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DEPARTMENT OF INTEGRATIVE BIOLOGY

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1001 I Street
Sacramento, CA 95814

Dear State Water Board members,

I would like to provide comments on the proposed approval of the Central Valley Regional Water Quality Control Board's amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the control of pyrethroid pesticides. As a faculty member at the University of California Berkeley, my research from 2003 to the present time has focused almost exclusively on pyrethroid pesticides, resulting in 38 peer-reviewed published papers, most pertaining to Region 5, and in a few cases, Region 3. The majority of this work was, in fact, funded by the State Water Board, largely through either bond measures or the SWAMP program. Given my experience with pyrethroid toxicology, I feel an obligation to serve the Board by providing comments, in recognition of the support the Board provided for my research, and more generally, to attempt to insure that the proposed approach utilizes the best scientific information available.

Some aspects of the currently proposed Region 5 Basin Plan amendment and associated staff report incorporate that best scientific information, with the presumption of pyrethroid additivity being an example. Unfortunately, however, I do not believe some other critical aspects of the work meet that standard, but rather, are founded on untested and indefensible approaches with exceedingly weak technical support. Of particular importance to the mandate of the State Water Board, the approaches used in the document depart radically from long-standing norms of how the Board has regulated the discharge of, and protected against aquatic toxicity of, all other chemicals. I will summarize my concerns within four general areas:

Quantification and regulation of only the bioavailable fraction – Conceptually, incorporation of bioavailability into a regulatory framework is a desirable goal. It has been a topic of very active research of my own, and of many other investigators. But unfortunately, a proven, generally accepted methodology ready for regulatory application does not yet exist. The Basin Plan employs an approach based on equilibrium partitioning theory, a potentially reasonable approach worthy of further investigation in a research context, but a frightening one in a regulatory context. I cannot over-emphasize the uniqueness of Region 5's proposed regulatory

use of this approach. To the best of my knowledge, it has not been applied in a regulatory context anywhere else at the state level, the federal level, or internationally. (Bioavailability has been used in South San Francisco Bay, but through an entirely different mechanism relevant only to metals.) There is a reason for its absence, and that is because no other environmental management organization has considered the approach sufficiently validated for regulatory purposes. I commend the staff for recognizing biovailability issues, but the approach they propose has not been sufficiently tested.

A consequence of the staff's approach is that approximately 90% of the pyrethroid in a given discharge becomes unregulated. If the material is bound to particles or associated with dissolved organic matter, it is viewed as toxicologically irrelevant and not subject to any regulatory limitation. There are many concerns with such an assumption (e.g., the potential for subsequent particle desorption of the pyrethroid, the potential for bioavailability upon particle ingestion, the incorporation of the pyrethroid-laden particle in bed sediments and exposure to benthic organisms). One has to wonder if regulation of only the dissolved "bioavailable" fraction is appropriate, as argued in the staff report, then why is it not used for any other contaminants with comparable chemical characteristics? Organochlorine pesticides like DDT, many of the PCBs, many of the polynuclear aromatic hydrocarbons all would seem to "benefit" from the same regulatory approach, yet it has been used with none of them. If the Board is going to adopt the proposed Basin Plan amendment and accept the arguments in the related documents, it must answer why pyrethroids merit regulation in such a way that the majority of the material discharged is ignored, when the approach has never been used for any other substance?

I have raised this issue many times in hearings in Region 5 and in my comments to earlier drafts of the staff report. The staff's response to the comment has basically been that the approach represents the best available science and the independent peer reviewers raised no objections. The former argument is simply an unsupported opinion. As to the latter response, comments warning against use of the bioavailability approach were received from EPA, California Department of Fish and Wildlife, environmental and fisheries groups, and myself. The wide array of groups and individuals voicing substantial concerns, all on the same topic, should carry at least as much weight as the three peer reviewers, and give the State Water Board pause before supporting such a dramatic departure from regulatory norms.

Selection of partitioning coefficients – Use of the bioavailability approach requires the use of coefficients that predict how the total pyrethroid mass is distributed among the particle-adsorbed fraction, that associated with dissolved organic matter, and that which is freely dissolved. As it is not realistic to expect discharges to measure these coefficients in every sample, generic default values are provided in the staff report. In an earlier draft, an average of multiple coefficients for each pyrethroid was used, as obtained from the publications of Jay Gan and his students (UC Riverside). In the final staff report, the staff decided the Gan values did not meet

all data acceptability criteria, and chose to use a single measurement for each pyrethroid, derived from an unpublished study funded by the pyrethroid registrants.

The single value provided by the registrants was based on how pyrethroids partitioned between water and sediment in a pond in Massachusetts. Their study did not examine how variable the coefficients may be from one site to the next, or even at a single site from one season to the next. The work provided no assurance that the single value from the Massachusetts pond was applicable to California or anywhere else beyond that pond. Particles and associated organic matter vary enormously in quality and quantity from site to site, and to assume one measurement is applicable to every creek, river, stormwater sample, effluent discharge, and agricultural drain in California is frankly, laughable. Certainly any default value, whether that from the registrants or elsewhere, is unlikely to accurately represent site-specific partition coefficients in any given sample. Using a single default value in a regulatory context to determine compliance is akin to assuming every person in a large and diverse population weighs 150 pounds, and then penalizing them if they don't. While 150 pounds may be the "best" answer in that it is the single number that describes the most people, there would certainly be many individuals for which the estimate is wholly inappropriate and not remotely accurate.

In their response to comments, staff argue that the registrants' coefficient is the best data available, which even if true, does not make a single value adequate for the purpose employed. They also argue that the registrants' value falls near the mid-point of the range of the abandoned data from Jay Gan. While that may also be true, the Gan data is our only indication of how variable coefficients can be from sample to sample, and the variation he documented is huge. For the pyrethroid bifenthrin, his K_{oc} estimates ranged from 98,000 to over 11,000,000 (the registrants' value is 4,228,000), and K_{doc} ranged from 180,000 to 43,440,000 (the registrants' value is 1,737,127). While staff's assertion that the value they chose is near the mid-point of the range is correct, it ignores the enormity of the range! Application of the proposed approach requires plugging into an equation a single default K_{oc} value (when the actual site-specific value appear likely to range over at least a factor of 100) and a single default K_{doc} value (which appears likely to range over at least a factor of at least 240), and then attempting to enforce the dubious finding that if the calculated result coming out of the equation is a 1, you pass, and if it is a 2, you are in violation. It defies belief to think that such an approach is not wide open to challenge by any discharger.

Concentration goals relative to toxicity thresholds – The staff report provides both acute and chronic pyrethroid concentration goals that dischargers are expected to meet. All goals are close to or exceed known 96-h LC50s for the amphipod, Hyalella azteca. In the case of the acute goals, for five of the six pyrethroids the goal exceeds the LC50 (that is, more than half the test animals would be expected to die in a toxicity test of water that meets acceptable limits for pyrethroids). In the case of the

chronic goals, the goal for one of the pyrethroids is exactly at the LC50 (that is, half the test animals would die in a sample that meets acceptable limits), and three of the remaining five pyrethroids have goals that are only slightly below the LC50 (about one-third to one-half the LC50).

Adoption of the Basin Plan amendment and associated staff report is not consistent with the level of protection for aquatic life that the State Water Board has historically provided. The Basin Plan's narrative objective for toxicity states: "All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life". The Implementation chapter of the Basin Plan states: "Where valid testing has developed 96 hour LC50 values for aquatic organisms, the Board will consider one tenth of this value for the most sensitive species tested as the upper limit (daily maximum) for the protection of aquatic life". The proposed concentration goals meet neither of these policies, and in fact, they promote policies that by definition release substances at concentrations expected to cause toxicity. The State Water Board should carefully consider the consequences of departure from long-standing practices, solely in the instance of pyrethroids.

The proposed concentration goals provide a very marginal level of protection for H. azteca (that is, only "reasonable protection" in the parlance of the staff report). Adoption of these goals would not insure protection of the species, in fact, it virtually insures some degree of toxicity in samples that are in compliance. There are ecological reasons why this policy should be of concern, such as the fact that H. azteca can be a dominant species in some habitats, and in such environments, it is an important component in the diet of multiple fish species. However, there are also very serious implications to toxicity testing as used for regulatory purposes. H. azteca was a widely used species for toxicity testing even before pyrethroids became of concern, and the species now plays an even greater role in testing. The dozens of studies documenting toxicity due to pyrethroids in California water bodies have been based on tests with this species. Toxicity to this species has been responsible for the many 303(d) listings attributable to pyrethroids. Given the pivotal role of this species in our water quality protection efforts, to set concentration goals that provide minimal protection for the species defies logic. It also raises the disturbing question of if we are not going to set goals that protect the species, then what is the point of monitoring water quality with it? It undercuts much of the toxicity testing now being done throughout California, and the management decisions, such as listing of impaired water bodies, that result.

Timeline for re-evaluation – The staff report and response to comments notes that the proposed approach has some limitations (most notably, in the case of the default partition coefficients), but portrays the approach as a phased one that can be modified as better information becomes available. The most troubling aspect of this approach is that re-evaluation is scheduled to occur in fifteen years. While it is possible that modifications could be made at an earlier time if Region 5 staff

consider it warranted, the default option would be review in 2033 (assuming 2018 adoption).

There are radical differences in the proposed regulatory approach to pyrethroids, compared to historical practices for other substances, and the technical uncertainties of the proposed approaches are great, as discussed above. One approach would be to adopt a more traditional regulatory approach (e.g., total concentration) in the near term, while developing the technical support for the conceptually preferred, but currently unworkable, alternatives (e.g,, bioavailability and partition coefficients). But if the State Water Board elects to move ahead immediately with the proposed approach, I believe 15 years is far too long to continue with a scientific foundation as weak as it is. If a concerted research effort is made, some of the most egregious uncertainties could be re-evaluated in 3-5 years. In particular, two areas need immediate study:

1) Efforts to develop a chemically-based criteria, whether incorporating bioavailability or not, are inherently a surrogate for toxicity testing. They are intended to protect aquatic life, without explicitly using that aquatic life to test every sample. The only way to determine if they have achieved their objective is a side-by-side comparison of toxicity test results with a chemical determination of whether the concentration goals were achieved. The staff report is vague on when toxicity tests will be required, and the staff's response to comments indicates it will be only some samples. At least in the initial years, concurrent toxicity testing should be the norm, and exceptions few or none. Though the proposed approach claims to provide "reasonable" protection for H. azteca, that claim is ill-defined, unproven, and in my view, dubious. Side-by-side testing is needed for its validation, and that testing should also note endpoints other than lethality, as my testing has shown paralysis to be a common, and no less environmentally relevant, consequence of pyrethroid exposure.

2) As described in detail above, the default partition coefficients proposed are from a single sample in a pond on the other side of the country. Their relevance to the diverse water types to which they would be applied in California, and the degree of site-specific or time-specific variation around any one value, are both untested. Since the partition coefficients are pivotal to the bioavailability approach proposed, immediate validation is critical, and in my view, essential before any discharger could be defensibly found to be non-compliant. A 15-year wait for this capability is not tenable. Immediate investigation is needed as to whether a partition coefficient-based approach to bioavailability is workable, whether alternative bioavailability approaches have merit (e.g., Tenax extraction), or whether quantification of bioavailability for regulatory purposes is even achievable.

In summary, I feel obligated to call the State Water Board's attention to the disparities between past regulatory approaches of the Board with regard to other

contaminants, and some of those proposed in the subject documents, and the failure, in my view, to provide adequate technical support for these disparities. Nevertheless, I am pleased that both Region 3 and Region 5 have chosen to pursue TMDLs focused on pyrethroids. To date, my laboratory has processed 325 water samples from rivers, creeks, sloughs, urban storm drains, and agricultural drains, testing all with H. azteca. Based on mortality alone, 26% of the samples have been toxic, and including paralysis as an endpoint raises the total to 38%. We have tested 349 sediment samples, with 45% causing mortality. In the vast majority of instances of water or sediment toxicity, pyrethroids were considered responsible, either because their concentration was high enough that we would have expected toxicity, or because causality was supported by Toxicity Identification Evaluation procedures. We have found the waters of both the American River and Cache Slough, as well as numerous urban creeks, to become toxic after most winter rains, due to the entry of pyrethroids via runoff. Widespread sediment toxicity due to pyrethroids has been known since 2004, and toxicity in the water column since 2010. Thus, attempts to mitigate the water quality effects of these compounds are warranted, and I hope my comments can support those efforts.

Sincerely,

Donald P Weston

Donald P. Weston
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