses and is also working to develop new Proposed Guidelines for Efficacy Testing of Topically Applied Pesticides Used Against Certain Ectoparasitic Pests on Pets. Additional information and materials from the agency’s June 11-14, 2019 Scientific Advisory Panel Meeting on the proposed efficacy guidelines are located in docket EPA-HQ-OPP-2019-0161. Both efforts may inform future work on the fate and transport of pesticides used in pet products.

Regardless of how uses were selected for the agency’s down-the-drain assessment model inputs, monitoring data available to the agency and cited by several commenters show that pyrethroid concentrations in POTW effluent exceeded toxicity endpoints for the most sensitive aquatic invertebrate species tested. EPA acknowledges that some of these residues were from pyrethroids that do not have uses included in the Agency’s modeling, indicating that the agency’s modeling may be underestimating pyrethroid exposure in POTW effluent in some instances. Additionally, these monitored residues are approximately 90% lower than what would otherwise be released from POTWs because of the secondary treatment processes that remove pyrethroids from wastewater (Weston et al., 2013). Thus, even with this high level of removal, the remaining residues occur at high enough concentrations to cause toxicity to aquatic invertebrates. Though the PWG has
commented that the down-the-drain assessment is overly conservative, it is important to consider that pyrethroids are being detected in treatment plant effluence at concentrations that have the potential to cause toxicity. For a full characterization of these real-world exposures, see the Agency’s down-the-drain risk assessment.

34. BACWA Comments on Pet Uses that are Considered Non-Pesticidal: BACWA commented that the agency should consider non-pesticidal uses of pyrethroids, such as for lice and scabies treatments, in its down-the-drain assessment. BACWA argued that, even though the EPA and the FDA have agreed that the FDA will be the primary regulator for these treatments, they are part of the context in which federal risk management decisions for pyrethroids must be made, and that understanding their contribution to aquatic risks is important. BACWA asserted that lice and scabies treatments contribute to pyrethroid loading in POTWs, and that the agency’s down-the-drain modeling failed to account for higher loadings that will occur during localized outbreaks of lice and scabies.

While BACWA and other commenters agree that pyrethroid flea-and-tick control products for pets have societal benefits, they argue that the agency did not consider “plentiful alternatives that are far less environmentally problematic than pyrethroids,” such as FDA-approved oral medications that are well-accepted by pet owners and veterinarians. Additionally, they argue that mechanical controls (e.g., vacuuming, washing of pet bedding) offer lower cost and greater long-term control as these are the sole options that address all life cycle stages of fleas. BACWA has also communicated to the agency that they do not consider fipronil or imidacloprid products to be less harmful alternatives to pyrethroid-based pet products.

EPA Response: The agency acknowledges that medicinal uses of pyrethroids for lice and scabies control are another source of pyrethroid residues that likely go down the drain to POTWs and that they are not within EPA’s jurisdiction. This further highlights the difficulty in estimating potential loading to POTWs and for interpreting the contributions of various uses to pyrethroid residues found in POTW effluent monitoring data. As a matter of policy, however, the agency is concerned about all sources of pyrethroid exposures and has considered overall reduction of pyrethroid down-the-drain exposures as part of its risk management process for pyrethroids. This is why the Pyrethroids and Pyrethrins: Ecological Risk Mitigation Proposal For 23 Chemicals proposes label changes for all indoor uses of pyrethroids to reduce unnecessary or improper down-the-drain disposal of pyrethroids.

The agency considers pesticide alternatives in registration review decisions in the risk-benefit balancing required under FIFRA. As such, the agency must balance the potential human health and environmental risks of alternatives against the economic, human health, pet, and other societal benefits in its regulatory decisions for pyrethroids. This risk-benefit balancing implemented on a continual basis by the agency is reflected by the increase in the use of down-the-drain pyrethroid uses over the last 20 years that facilitated the elimination of residential uses of older-generation insecticides (e.g., the organophosphates) that had posed higher potential risks to human health and the environment. In fact, some of the most recently registered pyrethroids were given expedited review because they would replace potentially riskier alternatives. Through its registration review process, the agency is continuing to balance the risks and benefits of pyrethroids in light of the risks
...and benefits of current alternatives to pyrethroids, such as fipronil and imidacloprid, which the commenters did not prefer based on a comparison of their potential for ecological risk.

That said, pesticide labels are not the means by which the agency could direct the public to use non-pesticidal alternatives to pesticides such as oral pet medicines or vacuuming of pet bedding and furniture. Education and stewardship programs could lead to greater use of alternatives identified by the commenters.

35. BACWA Comments on Pesticide Discharges to Sewer Systems: BACWA provided data indicating that pesticide discharges to the sewer system can be costly for POTWs due to the potential for pesticides to cause or contribute to wastewater treatment process interference, NPDES Permit compliance issues, impacts to receiving waters, recycled water quality and/or biosolids reuse, and exposing POTWs to the potential for third party lawsuits under the Clean Water Act (CWA).

Of particular concern to BACWA is the ability of a specific pesticide to exceed effluent toxicity limits. One universal water quality standard in the U.S., which stems directly from the Federal Clean Water Act (CWA), is that surface waters cannot be toxic to aquatic life. NPDES permits require POTWs to demonstrate that they meet this standard by evaluating toxicity using U.S. EPA standard methods (set forth in 40 CFR Part 136). To evaluate toxicity, every POTW must (1) conduct toxicity screening tests with a range of species, (2) select the most sensitive species, and (3) perform routine monitoring (typically monthly or quarterly). These monitoring data are used to determine whether the discharger has a reasonable potential to cause or contribute to toxicity in the receiving water. If it does, the CWA requires that numeric effluent limits be imposed, otherwise POTWs may be given numeric effluent triggers for further action. In the event that routine monitoring does exceed a toxicity limit or trigger, the POTW must perform accelerated monitoring; and if there is still evidence of consistent toxicity, the discharger must do a Toxicity Reduction Evaluation (TRE) to get back into compliance. The TRE requires dischargers to evaluate options to optimize their treatment plants and conduct a Toxicity Identification Evaluation (TIE), the cost of which can vary from $10,000 to well over $100,000 depending on the complexity and persistence of the toxicant. The goal of the TIE is to identify the substance, or combination of substances, causing the observed toxicity. If a POTW’s effluent is toxic because of a pesticide, it may not have any practical means to comply with CWA-mandated toxicity permit limits.

EPA Response: The EPA has acknowledged that pyrethroid residues resulting from indoor use in down-the-drain sources may potentially reach POTWs with relatively little degradation through municipal wastewater. The EPA appreciates that pesticide residues in wastewater may present a unique challenge in California, which is, at this time, the only state to have adopted aquatic life criteria for pyrethroids. The EPA is taking these concerns into consideration and is proposing advisory label language and graphics on indoor pyrethroid products that have down-the-drain uses to help mitigate this potential risk. The agency is not proposing mitigation at this time in response to comments that pet spot-on applications were left out of the risk assessment and could end up down-the-drain, because there is a larger effort regarding the efficacy of pet products that is being handled by the Agency’s Scientific Advisory Panel, with new Proposed Guidelines for Efficacy Testing...

To reduce the potential for aquatic risks from improper use and improper disposal of pyrethroids down indoor drains and storm drains, the EPA is proposing measures to make consumers more educated on the appropriate use sites for the pyrethroid products they purchase, as well as the importance of proper disposal of leftover pesticides and their containers. These product stewardship measures include clear, simple language about whether the product is meant to be used indoors or outdoors, as well as consistent label language and graphic imagery to encourage proper disposal.

The products that are subject to this proposal have registrations for any indoor or outdoor use in a residential or commercial setting. Note that all products registered for indoor residential and commercial uses are included, not just the those with indoor down-the-drain uses, because the potential for improper use or disposal is present for any household pyrethroid product. The agency does not expect that this proposed mitigation would have an adverse impact to pesticide users. The specific measures proposed for this requirement are intended to reduce the potential for runoff and drain disposal, and subsequent potential aquatic risk, and are outlined in the Pyrethroids and Pyrethrins: Ecological Risk Mitigation Proposal For 23 Chemicals.

Public Health (Wide-Area Mosquito Control) Use Comments

36. Bayer Comments on Conservatism of Risk Assessment: Bayer cited the combination of assumptions in the risk assessment that lead to an “ultra-conservative” exposure and effects estimation and suggested the agency should have used additional data on exposure and effects to refine the risk assessment.

EPA Response: The agency's risk assessment modeled wide-area mosquito adulticide uses for the PWG pesticides deltamethrin, permethrin, and pyrethrins using the Pesticide in Water Calculator (PWC). For the aerial adulticide uses, this included calculations of spray drift using the exposure model AGDISP, which estimates the deposition of the pesticide to the treated area and allows for the parameters particular to ULV mosquito adulticide spraying to be modeled, including extremely fine droplet size, boom height spray volumes, wind speed and direction, spray material, and specific gravity. The agency acknowledges that the aquatic EECs from exposure modeling for wide-area mosquito adulticide treatments are highly uncertain compared to broadcast agricultural applications to a defined watershed. The nature of the deposition of mosquito adulticides to water bodies likely leads to a conservative estimate of RQs for aquatic organisms in the water column and benthos.
References


USEPA. 2019. Review of USDA’s Assessment of the Benefits of Pyrethroids, August 2, 2019;


Appendix A: List of Public Commenters on the Pyrethroid Ecological Risk Assessment

a. **Registrants and Registrant Task Forces:**
   1. Bayer CropScience
   2. CropLife America (CLA)
   3. Consumer Specialty Products Association (CSPA) [As of 2017 renamed Household & Commercial Products Association (HCPA)]
   4. FMC
   5. MGK
   6. Pyrethrins Joint Venture
   7. Pyrethroid Working Group (PWG)
   8. Responsible Industry for a Sound Environment (RISE)
   9. SBM Life Science Corp
   10. Sumitomo Chemical Co.
   11. Syngenta Crop Protection, LLC
   12. Valent

b. **Federal Government:**
   1. United States Department of Agriculture (USDA)

c. **California Government Stakeholders:**
   1. Bay Area Clean Water Agencies (BACWA)
   2. California Central Coast Regional Water Quality Board
   3. California State Water Resources Control Board
   4. California Stormwater Quality Association (CASQA)
   5. San Francisco Bay Regional Water Board (SFBRWB)

d. **Other State and Local Governments:**
   1. Anastasia Mosquito Control District, University of Miami, Florida Mosquito Control
   2. National Association of State Departments of Agriculture (NASDA)
   3. North Shore Mosquito Abatement District (NSMAD), Cook County, IL
   4. Benton County Mosquito Control, WA

e. **Academic / Extension:**
   1. Arizona Pest Management Center (APMC), University of Arizona
   2. Auburn University
   3. College of Tropical Agriculture and Human Resources, University of Hawaii
   4. College of Tropical Agriculture and Human Resources, University of Hawaii – Submitted on behalf of Western Integrated Pest Management Center and seed crop producers
   5. Cornell College of Ag & Life Science
   6. Department of Entomology, University of Arizona
   7. Department of Horticulture, Oregon State University
8. Department of Plant and Environmental Protection Sciences, College of Tropical Agriculture and Human Resources, University of Hawaii
9. Department of Plant and Environmental Sciences, College of Agriculture, Forestry, and Life Sciences, Clemson University et al.
10. Integrated Plant Protection Center, Oregon State University (OSU) on behalf of the Oregon Blueberry Commission, Oregon Clover Commission, Oregon Raspberry and Blackberry Commission, Specialty Seed Growers of Western Oregon, and Strawberry Commission
11. Lindcove Research and Extension Center, Department of Entomology, University of California Riverside
12. Michigan State University
13. Mississippi State University
14. Southeast Row-Crop Entomology Working Group (faculty from Clemson Univ, Auburn Univ, the Univ of Georgia, North Carolina State Univ, and Virginia Tech Univ)
15. Strawberry Center, California Polytechnic University San Luis Obispo
16. University of Georgia
17. West TN Research and Education Center, The University of Tennessee

f. Commodity Groups and Agricultural Organizations/Businesses:
   1. Almond Alliance of California
   2. Almond Board of California (ABC)
   3. American Farm Bureau
   4. American Mushroom Institute (AMI)
   5. American Soybean Association
   6. Arizona Farm Bureau
   7. California Citrus Mutual (CCM)
   8. California Citrus Quality Council (CCQC)
   9. California Cotton Ginners and Growers Association (CCGGA)
   10. California Farm Bureau Federation (CFBF)
   11. California Fresh Fruit Association (CFFA)
   12. California Rice Commission (CRC)
   13. California Safflower Growers Association
   14. California Specialty Crops Council (CSCC)
   15. California Strawberry Commission
   16. California Tomato Growers Association (CTGA)
   17. California Walnut Commission (CWC)
   18. Cargill
   19. Corn Producers Association of Texas
   20. Del Monte Foods, Inc
   21. Florida Citrus Mutual
   22. Florida Fruit and Vegetable Association (FFVA)
   23. Florida State Beekeepers Association
   24. Grower-Shipper Association of Central California
   25. Gulf Citrus Growers Association (GCGA)
26. Highlands County Citrus Growers Association, Inc. (HCCGA)
27. Idaho Farm Bureau Federation
28. Illinois Corn Growers Association
29. Iowa Corn Growers Association (ICGA)
30. Louisiana Farm Bureau Federation, Inc.
31. Michigan Apple Committee
32. Midwest Food Products Association (MWFPA)
33. Minnesota Soybean Growers Associate (MSGA)
34. Minnesota Soybean Research and Promotion Council (MSRPC)
35. Mississippi Farm Bureau Federation
36. National Agricultural Aviation Association
37. National Alliance of Independent Crop Consultants (NAICC)
38. National Association of Landscape Professionals
39. National Association of Wheat Growers (NAWG)
40. National Corn Growers Association (NCGA)
41. National Cotton Council (NCC)
42. National Council of Farmer Cooperatives (NCFC)
43. National Potato Council
44. National Sorghum Producers (NSP)
45. National Sunflower Association
46. Nebraska Farm Bureau
47. Northwest Horticultural Council (NHC)
48. Oklahoma Farm Bureau
49. Oregon Hazelnut Commission
50. Pacific International Marketing et al.
51. Pacific Northwest Packers, Inc.
52. Pest Control Operators of California (PCOC)
53. Research for Minnesota Soybean
54. Samson Farms
55. Society of American Florists
56. Tennessee Farm Bureau Federation
57. The Cherry Marketing Institute
58. The Cranberry Institute
59. The Wonderful Company LLC et al.
60. Townline Growers, Inc.
61. United Fresh Produce Association
62. US Apple Association
63. US Canola Association
64. USA Dry pea & lentil council
65. USA Rice
66. Washington Friends of Farms & Forests
67. Washington Red Raspberries
68. Washington State Potato Commission
69. Western Agricultural Processors Association (WAPA)
70. Western Growers (WG)

g. Non-Governmental Organizations (NGO):
   1. American Mosquito Control Association (AMCA)
   2. Association, Florida Entomology Society
   3. California Tomato Research Institute (CTRI)
   4. Center for Biological Diversity (CBD)
   5. National Pest Management Association
   6. Oregonians for Food & Shelter (OFS) et al.
   7. Public Health Pesticides Program, IR-4 Project
   8. Western Integrated Pest Management Center

h. Individual Growers and Concerned Citizens (982 individuals)
   1. Messages from farmers of various crops, including berries, corn, nurseries, orchards,
      various vegetables, soybeans and other commercial crops
   2. Taylor Farms Ca Inc
   3. Golf course managers
   4. Citizens in general support
   5. Citizens expressing concern for the environment

i. Individual PCO’s:
   1. Androscoggin Pest Solutions
   2. Cape Chemical
   3. Clark Pest Control
   4. Certified Golf Course Superintendents
   5. Dee Vines
   6. Dewey Pest Control
   7. Dixon Pest
   8. Emerald Lawn Care
   9. Fords Hometown Services
   10. Griffin Pest Solutions
   11. Lawn and Landscape Management Professionals
   12. Lawn Doctor
   13. InDepth Agronomy
   14. Pacific International Marketing
   15. Plunkett’s Pest Control, Inc.
   16. ProBest Pest Management
   17. My AIPM
   18. New Pest Solutions
   19. Royal Pest Solutions Inc.
   20. Slaters Skeeter Control
   21. Stuart’s Pest Control, Inc.
   22. Verikill Pest Control
Appendix B: Error Corrections

EFED acknowledges the following errors that were identified, but none of them changed any of the risk conclusions:

- A typographical error in listing a *Lemna gibba* EC$_{50}$ for deltamethrin (MRID 48988204); the endpoint should have read $>0.779$ µg a.i./L; however, a recalculation using the corrected value did not change the conclusions.

- The *Leptochirus* NOAEC of 0.0002 µg/L, rather than the mysid NOAEC of 0.000781 µg/L, was inadvertently used in two instances to calculate estuarine/marine invertebrate chronic risk, once each in Parts II and III. All other instances used mysid endpoints to calculate estuarine/marine chronic risk. In those two cases, the re-calculated RQs using mysid endpoints below ranging from 4.4-141 in Table 79 (Part II) and 2.6 – 860 in Table 86 (Part III) (new RQs in tables below) – previously RQs ranged from 17-550, and 10-3360, respectively, but conclusions do not change.

- Additionally, in reviewing the calculations, an error was found in Part 1, p. 38, Table 22. The LOAEC (0.00073 µg/L), rather than the NOAEC (0.00047 µg/L) was used. The recalculated RQ should be 5.9, rather than 3.8 (see below), but the conclusion does not change.

The three tables involved are as follows with corrected values:

**Part I:**

**Table 22. Estuarine/Marine Invertebrates Risk Quotients for Eight Pyrethroids and Pyrethrins**

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Peak EEC = Chronic EEC$^1$ (µg/L)</th>
<th>96-hr EC$_{50}$ (µg/L)</th>
<th>Acute RQ</th>
<th>NOAEC (µg/L)</th>
<th>Chronic RQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifenthrin</td>
<td>0.014 – 0.021$^2$</td>
<td>0.00397</td>
<td>3.53 – 5.31</td>
<td>&lt;0.0006$^3$</td>
<td>&gt;23 – &gt;35</td>
</tr>
<tr>
<td>Cyfluthrin</td>
<td>0.00179</td>
<td>0.0022</td>
<td>0.81</td>
<td>0.00007</td>
<td>26</td>
</tr>
<tr>
<td>Lambda-Cyhalothrin</td>
<td>0.00205</td>
<td>0.00491</td>
<td>0.42</td>
<td>0.0002</td>
<td>10</td>
</tr>
<tr>
<td>Cypermethrin</td>
<td>0.0032</td>
<td>0.0054</td>
<td>4.3</td>
<td>0.000781</td>
<td>30</td>
</tr>
<tr>
<td>Deltamethrin</td>
<td>0.00278</td>
<td>0.0037</td>
<td>0.75</td>
<td>0.0000790.00047</td>
<td>3.85.9</td>
</tr>
<tr>
<td>Esfenvalerate</td>
<td>0.0103</td>
<td>0.00466</td>
<td>2.21</td>
<td>0.00017</td>
<td>51</td>
</tr>
<tr>
<td>Fenpropathrin</td>
<td>N/A</td>
<td>0.021</td>
<td>N/A</td>
<td>0.012</td>
<td>N/A</td>
</tr>
<tr>
<td>Permethrin</td>
<td>0.0124</td>
<td>0.018</td>
<td>0.69</td>
<td>0.0024</td>
<td>5.2</td>
</tr>
<tr>
<td>Pyrethrins</td>
<td>0.0814</td>
<td>1.4</td>
<td>0.06</td>
<td>0.25</td>
<td>0.33</td>
</tr>
</tbody>
</table>
### Part II:

**Table 79. Acute and Chronic RQs for Freshwater and Estuarine/Marine Invertebrates Exposed to Cypermethrin**

<table>
<thead>
<tr>
<th>Scenario/Uses</th>
<th>Peak EEC (µg/L)</th>
<th>21-day EEC (µg/L)</th>
<th>FW Invertebrates</th>
<th>E/M Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acute RQ#</td>
<td>Chronic RQ#</td>
<td>Acute RQ#</td>
<td>Chronic RQ#</td>
</tr>
<tr>
<td>01 CA turf (MI met file, W14840)</td>
<td>0.0942</td>
<td>0.00341</td>
<td>168</td>
<td>&gt;68</td>
</tr>
<tr>
<td>02 FL turf (TN met file, W13882)</td>
<td>0.0776</td>
<td>0.00349</td>
<td>139</td>
<td>&gt;70</td>
</tr>
<tr>
<td>03, 04, 05 CA residential, ROW, impervious [Residential lots]</td>
<td>0.0528</td>
<td>3.59x10⁻³</td>
<td>94</td>
<td>&gt;72</td>
</tr>
<tr>
<td>06, 07, 08 BSS residential, ROW, impervious [Residential lots]</td>
<td>0.126</td>
<td>6.51x10⁻³</td>
<td>225</td>
<td>&gt;130</td>
</tr>
<tr>
<td>09, 10, 11 CA residential, ROW, impervious (PA met file, W14751) [Residential lots]</td>
<td>0.106</td>
<td>5.58x10⁻³</td>
<td>189</td>
<td>&gt;112</td>
</tr>
<tr>
<td>12, 13, 14 CA residential, ROW, impervious (FL met file, W12839) [Commercial lots]</td>
<td>4.18</td>
<td>0.110</td>
<td>7460</td>
<td>&gt;2200</td>
</tr>
<tr>
<td>15 OR nursery [Ornamentals]</td>
<td>0.124</td>
<td>0.00354</td>
<td>221</td>
<td>&gt;71</td>
</tr>
<tr>
<td>16 NJ nursery [Ornamentals]</td>
<td>0.127</td>
<td>0.00553</td>
<td>227</td>
<td>&gt;111</td>
</tr>
</tbody>
</table>

For estuarine/marine invertebrates, Acute RQ = use-specific peak EEC / 0.0054 ppb [for Mysid shrimp, *Americanysis bahia*], Chronic RQ = use-specific 21-day EEC / 0.000781 ug/L [for Mysid shrimp, *Americanysis bahia*].

### Part III:

**Table 86. Acute and Chronic RQs for Freshwater and Estuarine/Marine Invertebrates Exposed to Cypermethrin**

<table>
<thead>
<tr>
<th>Scenario/Uses</th>
<th>Peak EEC (µg/L)</th>
<th>21-day EEC (µg/L)</th>
<th>FW Invertebrates</th>
<th>E/M Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acute RQ#</td>
<td>Chronic RQ#</td>
<td>Acute RQ#</td>
<td>Chronic RQ#</td>
</tr>
<tr>
<td>PA alfalfa/ Alfalfa</td>
<td>0.0847</td>
<td>0.00677</td>
<td>151</td>
<td>&gt;135</td>
</tr>
<tr>
<td>NY grapes/ Blueberries:</td>
<td>0.938</td>
<td>0.0562</td>
<td>1675</td>
<td>&gt;1124</td>
</tr>
<tr>
<td>FL citrus/ Citrus:</td>
<td>0.270</td>
<td>0.0150</td>
<td>482</td>
<td>&gt;300</td>
</tr>
<tr>
<td>IL corn/ Corn</td>
<td>0.461</td>
<td>0.0265</td>
<td>823</td>
<td>&gt;530</td>
</tr>
<tr>
<td>FL sweet corn/ Sweet Corn</td>
<td>0.193</td>
<td>0.0117</td>
<td>345</td>
<td>&gt;234</td>
</tr>
<tr>
<td>MS cotton/ Cotton</td>
<td>0.908</td>
<td>0.0353</td>
<td>1620</td>
<td>&gt;706</td>
</tr>
<tr>
<td>MS soybean/ Soybean</td>
<td>0.480</td>
<td>0.0254</td>
<td>857</td>
<td>&gt;508</td>
</tr>
<tr>
<td>ND wheat/ Sunflower</td>
<td>0.0403</td>
<td>0.00202</td>
<td>72</td>
<td>&gt;40</td>
</tr>
<tr>
<td>ND wheat/ Wheat</td>
<td>0.221</td>
<td>0.0128</td>
<td>395</td>
<td>&gt;256</td>
</tr>
<tr>
<td>FL tomato/ Brassica, Fruiting and Cucurbit Vegetables</td>
<td>0.318</td>
<td>0.0177</td>
<td>568</td>
<td>&gt;354</td>
</tr>
<tr>
<td>CA rice (Winter flood)/ Rice</td>
<td>3.97* (55.4)</td>
<td>0.672</td>
<td>7090</td>
<td>&gt;13440</td>
</tr>
</tbody>
</table>

For estuarine/marine invertebrates, Acute RQ = use-specific peak EEC / 0.0054 ppb [for Mysid shrimp, *Americanysis bahia*], Chronic RQ = use-specific 21-day EEC / 0.0002 ppb [for amphipod, *Leptocheirus plumulosus*], Mysid 0.000781 ug/L.