

DRAFT (DO NOT CITE)

Date: September 7, 2023

To: Central Valley Regional Water Quality Control Board

From: Delta Independent Science Board

RE: Comments on the Draft Pyrethroid Control Program and Research Plan

Summary

The Delta Independent Science Board (Delta ISB) commends the Central Valley Regional Water Quality Control Board (Regional Board) for the development of the Pyrethroid Control Program and Research Plan (Plan). The draft Plan, aimed at mitigating the impacts of offsite discharge of six pyrethroids from urban and agricultural areas, which affect the ecology of receiving water and potentially public health, lays out several clear management questions and identifies some important research gaps. Nevertheless, the Delta ISB feels that there should be a stronger linkage between management needs and the proposed research, and a stronger focus on monitoring and adaptive management. It is not clear how new research or monitoring would directly inform the management questions laid out in the draft Plan. The Delta ISB also questions the usefulness of the draft Plan for resolving management questions in a timely manner, and thereby recommends some focused approaches. Additionally, evaluating the effectiveness of mitigation measures, including costs, should be considered as an overarching theme.

Background

Section 303 of the federal Clean Water Act requires the Regional Board to “*develop water quality objectives that are sufficient to protect beneficial uses*” for each water body within its region, and to periodically review the Basin Plan to modify water quality objectives and/or beneficial uses as appropriate through a Triennial Review.

Pyrethroid insecticides, in particular bifenthrin, cyfluthrin, cypermethrin, esfenvalerate, lambda-cyhalothrin, and permethrin, have been detected at levels of concern for aquatic species in waters and sediments of the Sacramento and San Joaquin River watersheds. As required by the federal Clean Water Act, the Central Valley Regional Water Quality Control Board established a Control Program for Pyrethroid Pesticide Discharges in 2017 as well as a Total Maximum Daily Load for pyrethroid pesticides (TMDL; the maximum amount of a pollutant that a waterbody

DRAFT (DO NOT CITE)

can accept and still meet the state's Water Quality Standards for public and environmental health).

The TMDL and a Pyrethroid Control Program became effective in 2019. The Program includes a "*conditional prohibition which does not allow pyrethroid discharges at concentrations above specified aquatic life protection-based concentration trigger values*" unless the discharger is implementing a management plan to reduce pyrethroid levels in their discharges.

However, the Regional Board found that "*adequate information was not available at the time to establish numeric water quality objectives for pyrethroids.*" Therefore, the Pyrethroid Control Program included a commitment by the Regional Board to consider the adoption of numeric pyrethroid water quality objectives no later than "*15 years from the Pyrethroid Control Program effective date*" (i.e. in 2034).

The Regional Board was expected to work with stakeholders to develop a Pyrethroid Research Plan, which identifies and addresses knowledge gaps in order to achieve this goal. It is intended to serve as a basis upon which the science community may develop research proposals that will aid in addressing the Regional Board management questions. The Regional Board is required to coordinate and consult with the Delta Science Program, Delta Independent Science Board, Delta Stewardship Council, Department of Fish and Wildlife, and Delta Regional Monitoring Program, as appropriate.

General Comments

The Delta ISB review of the Plan was guided by four overarching questions to help assess whether they address recommendations from the Delta ISB's [2018 water quality review](#) on nutrients and contaminants, which are addressed below.

1. Does the Research Plan optimally address management needs?

The Pyrethroid Control Program seeks to mitigate the impacts of offsite discharge of pyrethroids from urban and agricultural areas. While the draft Plan acknowledges many unknowns about the ecotoxicology of pyrethroids, and the effectiveness of reduction and mitigation actions, the Delta ISB feels that relevant management needs are not well represented in the research questions. It is not clear how the proposed research would directly inform the management questions articulated in the draft Plan. In addition, it is important to gain reliable information on the effectiveness of mitigation measures, including costs.

DRAFT (DO NOT CITE)

Complying with the pyrethroid total maximum daily load (TMDL) is likely to involve reducing use and/or discharge of target pollutants. For agricultural producers, reducing use of one pesticide may require substituting another pesticide to achieve desired control. So, a key research question is, will available substitutes for pyrethroids improve ecosystem conditions or do they carry similar or other risks? Further, the Plan identified a data gap of “costs to dischargers” of meeting water quality objectives. However, no research questions on either topic were presented. Information about costs and the effectiveness of mitigation measures is needed to make informed decisions about discharge and runoff management in point and non-point source emission. Finally, the Plan could more clearly indicate how research will assist in establishing numeric targets, which was identified as an impediment to TMDL implementation.

Overall, the Delta ISB questions the usefulness of the draft Plan for resolving management questions in a timely manner. We suspect that adequate information is currently available to establish numeric water quality objectives for pyrethroids. It is difficult to understand why the Regional Board requires another 15 years of research to establish such numeric water quality objectives while the European Union (EU) finalized the scientific process and review of a number pyrethroids (cypermethrin, bifenthrin, deltamethrin, esfenvalerate, and permethrin) in 2022 (revised [Directive for Environmental Quality Standards](https://eur-lex.europa.eu/resource.html?uri=cellar:d0c11ba6-55f8-11ed-92ed-01aa75ed71a1.0001.02/DOC_2&format=PDF): https://eur-lex.europa.eu/resource.html?uri=cellar:d0c11ba6-55f8-11ed-92ed-01aa75ed71a1.0001.02/DOC_2&format=PDF), and is expected to adopt Environmental Quality Standards (chronic and acute) in 2024.

Recommendations:

- A. The Plan would benefit from articulating the practical and logistical steps for meeting the data and research needs, as well as the timeline to inform management questions.
- B. An effective adaptive management strategy should be developed that includes stronger linkages between management needs, proposed research, and monitoring. Given the known harms of pyrethroids, an adaptive management framework, such as the one described in the [Delta ISB's monitoring enterprise review](#), should be used to help set priorities and provide linkages between research and management decisions. Management decisions that can be addressed with key research in the short term, i.e., before the 15-year time frame, should be identified. A simple diagram or decision-tree linking information gaps to process drivers and

DRAFT (DO NOT CITE)

management would be very useful for shaping the actual research and decisions.

- C. Given the many unknowns for pyrethroid management, it is also worth considering a dynamic adaptive planning approach, rather than waiting for perfect information. This type of decision making under deep uncertainty can be used to create cost-effective interim management approaches and strategies for future adaptation, while additional data are collected. The process of developing such a system also can reveal which research needs are critical to specific decisions, including monitoring needs.
- D. A review of the EU Environmental Quality Standards (see above), combined with an update of the [water quality criteria already derived by the Regional Board and UC Davis](#), could provide numeric water quality objectives in a timely manner, thereby allowing for immediate management actions to control pyrethroids. Regular review and update of these objectives, as well as a well-designed monitoring program should be part of the adaptive management framework.

2. Will the draft Plan adequately address open questions concerning ecosystem effects of pyrethroids?

The overarching goal of pyrethroid control measures is the reduction or elimination of harmful environmental effects. The Plan addresses broad, fundamental research questions in ecotoxicology and environmental chemistry focused on this group of insecticides. While data generated will aid in the interpretation of monitoring data in an ecosystem context, the Plan includes a number of highly complex scientific efforts. Addressing any one of these (e.g., sublethal effects, mixture and multiple stressor effects, bioaccumulation/biomagnification) could take many years of coordinated efforts to identify the KEY factors. Potential funding sources and cost estimates are not provided. As a result, the Delta ISB wonders how the research will be prioritized, and how the data will be used to determine management actions.

A reasonable assessment of the of the environmental consequences of pyrethroids in the Delta will require a credible comparison of baseline and future conditions, but only after control plans have been implemented. The draft Plan does not seem to provide a strategy for collecting such baseline monitoring data.

DRAFT (DO NOT CITE)

Recommendations

- A. The Delta ISB would like a clear articulation of what type of data on pyrethroid concentrations, including their spatial and temporal distributions, are currently available. Further, the authors need to explain how these data can be used to assess the impact of different management practices currently employed to control the release of pyrethroids into surface waters.
- B. In its 2018 report on “Water Quality Science in the Sacramento-San Joaquin Delta,” the Delta ISB recommended holistic monitoring studies (e.g., ones that combine toxicity testing and chemical analyses with fish and food-web monitoring) and increased temporal and spatial coverage of monitoring activities. We recommend inclusion of a monitoring component in the Plan to inform management and to provide adequate baseline data for future management actions. This should include all pyrethroids registered for use in California as well as the potential replacement pesticides. Agricultural as well as urban sources should be considered.
- C. In Management Question 3 of the Plan, the authors ask if current pyrethroid management practices are effective. A better question is to ask how effective they are.

3. How will research efforts be coordinated with other agencies?

The program includes a provision that the Regional Board will work with stakeholders to develop the Plan. The document, however, does not identify the stakeholders clearly nor does it show clear evidence of engagement with other agencies and stakeholders for the preparation of this Plan.

Recommendations:

- A. The Delta ISB would like to know how potential research partners will be incentivized to support the Plan, as well as who those partners likely will be. The proposed process by which the research efforts will be coordinated with other agencies, institutions, and private companies needs to be well-articulated.
- B. The Plan would benefit from a discussion of other research plans for contaminants in the Delta or elsewhere, and should they exist and shown to be effective, how they might be used as a model.

DRAFT (DO NOT CITE)

4. Are data management (including quality assurance), monitoring, and adaptive management part of the plan?

The Plan includes neither data management measures, which are an essential component of monitoring programs, nor an adaptive management strategy (see recommendations above). The plan does outline ongoing quality assurance measures (inter laboratory comparison) regarding establishing analytical methods for pyrethroids.

Recommendations:

- A. The Delta ISB believes that a comprehensive focus on management, monitoring, data collection, and analysis as part of an adaptive management strategy is essential for an effective Plan to answer management questions (see Delta ISB's monitoring enterprise review). These should be included as key components of the Plan.

Additional Specific Comments

During the Delta ISB discussions of the Plan, a number of additional questions and issues arose. These are summarized below so that they may be considered by the authors when revising the Plan.

1. Regulatory Actions:

It is unclear to the Delta ISB what regulatory actions are associated with the current Pyrethroid Control Program. For instance:

- Does the existing TMDL cover only the 6 pyrethroids named in the Plan, or all pyrethroids registered in California?
- Are there existing regulations limiting the use and discharge of pyrethroids from agricultural land and human communities? If so, are the polluting entities discharging concentrations exceeding the amounts allowed?
- What management strategies and actions are in place to bring the discharging entities into compliance?
- Would sanitation district facilities be actively involved in tracking human-based contributions?

2. Numeric Targets:

The draft Plan refers to TMDL numeric targets (including applicable water quality standards), water quality criteria, pyrethroid concentration goals and pyrethroid triggers, all of which are (more or less) defined as numeric concentration thresholds protective of beneficial uses. Please provide an explanation for why it was possible

DRAFT (DO NOT CITE)

to establish these thresholds, while much more research appears to be needed to establish water quality objectives.

3. Partition Coefficients:

It is unclear how research on partition coefficients proposed in the Plan will be used to achieve management goals. While researchers have shown that bioavailability of pyrethroids can decrease in the presence of particles, it is highly dependent on environmental conditions and strongly species specific. For a review on this topic, see *Knauer et al. (2017). The influence of particles on bioavailability and toxicity of pesticides in surface water. Integrated Environmental Assessment and Management. DOI 10.1002/ieam.1867*

4. Analytical Method Development:

Monitoring of pyrethroids in the environment requires special analytical methods. Limits of detection in the parts per trillion (nanogram to picogram/L) range are required to cover proposed or existing water quality criteria for the protection of aquatic life. Sensitive water column analytical methods have been published: see *Rösch et al. (2019). Picogram per liter quantification of pyrethroid and organophosphate insecticides in surface waters: A result of large enrichment with liquid-liquid extraction and gas chromatography coupled to mass spectrometry using atmospheric pressure chemical ionization. Anal. Bioanal. Chem., 411, 3151-3164.*

5. Pyrethroid Fate and Transport:

The fate and transport of pyrethroids in the environment are not addressed in the Plan, with the exception of the proposed research on partition coefficients. It is not clear to the Delta ISB if this information is already so well known that it does not need to be of concern. If so, then it should be acknowledged.

6. Co-Stressors:

The topic of co-stressors is addressed in the Plan, but the questions (including research on “other” species) are extremely broad. While these are important research topics, the Delta ISB believes that the proposed research on co-stressors (e.g. sublethal effects, additive/synergistic effects) is a “bottomless pit.” Making the establishment of water quality objectives contingent upon the outcome of this co-stressor research appears unrealistic.

- Temperature: There is considerable information already available for pyrethroids, more than on many other chemicals. The question of how

DRAFT (DO NOT CITE)

climate change/seasonal changes affect pyrethroid toxicity is important and could be used to address management questions in the future.

- Salinity: Compared to other factors affecting bioavailability of pyrethroids (e.g., species-specific differences, temperature), the impact of salinity on pyrethroid bioavailability seems of minor importance. Species-specific differences in uptake and sensitivity are likely much more significant. Further, the authors state that "*However, the Pyrethroid Control Program does not consider the impacts of salinity in its numeric trigger derivation or application.*" If so, then why is this part of the Plan?
- Microplastics: The Delta ISB agrees that additional research on this topic is important but wonders if it is needed for the derivation of water quality objectives. A rationale needs to be provided for including this emerging form of pollution.
- Synergistic and additive toxicity/chronic toxicity/bioaccumulation: While these are important topics, the Delta ISB believes that research to fill management needs should be much more focused. It should be based on high quality monitoring data in order to focus on real-world contaminant mixtures and their effects on key biological species. A dynamic adaptive planning approach could use existing modeling approaches for addressing mixture effects, and safety factors to account for uncertainties, which are well established methods in risk assessment.